EU Strategy for the Adriatic and Ionian Region
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Master Plan of Energy Networks for the Adriatic-Ionian Region

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South East Europe Consultants

Summary

Introduction

The European Union Strategy for the Adriatic and Ionian Region (EUSAIR), adopted by the European Council in September 2014, represents a long-term strategic policy framework with two broad aims: to promote socio-economic growth, tighter relations between European Union members and countries in the Western Balkan region, while helping drive the EU enlargement and integration process; and to contribute to the economic development and social cohesion of its ten participating countries, 5 Western Balkan countries (Albania, Montenegro, North-Macedonia, Serbia and Bosnia-Herzegovina), 4 Member States (Italy, Croatia, Greece and Slovenia) and San Marino as the last joining country. The Strategy is proving beneficial for all the participating countries in particular non-EU countries from the Western Balkans region, as they would exploit the cooperation with EU countries, while they progress towards the goal of membership in the EU.

EUSAIR is structured on four thematic Pillars, each coordinated by two countries (EU Member State and non-EU Country). Pillar 2 "Connecting the Region", coordinated by Italy, Serbia and North-Macedonia (from 2020), gathers the common challenges faced by the macro-regional Strategy in terms of connectivity, intended as transport and Energy and has been structured in two different Sub-Groups, one dealing with Transport and the other with Energy networks.

One of the main contributions of EUSAIR to the improvement of connectivity within the Region and the rest of Europe in terms of energy networks is the endorsement (and related dialogue with funding institutions) of relevant projects identified through a bottom-up approach (so called "labelling process"). One of these projects is built by the efforts of the Thematic Steering Group (TSG), sub-group on Energy Networks to design the Master Plan of Energy Networks for the Adriatic-Ionian Region (hereinafter Master Plan) aimed at providing a broad outlook for long-term projects in the energy sector with coherent background and perspective.

Draft Terms of Reference of Master Plan were presented and approved by the EUSAIR TSG2 Sub-Group on Energy Networks according to the written procedure during Summer 2021.

The international tender to select the experts in charge of providing the Technical Assistance for developing the Master Plan was launched in October 2021 and the public bidding process ended in January 2022. Two companies are selected: NE Nomisma Energy Srl, a consulting company based in Bologna, Italy and South East Europe Consultants - S.E.E.C. Ltd., Serbian's leading energy consulting company, developed jointly the Master Plan.

The project kick-off meeting took place in March 2022, whereas the final delivery is made in June 2023.

Abbreviations and acronyms

ACER	Agency for the Cooperation of Energy Regulators
AERS	Energy Agency of the Republic of Serbia
AFD	Agence Française de Développement
AIR	Adriatic-Ionian Region
AL	Albania
ALPEX	Albanian Power Exchange
AT	Austria
BA	Bosnia and Herzegovina
bcm	Billion cubic meters
bcm/y	Billion cubic meters per year
BECCS	Bio-Energy Carbon Capture and Storage
BES	Balkan Energy School
BEV	Battery Electric Vehicle
BG	Bulgaria
CAM NC	The Network Code for Capacity Allocation Mechanisms
CAPEX	CAPital EXpenditure
CARI	Clean Air Regions Initiative
CBA	Cost Benefit Analysis
CCF	Corporate Carbon Footprint
CCUS	Carbon capture use and storage
CEF	Connecting Europe Facility
CEI	Central Europe Initiative
CEO	Chief Executive Officer
CESEC	The Central and South Eastern Europe energy connectivity
CF	Cohesion Fund
CGES	Montenegrin Electric Transmission system
CHP	Combined Heat and Power Units
COD	Commercial Operation Date
CONNECTA	The Technical Assistance to Connectivity in the Western Balkans
COP	Conference of the Parties
CPS	Current Policies Scenario
CROPEX	Croatian Power Exchange
CSE	Central and South East
CY	Cyprus
DAM	Day Ahead Market
DSDP	Detailed site development plan
DSO	Distribution System Operator
EBRD	European Bank for Reconstruction and Development
EEPR	European Energy Programme for Recovery

EIA	Environmental Impact Assessment
EIB	European Investment Bank
EL	Electricity
EMS	Elektromreza Srbije
EnC	Energy Community
EnCP’s	Energy Community Contracting Parties
EnCS	Energy Community Secretariat
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
EPCI	Engineering, Procurement, Construction and Installation
ERDF	European Bank for Reconstruction and Development
ESIA	Environmental and Social Impact Assessment
ETC	European Territorial Cooperation
ETS	Emmission Trading Scheme
EU	European Union
EU EIP	European Union Economic and Investment Plan for the Western Balkans
EUSAIR	EU Strategy for the Adriatic-Ionian region
EUSBSR	EU Strategy for the Baltic Sea Region
FBA	Federation of Bosnia and Herzegovina
FEC	Final energy consumption
FEED	Front End Engineering Design
FID	Final Investment Decision
FOLU	Forestry and Other Land Use
FS	Feasibility Study
FSRU	Floating storage and regasification unit
GCA	Grid Connection Agreement
GDP	Gross Domestic Product
GEFF	Green Economy Financing Facility
GGF	Green for Growth Fund
GHG	Greenhouse gas emissions
GRITA	Power link between Greece and Italy
GSI	Global Cybersecurity Index
GW	Gigawatt
H.D.D.	Horizontal Directional Drilling
H2	Hydrogen
HOPS	The independent Transmission System Operator in Croatia
HR	Croatia
HVDC	High Voltage Direct Current
IAP	Ionian Adriatic Pipeline
IBWT	Italian Borders Working Table
IDEA	USAID Investments in Developing Energy Assets Programme

IDM	Intra-day Market
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPA	Instrument for Pre-Accession Assistance
IPs	Interconnection Points
IT	Italy
KfW	Kreditanstalt für Wiederaufba
ktoe	Thousand tonnes of oil equivalent
kV	KiloVolt
LBM	Liquified biomethane
LCGEP	Least-cost generation expansion plan
LCPD	Large Combustion Plants Directive
LNG	Liquified Natural Gas
LSM	Liquified synthetic methane
LULUCF	Land Use, Land-Use Change and Forestry
m3	Cubic meter
MAECI	Ministry of Foreign Affairs and International Cooperation
mcm/day	Million cubic meters per day
ME	Montenegro
MED	Mediterranean
mEUR	Million EURO
MK	North Macedonia
MoCI	Ministry of Capital Investments of Montenegro
MoE	Ministry of Economy
MoEES	Ministry of Environment and Energy Security
MoME	Ministry of Mining and Energy
MONITA	Power link between Montenegro and Italy
MOU	Memorandum of Understanding
MP	Master Plan
Mtoe	Million tonnes of oil equivalent
MW	MegaWatt
NDC	Nationally Determined Contributions
NDP	National Development Plan
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NEMO	Nominated Electricity Market Operator
NIF	Neighbourhood Investment Facility
Nm3/h	Normal cubic meter per hour
NPS	New Policies Scenario
NRA	National Regulatory Authority
NREAP	National Renewable Energy Action Plan

NSEC	North Sea Energy Cooperation
NTG	National Transmission Grid
NZE	Net Zero Emission
NZS	Net Zero Scenario
OHL	Overhead line
PCI	Projects of Common Interest
PE EPS	Public Enterprise Electric Power Industry of Serbia
PECI	Projects of Energy Community Interest
PHEV	Plug In Hybrid Electric Vehicles
PMI	Projects of Mutual Interest
PPS	Purchasing Power Standard
PQ	Performance Qualification
PSETSA	Plan for the Sustainable Energy Transition of Suitable Areas
PSHPP	Pumped-Storage Hydroelectric Power Plant
Q	Quarter
RA	Regulatory Authorities
REEP	Regional Energy Efficiency Programme
REMIT	The Regulation on Wholesale Energy Market Integrity and Transparency
RES	Renewable Energy Sources
RS	Serbia
SDAC	Single Day-ahead Coupling
SDS	Sustainable Development Scenarios
SEE	South Eastern Europe
SEEPEX	South-East Europe Power Exchange
SGC	Southern Gas Corridor
SI	Slovenia
SIDC	Single Intra-Day Coupling
SS	Substation
ssLNG	Small Scale Liquified Natural Gas
STEPS	Stated Policies Scenario
TANAP	Trans-Anatolian Pipeline
TAP	Trans-Adriatic Gas Pipeline
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Networks for Transport
TOR	Terms of Reference
TPES	Total Primary Energy Supply
TPP	Thermal Power Plant
TRA	Transmission
TS	Transmission Station
TSGs	Thematic Steering Groups
TSO	Transmission System Operator

TWh	Terawatt-hour
TYDP	Ten Year Development Plan
TYNDP	Ten Year National Development Plan
UGS	Underground Gas Storage
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VAT	Value Added Tax
WAM	With Additional Measures
WB	World Bank
WB EDIF	Western Balkans Enterprise Development & Innovation Facility
WB6	Western Balkans 6
WBIF	Western Balkans Investment Framework
WEM	With existing measures
WEO	World Energy Outlook

1 Section 1 - Scope and structure of the Master Plan

1.1 The Master Plan in the framework of the EU policies

According to the Terms of Reference, the Master Plan of Energy Networks for the Adriatic-Ionian Region will include electricity and natural gas systems through EUSAIR member countries, as well as related facilities for supply, distribution and some clean fuel options for transport, while promoting the goals of energy efficiency, green energy and decarbonization. The need to introduce renewable energy sources, the connection between energy and gas, the use of hydrogen fuels can cause changes in the structure and operation of energy and gas networks and markets.

A special part will be dedicated to the regulation that governs the European and international energy sector and the impact of regulation in the field of environmental protection, which aims to combat climate change, reduce greenhouse gas emissions, increase energy savings and promote the use of renewable energy sources, and all with the ultimate goal of improving the environment and the complete decarbonization of energy systems towards a carbon-free economy by 2050. EUSAIR will produce synergy with European policies that are also applied to energy networks.

At the same time, it respects and take into account the different structural peculiarities of each EUSAIR Member States. As stated in the Terms of Reference, it contributes to the following set of objectives.

a) Providing projects and measures as they are identified and developed by the Sub-Group on Energy Networks with a coherent background and perspective of the gas and electricity systems of each Member State;
b) Prioritising projects and measures which have been or are being identified while setting timelines and highlighting synergic effects and complementarities towards decarbonization and more resilient gas and electricity markets;
c) Detecting gaps and initiatives for further projects and measures which are either needed or missing with a view to the changing background and EU energy policies and programmes for a stronger integration of the gas and electricity systems of each EUSAIR Member State into the larger EU system.
d) Providing the Flagship Projects on Energy Networks with a framework of adequate connections in an evolving context, while evaluating impacts and prospects according to a long-term perspective towards a stronger us of renewable energy sources, towards digitalisation and innovation.

1.2 The aims and limits of the Master Plan as a means for enacting the EU Strategy for the Adriatic-Ionian Region (EUSAIR)

According to the Terms of Reference, the Master Plan refers to the entire power and natural gas supply infrastructure by including choices for power generation, gas supply and storage as well as grids for distribution and delivery down to final consumers and customers. The evolution of electricity markets through the European Union and through the EUSAIR and its Member States is emphasizing the need of larger and stronger integration with the natural gas market. Not only gas is a cleaner fuel in terms of CO_2 emissions but it is as well the fuel of choice for flexible power production plants that are essential to offset the growing role of intermittence production from renewable energy sources along a mid-term perspective. The organisation of European electricity and gas networks is designed to implement common strategies for enhancing the reliability of energy supplies. As a consequence, this Master Plan approaches gas and electricity networks with an integrated view.

In general, the analysis of the changing interaction between energy suppliers and energy customers is excluded by the Master Plan as well as actions and programmes regarding demand-side management and efficient use of energy. The potential contribution of the direct use of LNG as a clean fuel for transport would receive consideration in the Master Plan in combination with the new and increasing use of electricity for transport.

According to a long-term perspective, the progressive and massive introduction of renewable energy sources, electricity versus gas nexus and use of hydrogen fuels may induce changes in the structure and operation of power and gas grids and markets. The full exploitation of variable renewable energy sources would require use of storage systems when the production is higher than demand. Among the potential solutions is power to gas, a technology that allows to use electricity from renewable sources to extract through electrolysis hydrogen from water and then inject it in the gas grid or mix it with CO_2 to obtain synthetic methane. Only integrated gas and electricity grids can pave the way to these developments that are essential for a faster growth of renewable energy resources in line with the EU targets for decarbonisation of the energy system.

1.3 Focus, structure and organisation of the Master Plan

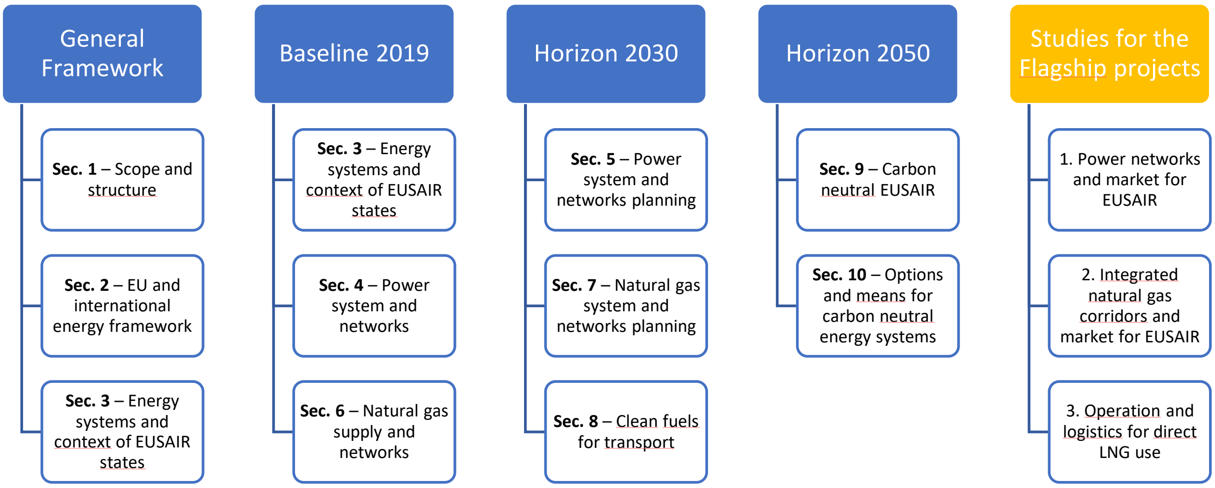
This Master Plan uses information obtained through activities of collection, analysis, and elaboration of data and results coming from primary and secondary sources directly or indirectly related to the prospects for development of the energy networks in the Adriatic-Ionian Region.

The development of the Master Plan requires interaction with the relevant administrations of EUSAIR Member States, their regulatory authorities, industry associations, academia, and stakeholders. Discussions have been developed in ad hoc workshops and meetings to provide the Technical Assistance with data and information. The Coordinators of the Sub-Group on Energy Networks of the EUSAIR TSG2 are the technical contact persons for the delivery of the Technical Assistance service.

Consideration is given to the work on long-term energy projections made by other organisations such as the Energy Community, Western Balkan 6 Initiative, Central and South-Eastern European Gas Connectivity (CESEC) Initiative, European Union Agency for the Cooperation of Energy Regulators (ACER), International Energy Agency and others. The Coordinators of the TSG2 Sub-Group on Energy Networks guide the work on the Master Plan.

The Master is developed under the sole responsibility of the Consultant and its contents does not imply neither involve the responsibilities or formal approval by the TSG2 Members of the Sub-Group on Energy Networks.

The structure of the Master Plan is as follows:



The Master Plan is developed according to the two-time horizons, namely year 2030 and year 2050.

The year 2030 is coherent with the time planning chosen for most of the key European projects and the commitments as foreseen by the National Energy and Climate Plans for 2021-2030 which may also outline a longer-term strategy. The Fit for 55 EU package sets targets up to the deadline of 2030. Targets for renewable energy sources aim at a level of 32% on final consumption while targets for CO2 emissions sets a 55% cut, this one raised in 2019 from the previous agreed 40%. These targets are essential parts of the EU energy transition to which the gas and electricity grid developments and integration should contribute.

It is noted on the other hand, that quite a few projects and measures which have been or are being identified by the Sub-Group on Energy Networks for new or upgraded energy infrastructure would deploy their effects over a much longer period of time than the year 2030. The selection of a long-term horizon such as the year 2050 reflects the time horizon of The European Green Deal and European Climate Law. According to The European Green Deal, the first priority of the EU Commission, carbon emission neutrality should be achieved across the European Union by the year 2050. Adopting such long-term time horizons, it makes sense to embrace different scenarios.

1.4 Information sources and data collection

The Master Plan gathers a coherent and comparable set of statistics for each Member Country of the EUSAIR Region concerning their energy systems. In order to provide the needed information a detailed list of required data is compiled. This will include detailed specifications of data based on the requirements of the Terms of Refence of the Master Plan. The Master Plan relies on the following list of data:

a) Basic energy data regarding total primary energy supply (TPES) and demand. Energy mix in TPES: shares of coal, oil, natural gas, renewable energy sources, others.

b) GDP, population and TPES intensity per unit GDP and per capita.

c) Electricity production and its share in total primary energy demand, electricity intensity per unit GDP.

d) Shares of total primary energy demand according to the main use sectors (housing, industry, transport, services, power generation).

e) Energy efficiency trend since 2010.

f) Greenhouse gases (CO_2 equivalent) energy-related emissions, emissions intensity per unit of GDP, per unit of TPES, and CO_2 emissions reduction trends since 2010.

g) Description of governance and regulation of the national energy system.

h) State of adoption of EU directives and regulations.

i) Total electricity generation capacity and electricity production.

j) Existing types of power generating units and their shares in total electricity production capacity and electricity production in the reference year. In particular, shares of renewable energy sources in total electricity production, and distributed power generation.

k) Electricity demand by sectors (housing, industry, transport, services) and their shares in national demand.

l) Trends for the period 2000-2019 of electricity prices for households and non-households' consumers.

m) Organisation and governance of the national power system: security concerns and cybersecurity, reserve capacity, peak loading, unbundling supply and distribution, regulated vs. non-cost reflective prices and tariffs, permitting procedures.

n) The electricity networks. HV and VHV power transmission lines in the Adriatic-Ionian Region, national lines, transboundary interconnections, maps for the year 2019 as the reference year.

o) Total gas supply, national gas production (if any), gas import shares according to their origin. LNG facilities (if any).

p) Natural gas demand by sectors (housing, industry, transport, services) and their shares in national demand.

q) Trends for the period 2000-2019 and gas prices for households and non-households' consumers.

r) Organisation and governance of the national gas system: security concerns and cybersecurity, reserve capacity and storage peak loading, unbundling supply and distribution, regulated vs no-cost reflective prices and tariffs, permitting procedures.

The main sources of information are:

- Annual and monthly statistics, source Eurostat.
- Energy Community.
- National Energy Strategy.
- National Energy Efficiency Action Plan (NEEAP)
- National Renewable Energy Action Plan (NREAP)
- National Energy and Climate Plans (NECPs)
- National commitments for the Paris Agreement
- EC Directorates General for Energy and for Regional and Urban Policy
- Regulatory Authority
- Competition Authority.
- Industry associations and other stakeholders.
- Data from national statistical offices.
- Relevant literature studies.
- International Energy Agency (IEA) data and statistics
- Development plans of Transmission System Operators for Electricity and Gas
- Other publicly available data sources.

Information sources and data collection will fall entirely upon the Technical Assistance and its responsibility while conducting work. Technical assistance will invite the Standing Members to cooperate in finding and coordinating the contacts with relevant institutions in all countries able to provide additional data not available publicly and to assess the available information.

2 Section 2 – The European and international energy framework

2.1 Climate crisis and Paris Agreement

Climate change has become one of the major concerns in today's political agenda all over the world, but the energy crisis of 2022 is forcing Europe to reconsider also issue of energy security and price competitiveness. Transitioning to a carbon neutral economy is still considered of utmost priority but with a better integration with stable and reliable energy supplies. The adoption of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) marked an unprecedented step in the global action against climate change, establishing the objective to limit global warming in this century to less than two degrees Celsius above pre-industrial levels. Furthermore, at the end of 2019, the EU reset the Commission's commitment to tackling climate and environmental-related challenges, setting out the EU Green Deal, the new growth strategy for the European Community. The strategic objectives of the Green Deal include zero net emissions of greenhouse gases by 2050 and economic growth decoupled from resource use. The successful limitation of the impacts of climate change requires a profound transformation of the global energy landscape, namely through a fast-paced deployment of low-carbon technologies to replace conventional fossil fuel-based technologies. The gas and electricity grids, the corner stone of the EUSAIR strategy on energy networks, will be central in allowing this process. This applies both to the supply and to the demand side. Consequently, not only the change in sources of energy is needed, but also the technologies for using that energy, namely through the electrification of fuel-based sectors (mobility/transport). As shown in Section 3, some of the EUSAIR Countries still use solid fuels, even coal for heating purposes in buildings, therefore electrification is needed in the building sector as well. Additionally, improvement of energy efficiency is needed, for example phasing out electric resistance heating, and using more efficient technologies like heat pumps. As far as the electrical sector is concerned, delivering the energy transition at the necessary pace and scale requires an almost complete decarbonization of the sector by 2050, which leads to an urgent scaling up of electricity production from renewable sources. Furthermore, the energy transition process also focuses on a more sustainable consumption, both by promoting the use of more efficient technologies on the demand side, but also by supporting the adoption of more responsible behaviors in using energy. Gas and electricity grids will be the place where this kind of deep change, almost a revolution, will take place, both on the production side, with a larger role of renewable energy sources, as well on the consumer side, where technology innovation and digitalization will enable stronger energy efficiency, distributed generation and demand response, through digitalization, to the benefit of more stable and resilient energy markets.

The sudden, unpredictable and tragic energy crisis of 2022 puts again security and affordability at the center of the energy policies since they are now of overwhelming concern for some countries through the Adriatic-Ionian Region. The short-term urgency to boost diversification of supply and to reduce gas consumption is on one hand giving strong support exactly to the exploitation of renewable energy sources, wind, solar, hydro, the pillar of the energy transition in order to reach the decarbonization targets. On the other hand, it is clear how the choice of Europe to abandon traditional energy sources that are presently more carbon intense, was too fast leaving many countries over exposed to the risk of complete shutdown of gas deliveries. Instead, those countries, like many also in the Balkan region, that still rely on carbon intensive fossil fuels have more flexibility to diversify and are more at repair from the negative effects of possible gas supply shortage.

2.2 The EU Green Deal and Next Generation EU policies and programmes

Since December 2019, the European Commission has been developing the European Green Deal that "aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use"[1]. The EU Green Deal is composed of a series of policy and legislative initiatives that would enable the EU to achieve climate neutrality by 2050. The Commission has already published several documents such as the EU's Energy System Integration Strategy[2], the Hydrogen Strategy[3], and the Climate Law. In parallel, as part of the post Covid-19 crisis recovery, in May 2020 the Commission put forward its proposal for a Recovery Plan that provides significant resources for clean and digital investments. The Commission proposed to increase the emission reduction target for 2030 from 40% to at least 55 %. This new goal might be too ambitious for some countries and not ambitious enough for others[4]. Subsequently, on 7th October 2020, the European Parliament's plenary voted for a 60% GHG emissions reduction target for 2030. Furthermore, in order to fulfil climate and energy legislation which needed to align with newly proposed target to reduce emissions by at least 55% by 2030, as compared to 1990 levels, a new package was proposed in 2021, "Fit for 55 Package" which covers everything from renewables to energy efficiency first, new gas law, energy taxation, emission trading revision and a wide range of other pieces of legislation.

2.3 EU energy targets towards the year 2030

2.3.1 The International Context

Since the 1990s, the issue of global warming and the need to combat climate change has become more and more of a priority and has attracted the attention of policy-makers worldwide.

From 1997, when the Kyoto Protocol on combating climate change was signed, to the present day, the initiatives taken by the European Union in this regard have been numerous and increasingly ambitious and have given it a leading role at global level in the challenges of climate protection and sustainability.

1997 - Kyoto Protocol

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[1] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

[2] https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf

[3] https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf

[4] https://ec.europa.eu/info/sites/info/files/soteu_2020_en.pdf

The Kyoto Protocol, signed on 11 December 1997 during the Conference of the Parties in Kyoto, is an international agreement aimed at combating global warming by reducing emissions of CO2 into the atmosphere.

The Kyoto Protocol committed the signatory countries to reduce by 2012 (date of termination of the Protocol's validity) the climate-altering gas emissions generated compared to their own emission levels in 1990, in percentages that differed from country to country and averaged 5%.

2015 - Paris Climate Agreement

At the end of the COP 21 negotiations in December 2015 in Paris, the Paris Agreement was signed. Under it, nations agreed to combat climate change by implementing policies and actions to invest in a low-carbon and climate-sustainable future, with the goal of keeping the average global temperature increase 'well below 2 °C'. The European Union's commitment to achieving the goals set by the Paris Agreement has evolved over time becoming more and more ambitious.

2021 - COP26 Glasgow

With COP26 in Glasgow, four main goals were achieved:

- Mitigation: zero net emissions by 2050 and contain the rise in temperatures by no more than 1.5 degrees by accelerating the phase-out of coal, reducing deforestation and increasing the use of renewable energy;
- Adaptation: supporting the most vulnerable countries to mitigate the impacts of climate change, safeguarding communities and natural habitats;
- Climate finance: mobilise financing for developing countries, reaching the target of $100 billion annually;
- Finalising the 'Paris Rulebook': operationalising the Paris Agreement, with particular reference to reference to (i) transparency of reporting on greenhouse gas emissions and the monitoring of countries' commitments, (ii) mechanisms (Art. 6 of the Paris Agreement) and (iii) common timeframes (common time horizons for NDC definition).

2.3.2 The EU directives and decisions

The following is a brief review of the path that has led the European Union to develop the energy policy strategies currently in place and set the ambitious targets for a complete transition to climate neutrality.

2009 - 20-20-20 Climate-Energy Package

In 2009, with the approval of Directive 2009/29/EC, the European Union approved the so-called "Climate-Energy Package 20-20-20", the purpose of which was to set new targets for the reduction of emissions for the period following the expiry of the Kyoto Protocol and, therefore, from January 2013 until 2020.

In particular, in order to combat climate change and promote the use of renewable energy sources through binding targets for member states, the 20-20-20 Package set the following targets to be achieved by 2020

- the reduction of greenhouse gas emissions by 20% compared to 1990;
- the increase of the share of energy produced from renewable sources to 20%;
- the increase of energy savings to 20 per cent.

2014/2015 - 2030 Climate and Energy Framework

The European Union's initial contribution to achieving the targets subsequently crystallised in the Paris Agreement consisted of a commitment to further reduce greenhouse gas emissions compared to the reductions previously envisaged in the 20-20-20 Package.

With the approval in 2015 of the 'Energy and Climate Policy Framework 2030', presented by the Commission on 22 January 2014, the European Union thus introduced:

- the binding target of reducing greenhouse gas emissions by at least 40 % by 2030 compared to 1990 levels;
- a target for the share of renewable energy sources consumed in 2030 of at least 27%;
- an energy efficiency improvement target of 27%.

2018 – Clean Energy Package and European Climate Act

In 2018, with the approval of the Clean Energy Package, a package of legislative changes proposed by the European Commission in November 2016 and aimed at reshaping the profile of the European electricity market, the European Union once again intervened in the areas of energy efficiency, renewable energy and security of electricity supply by updating the targets previously enshrined in the 'Energy and Climate Policy Framework 2030'.

In particular, among the most important innovations introduced by the Package are:

- the setting of a target of 32% of energy from renewable sources by 2030 by Directive 2018/2001/EU;
- the setting of the target of 32.5% energy efficiency by 2030 by the Directive 2018/2002/EU.

In order to achieve these objectives, it takes the form of a legislative basis for an energy Union governance necessary to ensure the achievement of the established long-term goals and targets, in line with the 2015 Paris Agreement on climate change.

2019 - European Green Deal

In December 2019, the Commission published the European Green Deal which represents Europe's overall strategy for Europe's growth and which redesigns the climate and environment commitments for the next 30 years.

The macro-objectives of the Green Deal, as originally conceived, are:

1. to reduce greenhouse gas emissions by 50%-55% by 2030 and achieve climate neutrality by 2050;
2. protect human, animal and plant life by reducing pollution;
3. to help companies become world leaders in clean technologies and products;
4. contribute to a just and inclusive transition.

To achieve these goals, in the same Communication with which the Commission outlined the Green Deal, it was announced that by June 2021 it would review all relevant climate policy instruments and propose an amendment to existing legislation as well as an update of the European Climate Act (Reg. 1999/2018/EU).

2021 - European Climate Law Review and Fit for 55 Package

The intentions announced in 2019 by the Commission in its Communication on the European Green Deal have been followed up:

- on the one hand, with the final approval in June 2021 of Reg. 1119/2021/EU to amending the 2018 European Climate Act, which introduced the new target of reduction of climate-altering emissions by at least 55% compared to 1990 levels by 2030;
- and, on the other hand, with the presentation by the European Commission on 14 July 2021 of the new 'Fit for 55' package containing a series of legislative proposals and new targets in several policy and economic areas including climate, energy and fuels, transport construction, land use and forestry that are intended to become binding.

2022 REPoweEU

In response to the energy crisis triggered by the Ukraine war, the European Commission's approved in May 2022 REPowerEU, a plan to accelerate clean energy transition and increase Europe's energy independence from unreliable suppliers and volatile fossil fuels.

The REPowerEU plan sets out a series of measures based on:

- energy saving;
- diversification of energy supply;
- a more rapid deployment of renewable energies to replace fossil fuels in homes, industry and in the generation of electricity.

Saving energy is the fastest and cheapest way to cope with the energy crisis and allowing at the meantime a reduction of energy bills for final consumers. The Commission proposes to strengthen long-term energy efficiency measures, including an increase from 9% to 13% of the binding energy efficiency target set under the "Fit for 55%" legislative package connected to the European Green Deal.

As regards the second objective, that relating to the diversification of energy supply, the Commission notes that the EU has been working for several months with international partners to diversify its supply and has managed to guarantee record levels of LNG imports and increased supplies of gas via pipelines.

Finally, the REPowerEU package intends to accelerate the uptake of renewable energy in electricity generation, industry, construction and transport to achieve fossil fuel independence faster, boosting the green transition and lowering energy prices in the medium to long term. To this end, the Commission has proposed to increase the headline target for 2030 for renewables from 40% to 45% under the "Fit for 55%" package.

2.3.3 The Regional context

The Western Balkans are a group of countries that are targeted by the European Union enlargement policy. This group is originally constituted by Albania, Croatia, North Macedonia, Montenegro, Bosnia and Herzegovina, Serbia and Kosovo∗. Croatia joined the European Union in 2013, and hence is no longer targeted by the Western Balkan EU policy. Among the six remaining countries – also referred as the Western Balkan 6 (WB6) – four are candidate countries to enter the EU (Montenegro, Albania, Serbia and North Macedonia) and two (Bosnia and Herzegovina and Kosovo∗) are potential candidates.

2006 The Energy Community

The Energy Community is the international organisation which brings together the European Union and its neighbours to create an integrated pan-European energy market. The organisation was established by the Energy Community Treaty and Council Decision of 29 May 2006 and entered into force on 1 July 2006. The key objective of the Energy Community is to extend the EU internal energy market rules and principles to countries in South East Europe, the Black Sea region and beyond on the basis of a legally binding framework.

The Parties to the Treaty are the European Union and the Contracting Parties, namely Albania, Bosnia and Herzegovina, Georgia, Kosovo∗, North Macedonia, Moldova, Montenegro, Serbia and Ukraine. Armenia, Norway and Turkey participate as Observers.

By signing the Energy Community Treaty, the Contracting Parties committed to implementing key EU energy legislation within a fixed timeframe.

The Energy Community Treaty aims to:

- Establish a stable regulatory and market framework capable of attracting investment in power generation and networks;
- Create an integrated energy market allowing for cross-border energy trade and integration with the EU market;
- Enhance the security of supply to ensure stable and continuous energy supply that is essential for economic development and social stability;

∗ Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

- Improve the environmental situation in relation with energy supply in the region and foster the use of renewable energy and energy efficiency; and
- Develop competition at regional level and exploit economies of scale

2009 - Western Balkans Investment Framework (WBIF)

The WBIF, established in 2009, is a joint initiative of the European Commission, the Council of Europe Development Bank (CEB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), and several bilateral donors, like World Bank Group, KfW Development bank, and Agence Française de Développement (AFD) aimed at enhancing harmonisation and cooperation in investments for the socio-economic development of the region and contributing to the European perspective of the Western Balkans. The WBIF is the main vehicle for implementation of the EU's ambitious Economic and Investment Plan for the Western Balkans.

2015 – February - CESEC - Central and South-Eastern European Gas Connectivity

The European Commission's (EC) initiative for Central and South-Eastern Europe Energy Connectivity (CESEC) works to accelerate the integration of Central Eastern and South-Eastern European gas and electricity markets. The CESEC High Level Working Group was set up by Austria, Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia, Slovenia and the European Union (EU) in February 2015. They were joined later by eight Energy Community Contracting Parties: Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Republic of Moldova, Serbia and Ukraine. The aim of the group is to co-ordinate efforts to facilitate the swift completion of cross-border and trans-European projects that diversify gas supplies to the region and to develop regional gas markets and implement harmonised EU rules to ensure the optimal functioning of the infrastructure. It also includes a joint approach on electricity markets, energy efficiency and renewable development; a list of priority projects to build an interconnected regional electricity market; and specific actions to boost renewables and investment in energy efficiency.

2020 – October - Economic and Investment Plan for the Western Balkans

The European Commission's (EC) Economic and Investment Plan for the Western Balkans accompanied by a Green Agenda for the Western Balkans are intended to enhance the long-term economic recovery of the region building on Green and Digital transition through a substantial investment package leading to sustained economic growth, implementation of reforms required to move forward on the EU path and bringing the Western Balkans closer to the EU Single Market. The Commission aims to mobilize up to EUR 9 billion of grant funding under the future Instrument of Pre-Accession Assistance (IPA III) to support the socio-economic convergence of the region with the EU. It will be complemented by the new Western Balkans Guarantee facility, which should be raising investments of up to at least EUR 20 billion. This process should be done through integrity compliance with EU standards and reliable project implementation process. The new package of connectivity projects presented by the EC under the Western Balkans Investment Framework constitutes the first step in the implementation of the flagship projects of the Economic and Investment Plan, while at the same time completes the delivery of the EU's 2015 pledge to deliver EUR 1 billion in support of connectivity in the region.

2020 – November -EU's Sofia Declaration on the Green Agenda

In November 2020, all of the WB6 countries signed the EU's Sofia Declaration on the Green Agenda for the Western Balkans which meant they committed to work towards the 2050 target of a carbon-neutral continent together with the EU. This was a decision of strong political significance, but as the declaration did not contain deadlines or mechanisms for delivery much depend on action plans which are to be prepared with the support of the Regional Cooperation Council. The contracting parties have committed to implement actions in five pillars, which include climate, energy, mobility, circular economy, depollution, sustainable agriculture and food production, and biodiversity.

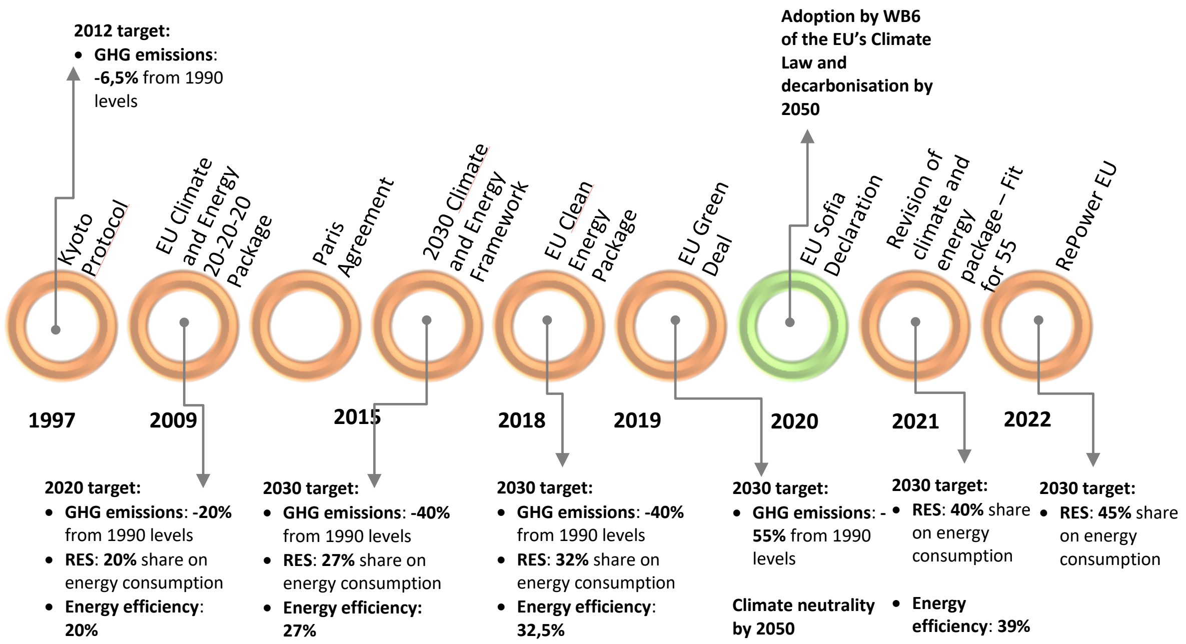

Figure 1 - Development of key EU climate and energy targets

Source: Consultant's elaboration

2.3.4 Implications of the EU Policies for the EUSAIR and its member states

The EUSAIR must produce synergies with European policies applying to its Thematic Areas, among which the Energy networks thus it's important to ensure links and greater alignment between EUSAIR and other EU and non-EU national and cross-border policies.

The EUSAIR is the ideal instrument to open gradually EU policies to candidate and potential candidate countries to create a closer link to the enlargement process in the Wester Balkans, in line with the new Commission objective of "a stronger Europe in the world". It can allow cooperation at political level through initiatives in the region such as the EU-Western Balkan Summits and relevant regional cooperation initiatives.

One of the objectives of the EUSAIR is the achieving the goals of the European Green Deal, thus putting mitigation of climate change in the national agenda of EUSAIR countries. Thus, the EUSAIR is the ideal instrument to enable cooperation on joint actions, projects and processes, supporting decarbonization efforts in the Adriatic and Ionian region.

The EU target to make Europe a climate-neutral continent by 2050 makes essential to align the EUSAIR to national strategic and development documents in all participating countries such as policy implementation plans and programs required by the EU acquis.

EUSAIR offers mechanisms that allow swift reactions to crises and sudden challenges, as in the case of the war conflicts and security of supply.

2.4 The EUSAIR Action Plan for Pillar 2 – Connecting the Region – Energy Networks

The Strategy and the EUSAIR Action Plan were approved and launched in 2014 and formulated during that year and before. With regard to energy matters several changes occurred since those times in EU policies, programmes, directives and regulations. Just to quote a few elements and events which appear to shape the new energy scene are: the Paris Agreement on climate change of December 2015; the Clean Energy for All Europeans Package adopted by the EU in 2019; the Investment Plan for Recovery for Western Balkans of October 2020; the Fit for 55 Package of 14 July 2021. The general aim is at decarbonizing the EU energy system towards a carbon-neutral economy by the year 2050. All these new elements appear hard to accommodate within the present structure of the EUSAIR Action Plan.

The action by the EUSAIR TSG2 Sub-Group on Energy Networks has its focus on three classes of projects where projects can be “hard” when they involve the construction of infrastructures, installations and plants or projects can be “soft” when they involve measures aimed at new organisational arrangement, new laws and regulations, new or modernized activities. In these three classes of projects, we have first the projects which are given or deserve the EUSAIR-label; second are the Flagship Projects; third the strategic project ideas which are proposed for development until they become bankable projects or projects able to deploy new knowledge and connections.

Mechanisms for the financial support of hard projects are including the Connecting Europe Facility (CEF) grants, loans, equity investments and guarantees by EIB (European Investment Bank) and EBRD (European Bank for Reconstruction and Development). In any case Energy Investments are supported by International financial institutions and private sources. In non-Member States of Western Balkans, it is also possible to finance infrastructure projects through International Donors, like WBIF (Western Balkans Investment Framework). Energy Actions are not supported by ERDF (European Regional Development Fund) and CF (Cohesion Fund) if they are not referring to energy efficiency improvement and/or promotion of RES (Renewable Energy Sources). ADRION and ETC (European Territorial

Cooperation) programs support mainly soft projects referring to capacity building, technical assistance, networking, cooperation, stakeholder engagement etc. within EUSAIR area. There is a difference between access to EU funding between EU and non-EU Countries. In the next programming period 2021-2027, the budget of the ADRION program foresees an important increase of IPA funds creating a new space between actions led by IPA partners (5 countries) and actions led by ERDF partners (4 countries) in the Adriatic-Ionian Region.

The EU should additionally, beyond the mentioned mechanisms, support the more ambitious transition goals of non-EU countries in the EUSAIR region towards decarbonization.

2.5 Interactions and relations between the EUSAIR and its Member States

Pillar 2 - Connecting the Region, Sub-Group on Energy Networks deals with Energy Networks for a Green Adriatic-Ionian Region and the necessity of EUSAIR to be at the forefront of coordinated efforts by its participating countries to achieve environmentally sustainable solutions for the energy transition.

The EUSAIR is considered as a key role in accelerating and contributing to the transition towards more integrated and interconnected energy systems through the Adriatic-Ionian Region and beyond. To confront the climate challenge enhanced collaboration and harmonised energy programmes and investments are needed with a view at green carbon-neutral economies in the long term. Energy investments for the energy transition could become an opportunity for sustainable economic and social development on one hand, or a roadblock on the other. A number of Countries of the Adriatic-Ionian Region are heavily relying upon fossil fuels for their energy supply. An uncoordinated transition towards decarbonised resilient energy systems might induce stranded costs hard to recover. Joint effort by the EUSAIR, Energy Community, EUSDR, EU programmes and project embedding would have a role and contribute to overcome difficulties in this respect.

New power lines, new gas interconnection and infrastructure, adoption of renewable energy sources and energy efficiency should be envisioned to strengthen energy security and resilience while protecting environment, promoting economic growth, innovation and industrial leadership.

The goals for the for the Adriatic-Ionian Region are energy sources diversification for the short term and accelerating the clean energy transition as a lasting solution to prevent energy price spikes, ensure affordable energy and consumer protection especially for the most vulnerable part of the population and energy-intensive industry.

The share of technology innovation in smart power grids and hydrogen in the region would accelerate the recovery and transition towards a green economy and the Green Deal gives great potential in this respect. Given the difficult context and the challenges ahead, a clear consensus emerged on the need to enhance energy co-operation within EUSAIR and beyond its borders to accelerate energy recovery and transition towards a green economy. Smart grids and hydrogen are two key assets and directions for moving towards a carbon-zero energy system. A green energy deal for the Adriatic and Ionian Region would provide EUSAIR Member States with opportunities for collaboration on smart power grids and hydrogen, to share technology innovation, business potential and converge on a common mission.

Concrete policy and coordinated regulatory measures at EUSAIR and multilateral level are essential to prepare and shape the green Adriatic-Ionian Region while respecting the different starting points of Member States.

The EUSAIR is called to play a leading role in the energy sector transformation to increase energy security and reduce greenhouse gas emissions while helping Member countries decarbonising their energy systems, enhancing their energy technology innovation capacity and creating job opportunities for the young generations. The implementation of energy projects such as the use of liquified natural gas and other clean fuels for maritime transport towards a low emission and zero-emission Adriatic-Ionian Sea would represent a concrete and extraordinary achievement and present for the new generations.

2.6 Description and analysis of three energy scenarios for the future

2.6.1 EUSAIR Master Plan scenarios

The Master Plan of Energy Networks for the Adriatic-Ionian Region will be developed on two-time horizons, namely by the year 2030 and by the year 2050. **Three Scenarios** will be elaborated:

1. First, the **Current Policies Scenario** which will show what could happen should a large number of EUSAIR Member States or the EUSAIR on the average continue in the present national policies and **business as usual** conditions while making limited progress along integration of energy policies and programmes through the Adriatic-Ionian Region and between the Adriatic-Ionian Region and the EU.
2. Second, the **New Policies Scenario** which will consider and will be based upon **new declared policies and commitments** (by a large number of EUSAIR Member States) towards energy integration and decarbonisation by the Year 2030 or so. In this Scenario EUSAIR Member States may also wish to embark into forms of enhanced cooperation to maximise business and investment opportunities with the aim of maximizing the value of their commitments.
3. Third, the **Carbon Neutral Scenario (Net Zero Scenario)** by the Year 2050, a Scenario which will highlight actions and measures to be undertaken by EUSAIR Member States toward carbon neutrality by the year 2050. Clearly, this is a very challenging Scenario and details and achievements would depend upon the starting points of the different EUSAIR Member States and achievements which would be made by the year 2030.

Going into more detail, the Scenarios will be developed primary on the information contained in National Energy and Climate Plans (NECPs) and on the basis of the following general guidelines:

- the **Current Policy Scenario (CPS)** will be based only on existing trends of energy consumption linked to specific variables of each sector of final energy use, without envisaging any new policies nor new significant structural change, both in policies and of consumer technologies or new energy sources: this scenario is much the same as the "*With Existing Measure (WEM)*" scenario contained in NECPs;

- the **New Policy Scenario (NPS)** will be developed considering the targets set by each Country in its NECPs, thus taking into account technological changes and the related energy consumption trajectories up to 2030: this scenario is much the same as the "*With Additional Measure (WAM)*" scenario contained in NECPs;
- the **Carbon Neutral Scenario** will be set in order to achieve climate neutrality for each Country by 2050, thus adopting the appropriate technological trajectories, specific for each Country, which will facilitate to reach their targets: it will be based on, i.e., maximizing the production of energy from renewable sources, increasing system flexibility by e.g. batteries deployment, accelerating investments in energy efficiency, adopting methods for sustainable and decarbonized transports, and applying heat pumps and, if necessary, the carbon capture and storage for hard-to-abate sectors.

The CPS and NPS scenarios are therefore based on the information available in the NECPs of the individual Countries.

If available, the data from the WEM and WAM scenarios relating to the **consumption of natural gas and electricity** in the individual sectors of use (industry, residential, tertiary, transport, etc.) are used directly.

In the case of **electricity production**, the RES development scenarios and the evolution of the electricity generation plants over the time horizon of the NECP are used.

If only indirect information is available in the NECPs, the CPS and NPS scenarios are created by processing, where possible, this information, also starting from the reference data for the 2019 base year.

If the NECP information are not available for some EUSAIR countries, for the CPS and NPS scenarios will be used respectively the Stated Policies Scenario (STEPS[5]) and the Sustainable Development Scenario (SDS[6]) of the IEA World Energy Outlook 2020 (WEO 2020[7]). In this case, according to regional groupings in WEO, the scenarios will be related to "European Union" for Italy, Slovenia, Croatia and Greece and "Europe" for Albania, Bosnia and Herzegovina, North Macedonia, Montenegro and Serbia.

[5] The Stated Policies Scenario (STEPS) is based on 2021's policy settings. In this scenario, GDP also returns to pre-covid 19 levels in 2021, and energy demand in early 2023, but outcomes vary sharply by fuel: renewables meet 90% of the strong growth in global electricity demand over the next two decades, led by continued high levels of solar PV deployment, but global coal use never gets back to previous levels.

[6] The Sustainable Development Scenario (SDS) sees a near-term surge of investment in clean energy technologies over the next ten years, along with action to reduce emissions from existing infrastructure; this is enough to make 2019 the definitive peak year for global CO_2 emissions.

[7] Available here: https://www.iea.org/reports/world-energy-outlook-2020

Considering the relevance of transmission system operators (TSOs) operating in the electricity and natural gas systems, the scenarios developed by ENTSO-E and ENTSO-G will be considered in the verification process of the EUSAIR scenarios.

Given the variety of EUSAIR Member States the proposed Scenarios are indicative and they cannot influence, neither determine policies, programmes or options which will be decided by the EUSAIR Member States and their Governments according to their needs and opportunities.

2.6.2 Relationship between EUSAIR Master Plan scenarios and other available scenarios

EU Policy scenarios

The EU Reference Scenario is one of the European Commission's key analysis tools in the areas of energy, transport and climate action. It allows policymakers to analyse the long-term economic, energy, climate and transport outlook based on the policy framework in place in 2020.

The Reference Scenario 2020 is a projection of the evolution of the energy and transport systems and the associated GHG emissions in every Member State and in the EU as a whole until 2050 subject to the policy framework in place as of December 2019, including the NECPs. The projection is also subject to assumptions regarding the evolution of population, economic and industrial activity, world fuel prices, technology and market trends.

The assumed policy framework, including the NECPs, by design, have an implementation horizon until 2030. While there are no specific policy targets for the period after 2030, the assumed policy framework shows long-lasting impacts thanks to investment decisions and technological developments across the sectors. The EU ETS in particular is assumed to include provisions to the horizon of 2050 and so the ensuing carbon prices constitute a driver that influences investment and choices until 2050. Nonetheless, the long-term effects get progressively weaker over time and the transformation that happens until 2030 slows down afterwards, up to 2050.

The Reference Scenario is not a forecast and thus not a prediction of the most plausible evolution of the energy and transport systems. It is a projection or, in other words, a quantification of causal effects of policy and other assumptions on the energy and transport systems.

The MIX scenario includes policies, measures and carbon pricing combined to reach a GHG reduction of 55% and has been developed by European Commission, together with other scenarios, for the impact assessment of “Fit for 55” package. In this scenario, the target of -55% of GHG is reached both expanding carbon pricing and moderately increasing the ambition of policies on energy efficiency, renewable energy and transport. Furthermore, the MIX scenario includes in ETS also road transport and buildings and provides possible application of ESR.

EU Policy Scenarios might find considerable change due to the energy supply emergency that the EU is facing.

ENTSOs TYNDP scenario

A core element of ENTSO-G and ENTSO-E's scenario building process has been the use of supply and demand data collected from both gas and electricity TSOs as well as from official EU and Member State data sources and key industry projections to build robust bottom-up scenarios.

The following scenarios were proposed to be used for Ten-Year Network Development Plan (TYNDP 2020 and 2022)[8] calculation:

- **National Trends (NT)** is in line with national energy and climate policies (NECPs, national long term strategies, hydrogen strategies, etc.) derived from the European targets. The electricity and gas datasets for this scenario are based on figures provided by official data sets (such as PRIMES).
- **Distributed Energy (DE)** pictures a pathway achieving EU27 carbon neutrality by 2050 and at least 55 % emission reduction in 2030. The scenario is driven by a willingness of the society to achieve energy autonomy based on widely available indigenous renewable energy sources. It translates into both a way-of-life evolution and a strong decentralised drive towards decarbonisation through local initiatives by citizens, communities and businesses, supported by authorities. This leads to a maximization of renewable energy production in Europe and a strong decrease of energy imports.
- **Global Ambition (GA)** pictures a pathway to achieving carbon neutrality by 2050 and at least 55 % emission reduction in 2030, driven by a global move towards the Paris Agreement targets. It translates into the development of a wide range of renewable and low-carbon technologies (many being centralised) and the use of global energy trade as a tool to accelerate decarbonization. Economies of scale lead to significant cost reductions in emerging technologies such as offshore wind, but also imports of decarbonised energy from competitive sources are considered as a viable option.

Electricity and natural gas data for the ENTSOs scenarios are verified by national TSOs members of the European Network of Transmission System Operators for electricity (ENTSO-E) and natural gas (ENTSO-G).

International Energy Agency World Energy Outlook (WEO) scenarios

For the IEA World Energy Outlook (WEO)[9], three scenarios have been currently modelled:

1. **Net Zero Emissions by 2050 Scenario (NZE)** sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO2 emissions by 2050. It is designed to achieve an emissions trajectory consistent with keeping the temperature rise in 2100 below 1.5°C (with a 50% probability), universal access to modern energy services and major improvements in air

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[8] TYNDP 2022, Scenario Report, version, April 2022

[9] https://www.iea.org/reports/global-energy-and-climate-model/understanding-gec-model-scenarios

quality. It doesn't rely on emissions reductions from outside the energy sector to achieve its goals. **<u>The IEA NZE Scenario has been used as main reference for the construction of NZE scenarios in this Master Plan.</u>**

2. **Announced Pledges Scenario (APS),** assumes that all climate commitments made by governments around the world, including Nationally Determined Contributions (NDCs) and longer-term net zero targets, will be met in full and on time.
3. **Stated Policies Scenario (STEPS)** reflects current policy settings based on a sector-by-sector assessment of the specific policies that are in place, as well as those that have been announced by governments around the world.

Unlike the previous ones, the WEO 2022 edition does not include the **Sustainable Development Scenario (SDS),** an integrated scenario specifying a pathway aiming at ensuring universal access to affordable, reliable, sustainable and modern energy services by 2030 (SDG 7), substantially reducing air pollution (SDG 3.9) and taking effective action to combat climate change (SDG 13). The SDS was however included in IEA WEO 2020, with the base year 2019: for this reason, **<u>the SDS scenario has been used as main reference for the construction of NPS scenarios in countries without NECPs.</u>**

Matching of EUSAIR Master Plan scenarios with the most similar one scenario for EUSAIR countries is as follows:

<table>
<tr><th>EUSAIR Master Plan Scenarios</th><th>NECPs</th><th>European Commission
(PRIMES Scenario)</th><th>ENTSOs
TYNDP 2022 Scenarios</th><th>IEA WEO 2022 scenarios</th></tr>
<tr><td>Current Policy Scenario (2030)</td><td>With existing measures (WEM)</td><td>EU Reference Scenario 2020</td><td rowspan="2">National Trends</td><td>Stated Policies Scenario (STEPS)</td></tr>
<tr><td>New Policy Scenario (2030)</td><td>With additional measures (WAM)</td><td>Fit for 55
(MIX Scenario)</td><td>Sustainable Development Scenario (SDS)</td></tr>
<tr><td>Carbon Neutral Scenario (2050)</td><td>n.a.</td><td>EU climate-neutral vision[10]</td><td>Distributed Energy
Global Ambition</td><td>Net Zero Emissions by 2050 Scenario (NZE)</td></tr>
</table>

[10] COM (2018) 773 - A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy

3 Section 3 - Energy systems and context of EUSAIR Member States

3.1 The energy supply and demand systems

The Adriatic-Ionian Region covered by the EUSAIR macro strategy differs considerably between countries in terms of economic development, as well as concerning energy supply and demand systems. The EUSAIR countries are also in various stages of the institutional reforms of their energy sectors, but all of them they strive for the same goal common EU energy market. All EUSAIR countries move towards general economic development. While EU countries (Italy, Slovenia, Croatia and Greece) motivation to liberalise their energy markets was guided by the free trade and competitiveness of their energy markets; in the EUSAIR Western Balkans countries, which were also motived by faster economic growth, main drivers for these reforms were perspectives of EU accession process, obligations taken under Energy Community Treaty and attracting of direct foreign investments.

The EUSAIR countries, both energy supply and demand sides, are highly dependent on fossil fuels and its imports. The exposure on fossil fuel imports (mainly gas and oil) creates additional energy vulnerability with regards to potential supply disruptions and energy security problems. Limited diversity in gas supply is affecting several EUSAIR countries (Serbia, BIH, N. Macedonia), which are supplied from a single supplier under long-term contracts. Other (like Italy) which have alternative gas supply routes are also affected due to its high consumption of natural gas, as large part of market is covered by dominant supplier whose market share is crucial in sustaining secure gas supply. Missing definitions of transit regimes, missing infrastructure and/or inefficient use of the existing are also reasons causing lack of alternative gas supply throughout the region.

Besides, fossil fuel consumption and import dependence, need for modernisation of the energy sector infrastructure is one of the most important issues. The need for modernisation goes together with the need for decarbonisation and starting energy transition processes, as combustion of large amount of fossil fuels causes low air quality and significant health impacts to citizens across several countries of the EUSAIR region. All EUSAIR countries have significant potential for energy savings and renewables which is not being untapped properly.

The socio-economic conditions (low prices of energy) of non-EU EUSAIR members are preventing full liberalisation of energy markets and introduction of cost-reflective energy tariffs, due to the issues of energy affordability for citizens and improving the economic competitiveness of the respective countries. This approach is in direct opposition to the development of transparent and liquid energy markets.

It is especially worth to point out the differences across EUSAIR existing between the EU Member States and non-EU countries (Energy Community Contracting Parties - EnCP's), particularly when it comes to regulatory frameworks. Adoption and implementation of EU acquis by the EnCP's, as well among legislation coordination among countries is of the utmost importance to prepare regulatory and institutional conditions in order to move towards single EU energy market.

Under these conditions, moving of the EUSAIR countries under single EU market would definitely contribute to increased competitiveness of the energy sectors, monopoly elimination, increased penetration of renewables, foreign investments and development of new efficient technologies to boost national industries.

In order to provide solutions for previously listed challenges in the EUSAIR region and market integration, there is need for aligning of the regulatory frameworks and significant infrastructure development and reinforcement (to eliminate technical constraints and barriers), but also improvements in capacity calculation methodologies for cross-border trade.

Other barriers like fossil fuel subsidies are big issue in some non-EU EUSAIR countries, as well as long-term political vision and political stability (frequent changes in the leadership and political conflicts).

3.2 Overview and comparison of the energy systems of each one of the EUSAIR Member States

3.2.1 Primary and final energy demand

The **primary energy consumption** of the EUSAIR countries amounts to a total of approximately 165 Mtoe, of which almost 60% is borne by the Italian regions, 14% by Greece and 9% by Serbia.

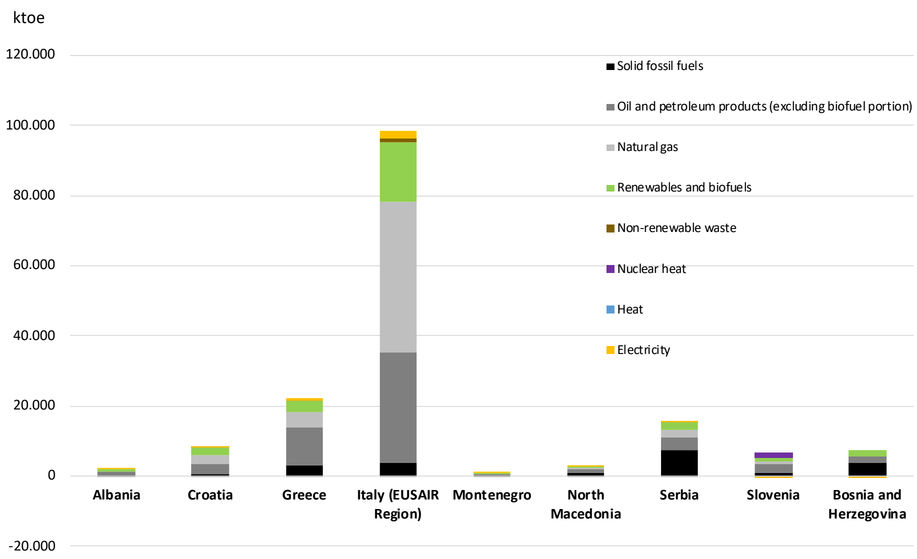


Figure 2 – Total primary energy supply in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

Analyzing the consumption of primary energy by source for each country, the propensity of those in the Balkans to use solid fuels, which in some cases (Bosnia and Serbia) even cover approximately 50% or more of primary consumption, stands out.

From this point of view, Italy is the country least exposed to the consumption of coal, while it is the one most heavily unbalanced on natural gas, which covers 44% of its primary consumption.

Among the EUSAIR countries the consumption of fossil fuels is largely prevalent, with peaks above 80% in Serbia, North Macedonia and Greece and with most of the countries being slightly lower.

As for renewable sources, Albania and Montenegro stand out among the most virtuous countries, thanks in particular to their hydroelectric production.

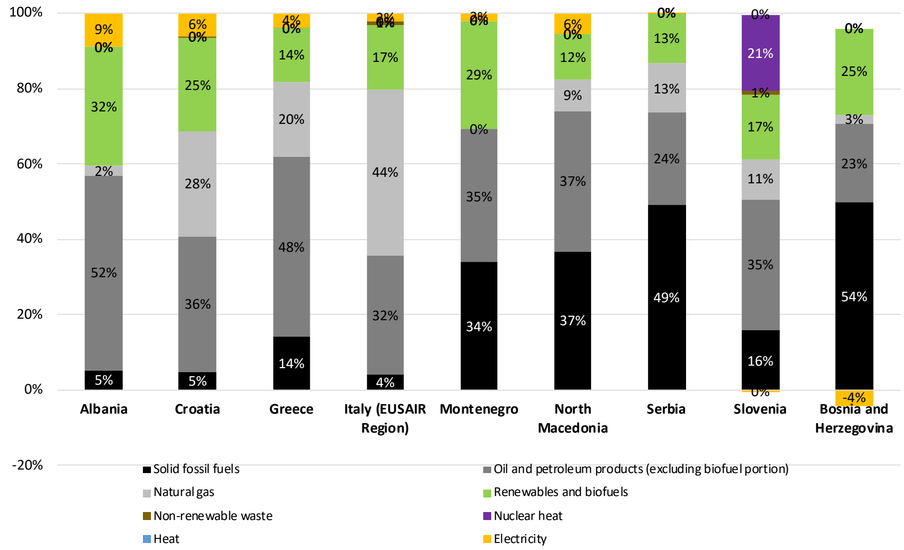


Figure 3 – Total primary energy supply in 2019 (%)

Source: Consultant's elaboration on Eurostat data

As regards **final energy consumption** by source, the EUSAIR countries reach a total of 120 Mtoe, of which about 63% from the Italian regions, 13% from Greece and 7% from Serbia.

Montenegro, North Macedonia and Albania do not exceed 2% of the total.

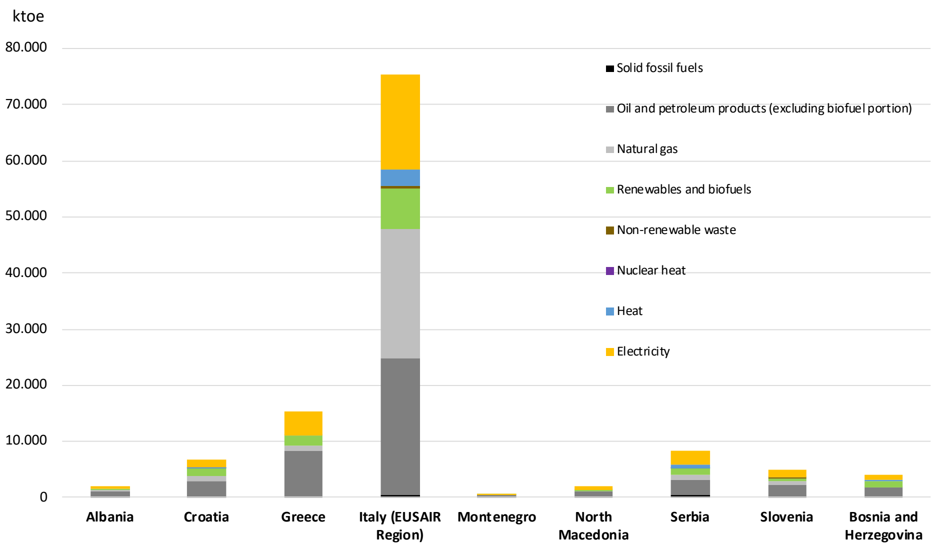


Figure 4 – Final energy consumption per source in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

Even in the case of final consumption by source, there is a consumption, albeit marginal, of coal by many Balkan countries, while also in this case Italy is the most exposed to natural gas consumption and, in general, to consumption of fossil sources (the highest level of fossil consumption, around 63% of total final consumption).

Renewables reaches 29% of final consumption in Bosnia, 19% in Montenegro and 17% in Croatia: in all other countries the share of renewables remains below 15%.

The level of electrification of final consumption is very high in Montenegro, where it is close to 35%, while in the other cases it remains below 30%.

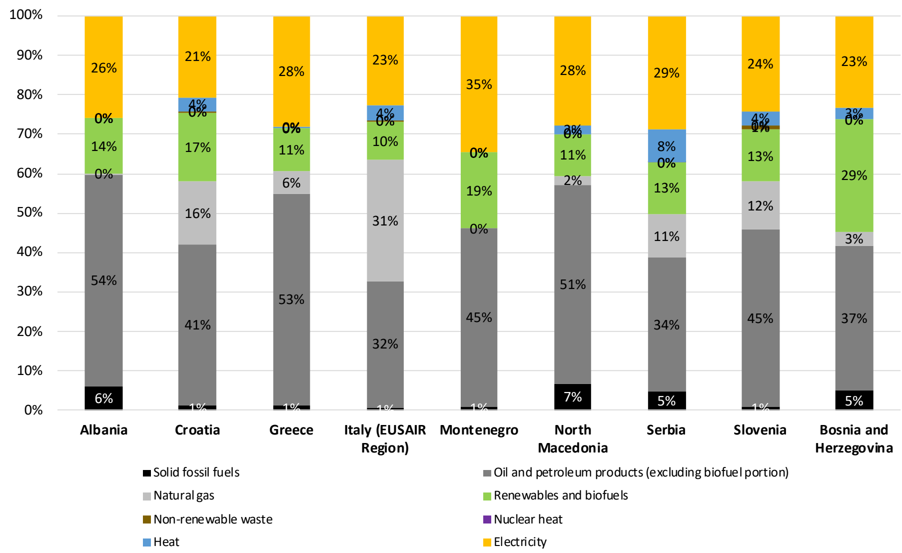


Figure 5 –Final energy consumption per source in 2019 (%)

Source: Consultant's elaboration on Eurostat data

3.2.2 Macroeconomic data and energy indicators

Overall, the EUSAIR countries recorded a gross domestic product of over 1,115 billion purchasing power standards (PPS) in 2020.

Of these, about 67% come from the Italian regions, 13% from Greece, 6% from Serbia, 5% from Croatia and 4% from Slovenia. The other countries accounted for about 1% or 2% each.

Until 2008, all EUSAIR countries recorded positive PPS growth rates, while starting from 2008 there were ups and downs (except in 2012).

In any case, with the exception of Greece, which spent several years in recession due to the debt crisis, the other EUSAIR countries tended to record a rather constant increase in their PPS to varying degrees from one country to another: in all Balkan countries the average annual PPS growth rates were higher than 4%, while in the EU countries none reached similar figures (with EUSAIR Italian Regions at 1.8% on average).

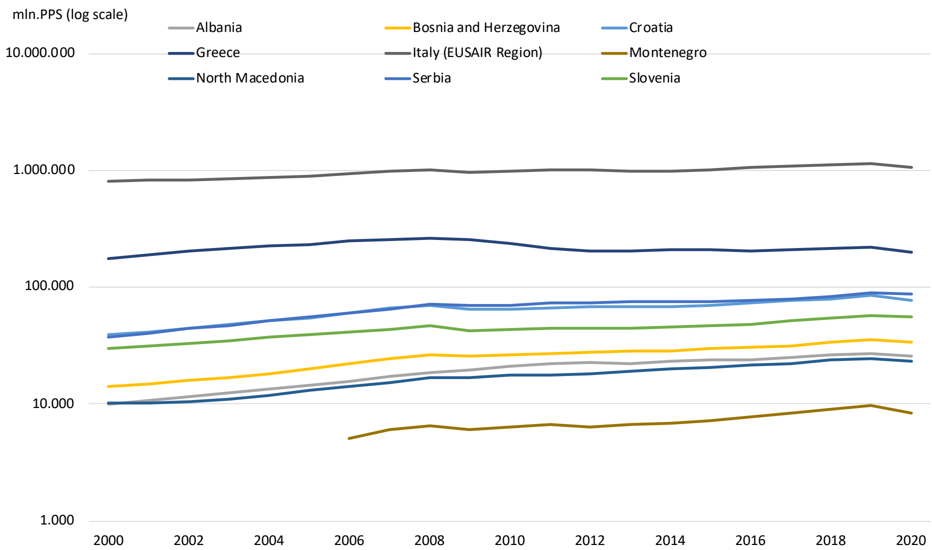


Figure 6 –Gross domestic product (PPS)

Source: Consultant's elaboration on Eurostat data

Overall, the EUSAIR countries have a population of approximately 62 million people.

Of these, about 53% reside in the Italian regions, 15% in Greece, 10% in Serbia, 6% in Croatia. The other countries are less than 5%.

Over the last twenty years, Albania, North Macedonia and Serbia have seen their resident populations steadily decline, while only Slovenia has never experienced a negative growth rate in the same period.

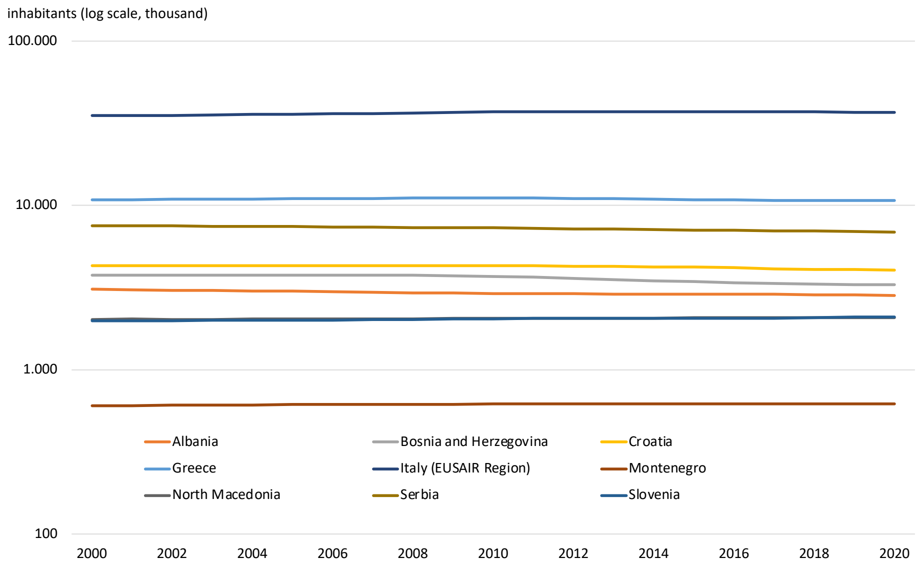


Figure 7 –Population

Source: Consultant's elaboration on Eurostat and World Bank data

Primary energy consumption per unit of PPS varies significantly from one country to another, with Bosnia and Serbia having an energy intensity of around 180-200 toe/mln.PPS, while Italy and Albania lower than 90 toe/mln.PPS.

There are many factors that contribute to a different level of primary energy consumption for the same PPS between the various countries: certainly, some factors are linked to a different efficiency in the use of energy in the final use sectors (industry, residential, transport in particular), while others are linked to the efficiency of the transformations of primary energy into energy useful for consumption, primarily in the electricity production sector.

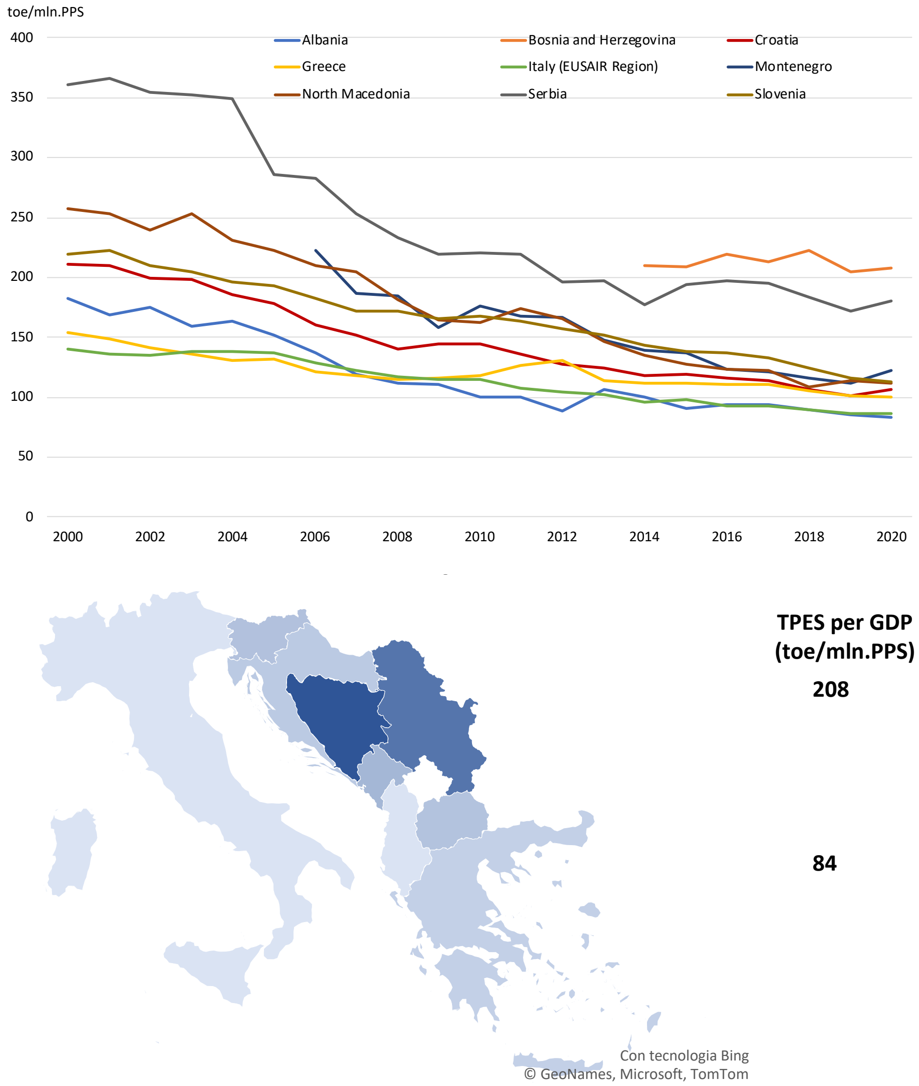
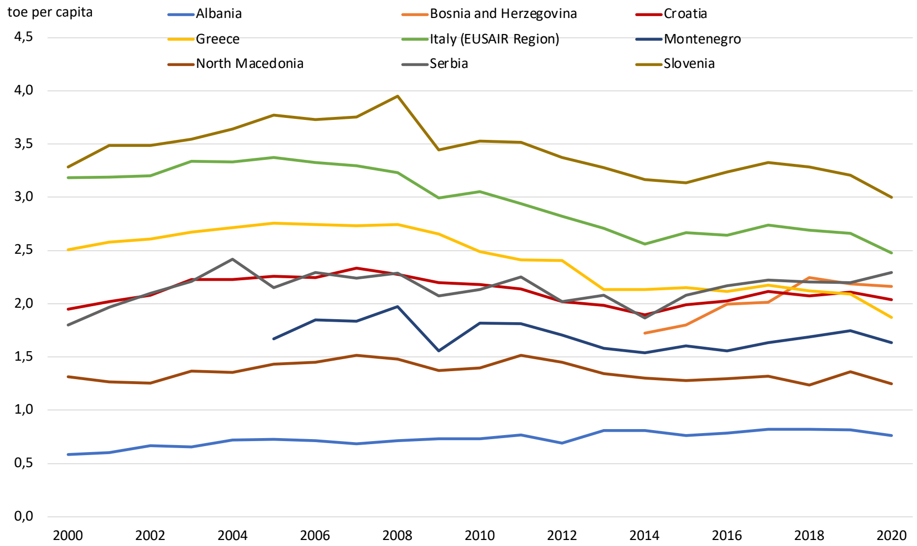


Figure 8 – Total primary energy supply per unit of GDP (toe/mln.PPS)

Source: Consultant's elaboration on Eurostat data

The consumption of primary energy per capita is instead higher in Slovenia (3.0 toe per capita) and in Italy (2.5 toe per capita), while in Montenegro and Albania, the countries where this indicator is lowest, the average consumption per capita it is also less than 1 toe per capita.

Also in this case there are many factors that contribute to a different level of primary energy consumption per capita among the various countries: the main factor, however, concerns the level of development of the economy of the countries, whereas usually countries with more developed economies have a degree of supply and integration in the various final sectors of energy use that is even significantly higher than in countries with less developed economies.



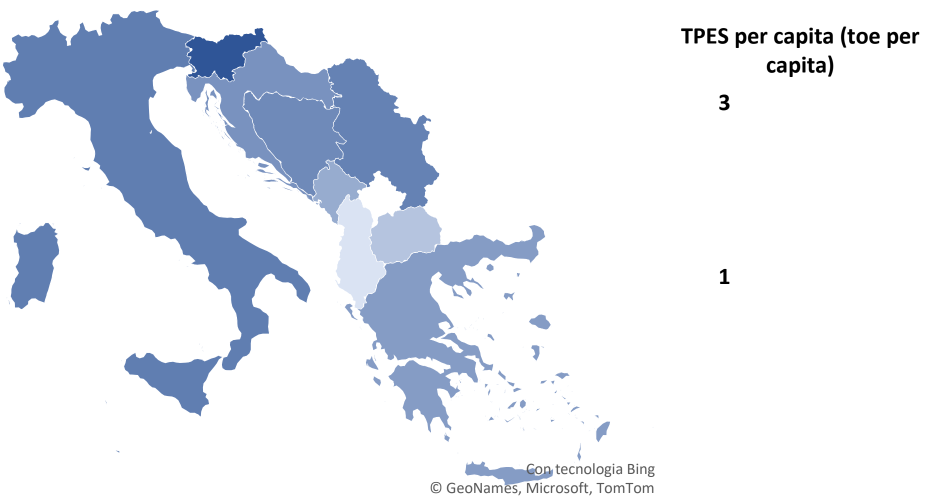


Figure 9 – Total primary energy supply per capita (toe per capita)

Source: Consultant’s elaboration on Eurostat and World Bank data

3.2.3 Electricity production and indicators

Electricity production in the EUSAIR countries exceeded 29,6 Mtoe in 2019 (about 345 TWh), of which 57% was produced in the Italian regions, 14% in Greece, 11% in Serbia.

Serbia, Bosnia and North Macedonia are still closely linked to coal in domestic electricity production (over 60%), while Italy and Greece have focused more on natural gas.

Overall, most countries use fossil fuels to produce more than 50% of their electricity, while Albania, Croatia and Montenegro use more renewables for electricity generation.

Slovenia is the only country to have a nuclear power plant, which covers approximately 36% of the total national electricity production.

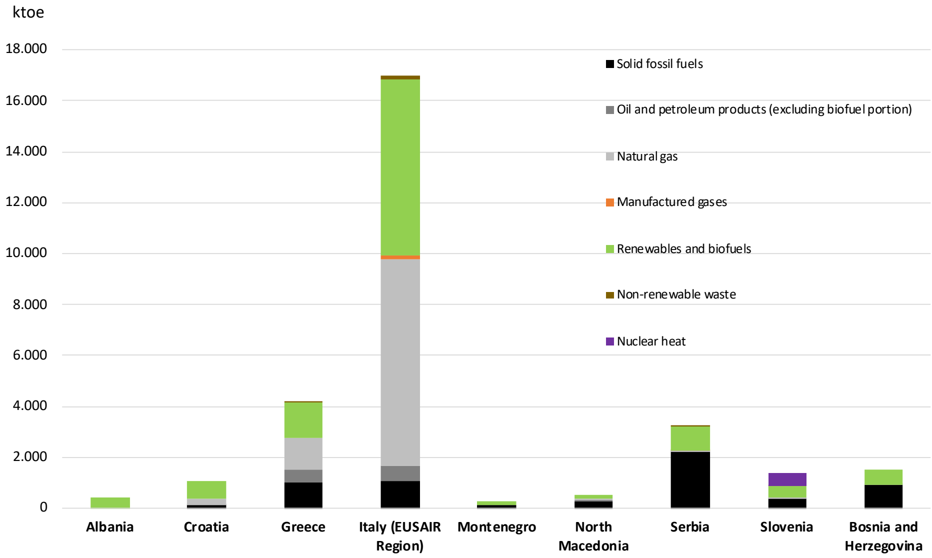


Figure 10 – Gross electricity generation per source in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

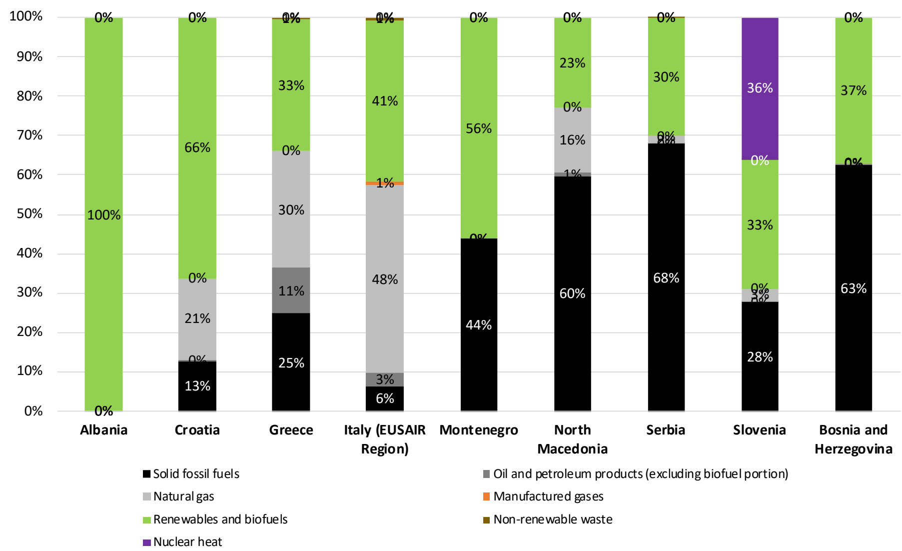


Figure 11 – Gross electricity generation per source in 2019 (%)

Source: Consultant's elaboration on Eurostat data

Electricity production from renewable sources in the EUSAIR countries reached 11.8 Mtoe in 2019 (about 137 TWh), of which almost 60% was produced in the Italian regions, 12% in Greece, 8% in Serbia and 6% in Croatia. The other countries accounted for 5% or less each.

The Italian regions and Greece are the countries with the greatest differentiation in terms of renewable sources used for electricity generation.

All the other countries are heavily biased towards hydroelectricity, which in some cases (Albania and Bosnia) covers over 90% of their renewable electricity production.

Wind power is significantly present in Greece, Italy, Croatia and Montenegro, while solar photovoltaics are widespread only in Italy and Greece (and in a small amount in Slovenia).

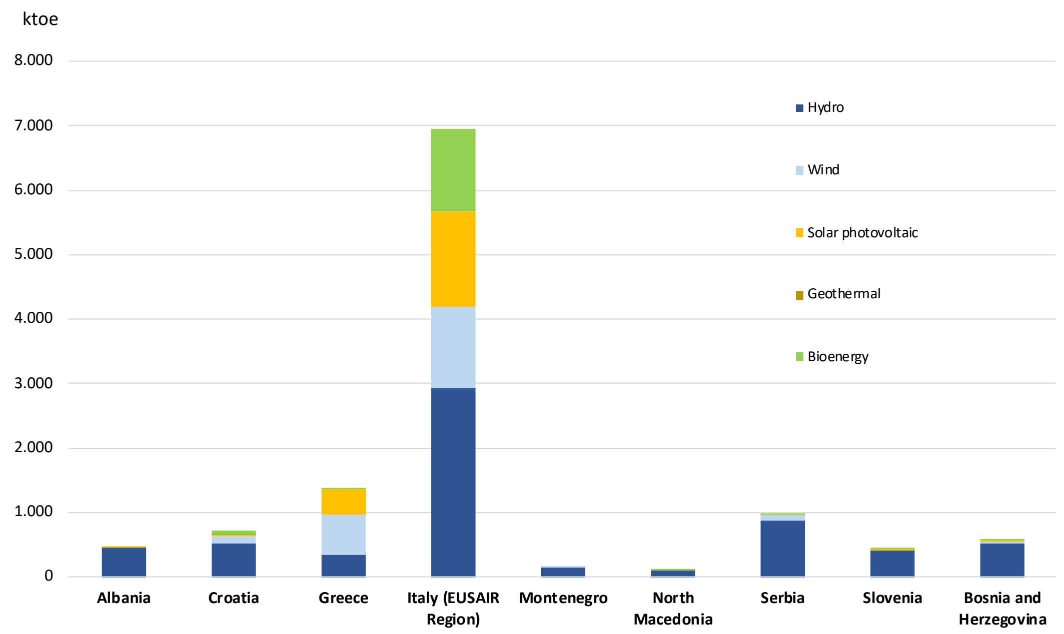


Figure 12 – RES electricity generation per source in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

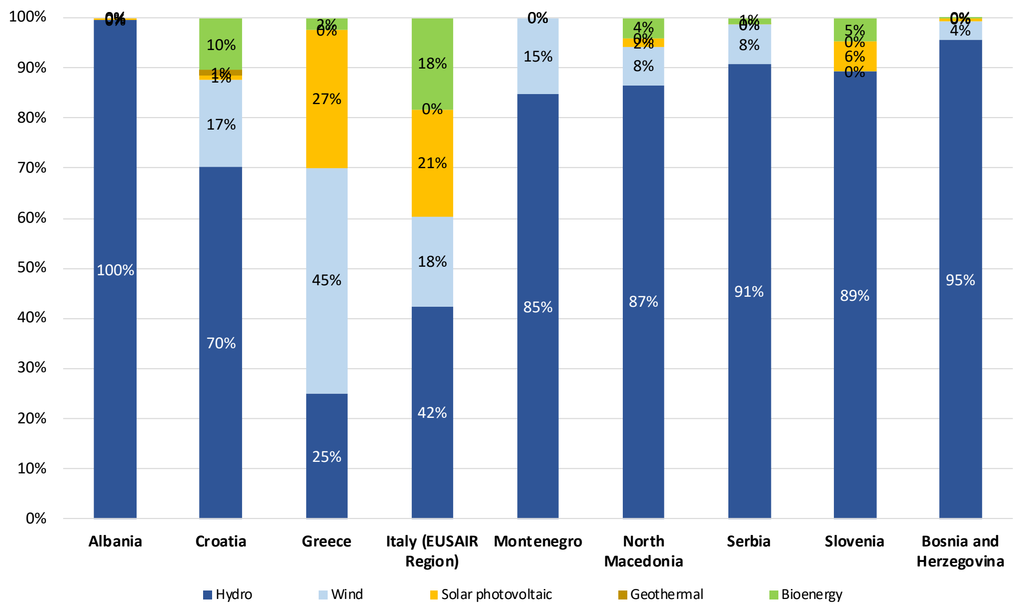
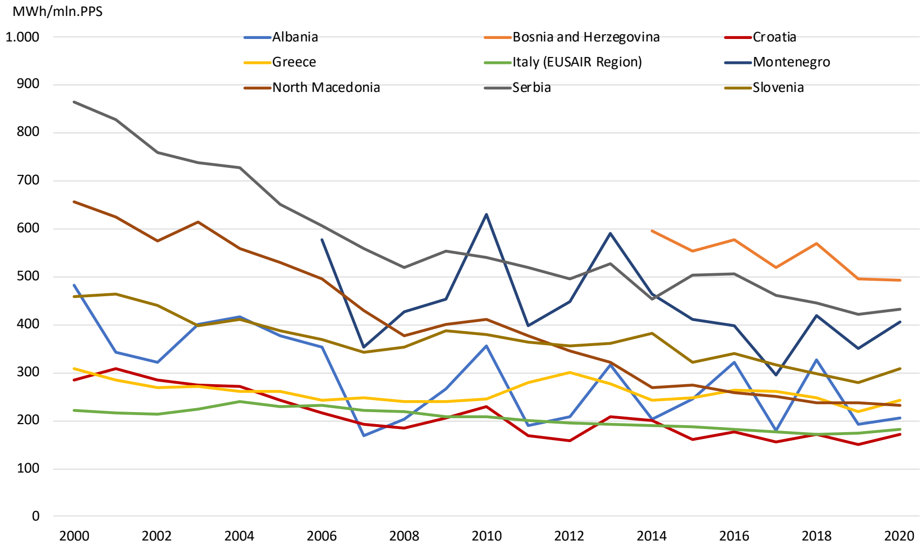


Figure 13 – RES electricity generation per source in 2019 (%)

Source: Consultant's elaboration on Eurostat data

The indicators related to production are very different between different countries.

In the case of electricity production per unit of PPS, it goes from around 500 MWh / mln.PPS in Bosnia to less than 200 MWh / mln.PPS in Croatia and Italian regions.



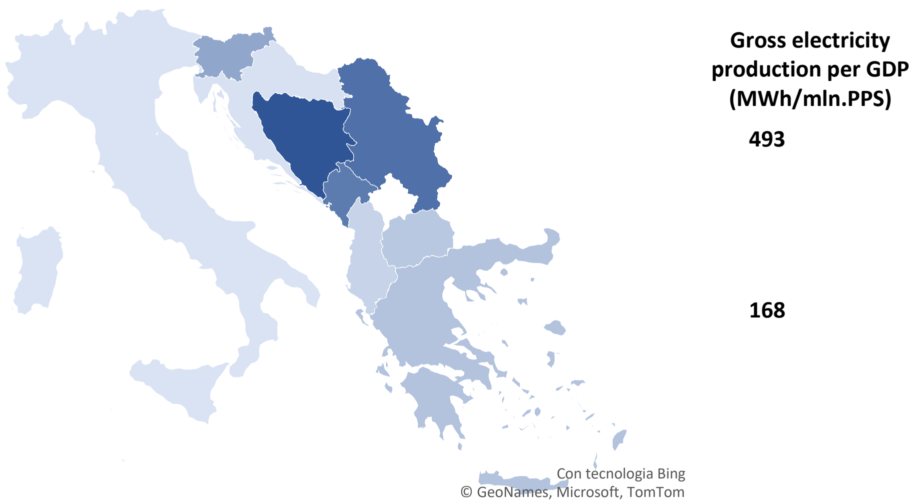


Figure 14 – Gross electricity production per unit of GDP (MWh/mln.PPS)

Source: Consultant's elaboration on Eurostat data

Similarly, per capita electricity production also goes from over 8 MWh / inhabitant of Slovenia to less than 2 MWh / inhabitant of Albania.

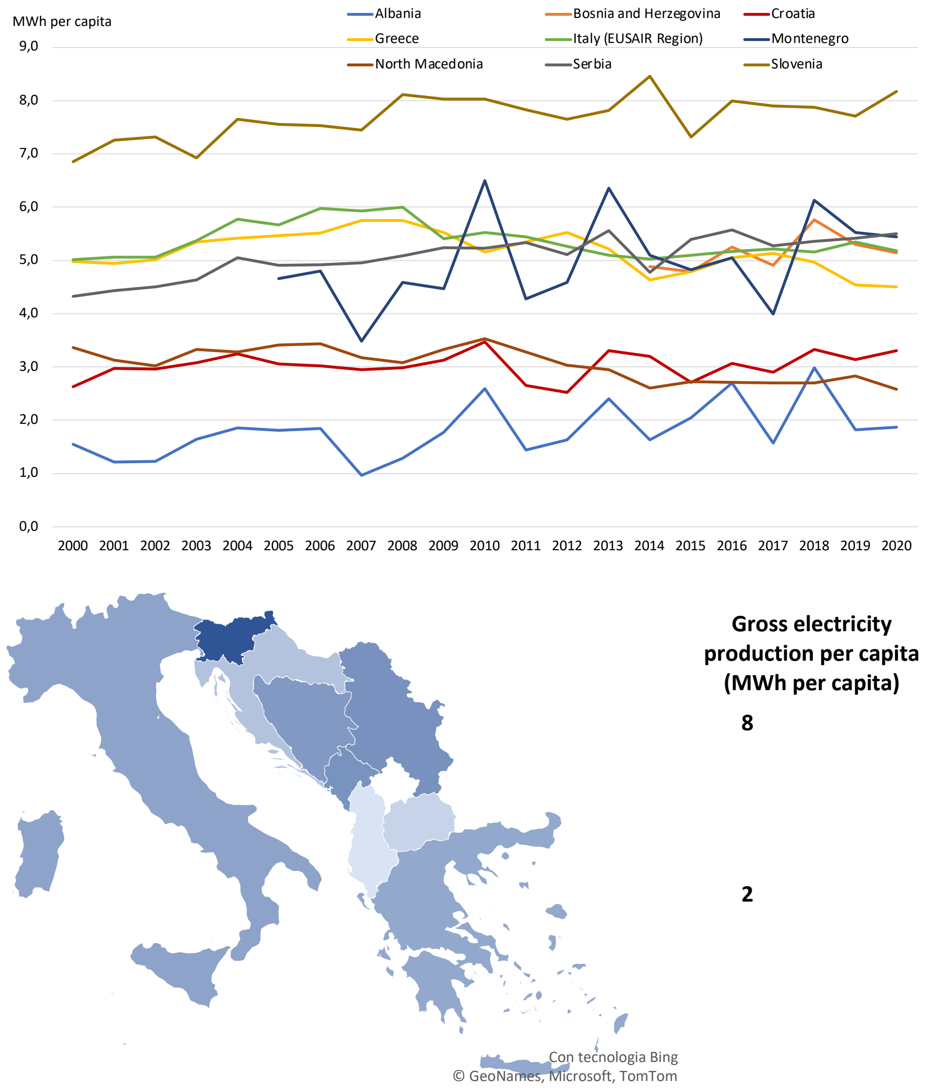


Figure 15 – Gross electricity production per capita (MWh per capita)

Source: Consultant's elaboration on Eurostat and World Bank data

3.2.4 Final energy consumption per sectors

Overall, of the 120 Mtoe consumed for end uses in the EUSAIR countries, around 38 Mtoe (32%) were used for transport, almost 34 Mtoe (28%) were used in the domestic sector, over 27 Mtoe (23%) were destined to industry, over 17 Mtoe (15%) were destined for the tertiary sector and less than 3 Mtoe (2%) were used for agricultural uses.

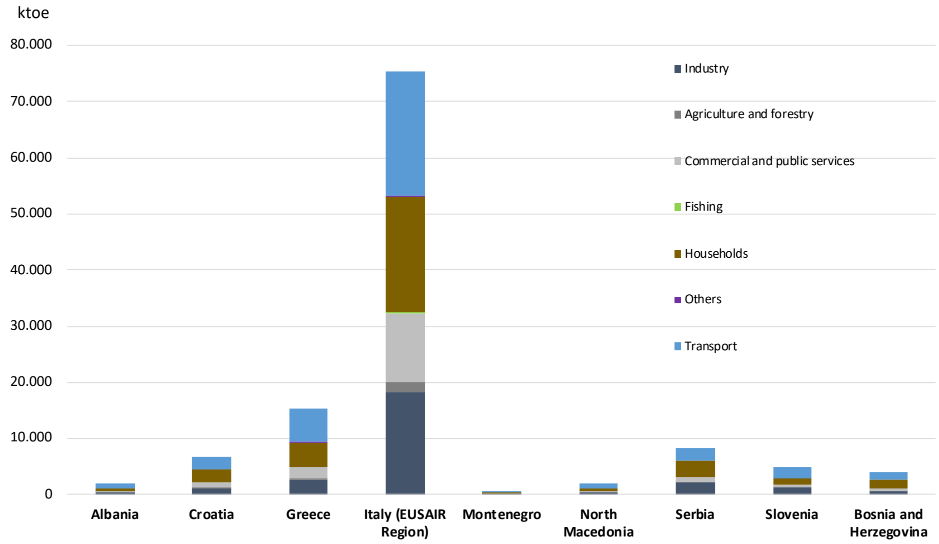


Figure 16 –Final energy consumption per sector in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

The transport sector generally accounts for more than 30%, except in a few cases, including Italy, where it accounts for 29%, and Serbia, where it accounts for 28% of final consumption.

The residential sector is particularly relevant in Bosnia, where it exceeds 40% of total final consumption, while in Slovenia is particularly low, accounting for 22% of total final energy consumption.

The economic sectors (industry, services, agriculture and fishing), which on average represent 40% of total final consumption, exceed this threshold only in Italy, where they reach 43%; vice versa, only Bosnia is below 30%, where these sectors account for 26%.

The industrial sector, which remains below 30% of total final consumption in all countries, reaches 27% in Slovenia, 26% in Serbia and 24% in Italy (in Bosnia it stops at 15%).

The tertiary sector, generally between 10 and 15% of consumption, is particularly relevant in Italy (16%) while it is not very significant in Slovenia (9%).

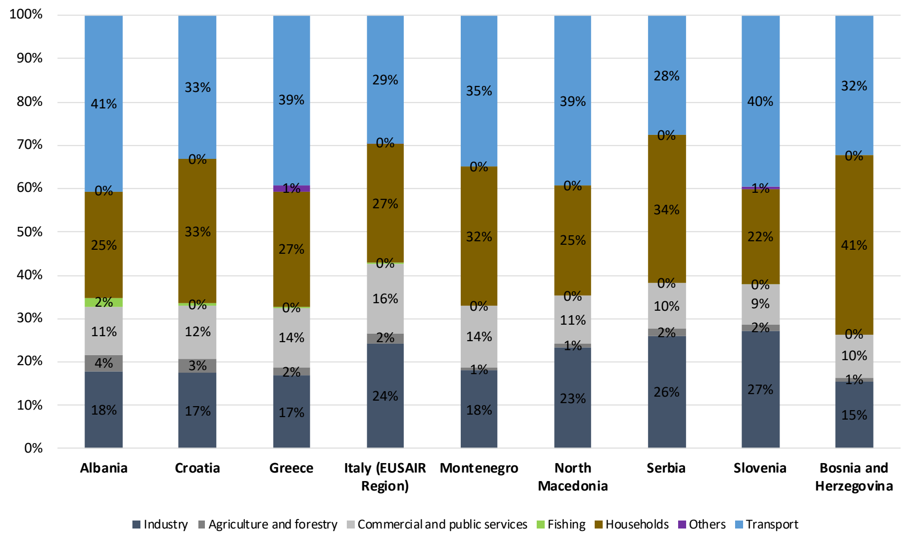


Figure 17 –Final energy consumption per sector in 2019 (%)

Source: Consultant’s elaboration on Eurostat data

3.2.5 Greenhouse gas emissions and indicators

Greenhouse gas emissions are generally decreasing in all European EUSAIR countries and in North Macedonia, while are increasing, according to higher economic development, in Montenegro, Albania, Bosnia and in a smaller amount also in Serbia.

Based on the latest available data (2019), compared to 2000 levels, EU countries' greenhouse emissions decreased by 8% in Slovenia, by 10% in Croatia, by 27% in Italy and by 37% in Greece.

As for the Balkan countries, according to the UNFCCC database, the latest available data often refer to years that are not very recent (e.g. 2014). In any case, based on the available trends, it emerges that only North Macedonia is reducing its emissions (-17%), while the other countries are also increasing them significantly, in particular Albania (+ 54%) and Bosnia (+ 71%); Serbia increased its emissions of +9% in the period 2000-2014, while Montenegro +18% in 2000-2019 period; these increases are certainly by virtue of the greater economic growth that has taken place in these countries in the last two decades.

Unfortunately, for these Balkan Countries there are no more updated data concerning GHG emissions both on EEA or UNFCCC database.

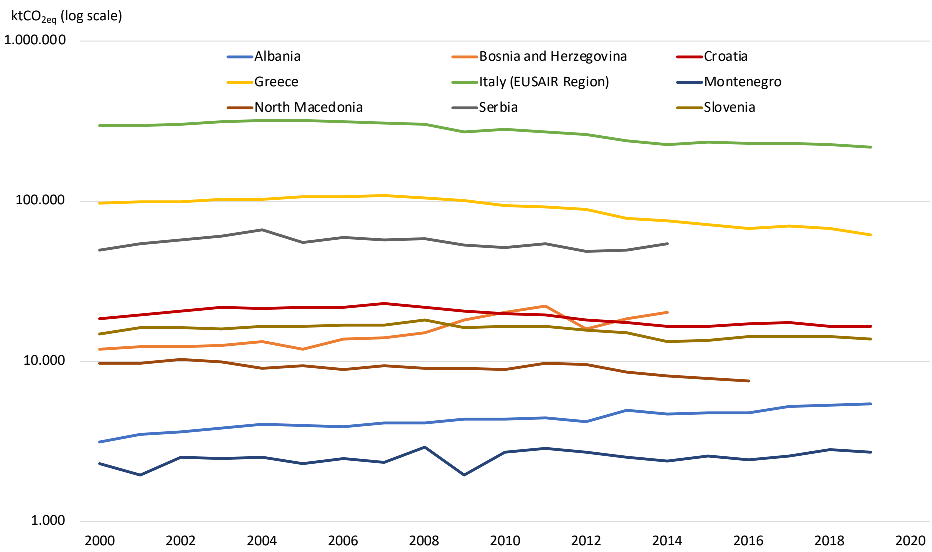


Figure 18 –Greenhouse gas emissions (ktCO2eq)

Source: Consultant's elaboration on EEA and UNFCCC data

Despite this, carbon intensity is also decreasing both in all regions of the Balkans, as well as in all European countries.

In the case, for example, of greenhouse emissions per unit of PPS, there are drops compared to the corresponding values of 2000 even than 58% in Croatia and around 50% in all EU countries (Slovenia, Greece and Italy).

Only Bosnia and Serbia recorded, in the most recent available period, an increase in carbon intensity, especially as a result of the greater penetration of solid fuels in the national energy mix.

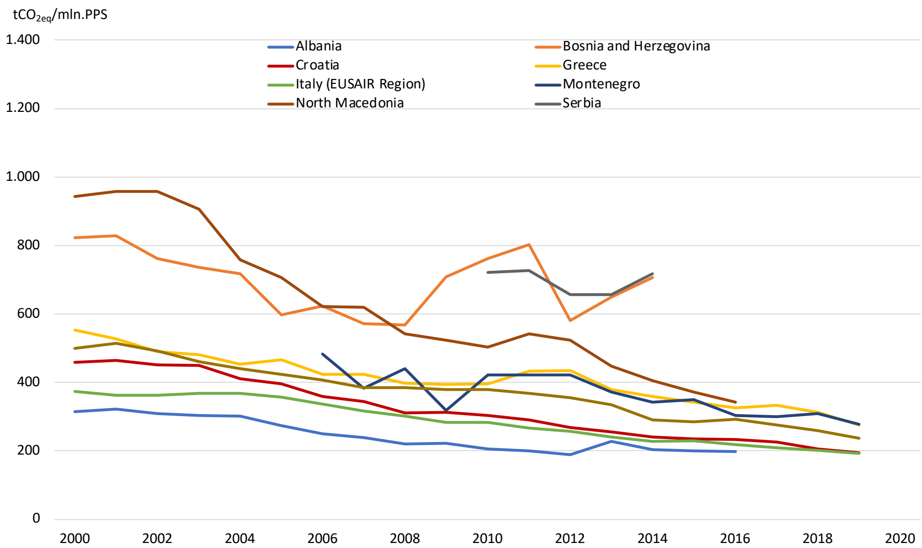


Figure 19 –Greenhouse gas emissions per unit of GDP (tCO2eq/mln.PPS)

Source: Consultant's elaboration on EEA, UNFCCC and Eurostat data

In general, these decreases are due, in particular, as shown by the trend of the indicator relating to greenhouse emissions per unit of primary energy consumed, to a transition of energy systems towards sources characterized by a lower carbon content, such as natural gas, or towards renewables or the electrification of consumption.

For some Balkan countries, on the other hand, the increase in the indicator relating to specific greenhouse emissions per unit of primary energy consumed mostly depends on a shift from low consumption fueled mostly by renewable sources towards more significant consumption supported by fossil sources, not necessarily coal.

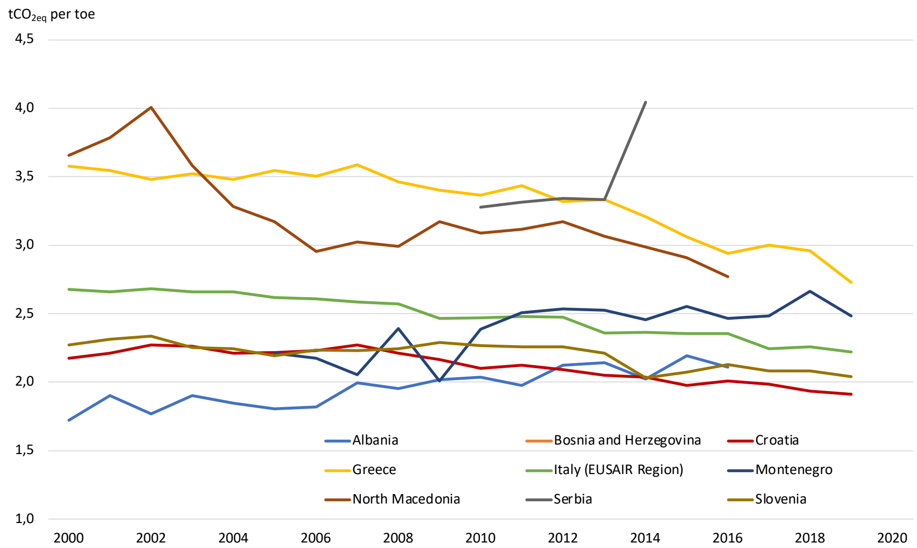


Figure 20 –Greenhouse gas emissions per unit of TPES (tCO2eq/toe)

Source: Consultant’s elaboration on EEA, UNFCCC and Eurostat data

3.2.6 Abridged description of governance and regulation of the national energy system

3.2.6.1 Albania

The institutional framework of the Albanian electricity sector is determined by the Power Sector Law, adopted in 2015 and Renewables Energy Law adopted in 2017 with subsequent amendments, which since then paved the way for sector reforms in line with the EU's 'acquis'. The mentioned law is governing the legal and regulatory framework for the development of electricity and renewables sector and market in Albania and is in compliance with the EU Third Energy Package.

In addition, to the local legal and regulatory acts, development of the energy sector in Albania is also determined and very much influenced by internationally undertaken obligations by membership in the Energy Community and the process of accession to the EU. The Energy Community Treaty was signed in 2005 and it is the first treaty between Albania and the EU under which Albania undertook the obligation to implement EU regulations in its energy sector.

The Power Sector Law transposes the provisions of Directive 2009/72/EC and addresses the liberalization of the electricity market, treatment of public service obligations, unbundling of the transmission and system operation, powers/mandate of the national energy regulatory authority, supply of electricity, and customer protection. Beside the Power Sector Law, the sector is also governed by the different laws and by-laws adopted at the same time and in subsequent years. The Power Sector Law provides priority and guaranteed access of RES to the to the grid but also the priority in dispatching of generated electricity. According to the Law is ERE is obliged to take measures to facilitate the integration of new capacities to the network, by removing barriers for entering of new market participants and RES producers. The Renewables Energy Law introduced auction mechanism and CfD support scheme, but new support scheme implementation has been delayed even in 2022. The natural gas sector is determined by the Law on the Natural Gas Sector. From the adoption of this Law back in 2015, country made limited success in developing natural gas market based on the adopted regulatory framework. Despite the fact Albania's natural gas sector legislation is partly aligned with EU Directives, and it has achieved some progress on its secondary legislation, adoption of network code, as well as rules on public supply and exemptions Albania still has not developed its own gas distribution infrastructure to supply final consumers in the country. In 2021 the Law on the Natural Gas Sector has been amended in order to introduce some elements from Regulation (EU) 2017/1938 on security of supply.

The Law on Energy Efficiency adopted in 2015, with respective amendments in 2019 and 2021 transposed Directive 2012/27/EU. This Law regulates the relations between government authorities and natural and/or legal persons from all sectors of economy in order to promote the use of energy efficiency and market development for energy services. Law on Energy Performance of Buildings from 2016 and accompanying by-laws, are defining methodology for calculation and setting of minimal energy performance requirements and certification of buildings. However, the energy efficiency sector is still not in compliance with the EU acquis. Law on Labelling of energy-related products prescribes the obligation to inform all the consumers about the energy consumption of energy-related products.

Jurisdiction in the countries energy sector falls under:

- MIE - Ministry of Infrastructure and Energy,
- ERE - Energy Regulatory Entity,
- AEE - Energy Efficiency Agency,
- AKBN - National Agency of Natural Resources.

The Ministry of Infrastructure and Energy is in charged to perform state administration related to: energy, energy policy and planning of energy development in the field of electricity, natural gas, oil and oil derivatives. It is also responsible for national climate policy and international cooperation on climate change, meteorology and national geological surveys, water, wastewater services and industry in Albania. Also, under the responsibility and supervision of the MIE two agencies are operating Agency for Energy Efficiency and National Agency of Natural Resources. AEE is responsible for improving and promoting energy efficiency in all areas in order to enable consumers to reduce their energy supply costs and reduce negative impacts to environment and climate change. Besides, AEE is in charged for development, implementation and monitoring of EE policies; NEEAP implementation; cooperation across industry chains in developing database to monitor progress of EE measures implementation; development of technical standards and regulations to improve the energy efficiency of products in all sectors; evaluation of EE projects for granting funds; support and advisory to end users in the EE field and verification of energy audits if necessary. The AKBN designated and responsible for the development and supervision of the rational use of natural resources, by monitoring its sustainable use and rehabilitation of natural resources in mines, hydrocarbons and energy. In addition, AKBN is responsible for development, implementation and monitoring of government policies and strategies in the field of mining, hydrocarbons and energy; ensuring opinions and acceptance for the special studies and projects in the field of activity of mining, hydrocarbons and energy; promotion of mineral resources, petroleum, hydro and renewable energy sources; negotiation of petroleum and mining agreements and monitor the implementation of their development plans; licensing in use of the petroleum resources; monitoring the implementation of agreements on hydrocarbons and supervision of mining, hydrocarbons and energy sectors; monitoring closed mine areas and assess the risk of closure of mining and mining activities; monitoring the concessionary contracts for hydropower; management of all primary hydrocarbon sector data and data related to mining and post-mining activities; preparation and publishing of the annual energy balance sheets at the national and regional levels.

The Energy Regulatory Entity ("ERE") is responsible for regulation of the electricity, gas and oil sectors. ERE was established in 1995 and it is mandated and operates based on Power Sector Law, Law On Natural Gas Sector and Renewables Energy Law. ERE is responsible for approval and setting of tariffs and regulated prices, licensing of companies in electricity and gas sectors and monitoring of their activity, developing and approving all the secondary legislation in the electricity and gas sectors, and handling customer complaints. ERE is an independent non-profit legal entity and independent authority organization which reports every year to the national Parliament.

3.2.6.2 Bosnia and Herzegovina

The complex political and institutional set-up of Bosnia and Herzegovina (BIH) is also reflected in the institutional framework of the its energy sector, where number of institutions is responsible for the implementation of the regulation of energy sector related activities depending on its level of jurisdiction in different parts of countries territory. Bosnia and Herzegovina is consisted of the two entities, Republika Srpska (RS) and the Federation of Bosnia and Herzegovina (FBIH), and the Brčko District of Bosnia and Herzegovina (BD BIH) which is not entity, but has a specific status as a separate self-governing administrative unit in the country under the sovereignty of BiH. Therefore BiH, as well as RS, BD BIH and the cantons all have their own constitution, government and parliament. Energy sector in BIH is thus fragmented and has a complex administrative, legislative and regulatory structure, as practically three parallel structures are existing and operating depending on their allocation of powers. This situation has particular influence on slowing down the reforms in the energy sector which are compulsory by internationally undertaken obligations by membership in the Energy Community and the process of accession to the EU. The Energy Community Treaty was signed in 2005 and it is the first treaty between BIH and the EU under which BIH undertook the obligation to implement EU regulations in its energy sector.

Overview of the relevant institutions in the energy sector is provided below with short description of respective institutional competence, each of them:

- MOFTER - The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina - is a part of the Council of Ministers of Bosnia and Herzegovina and acts in line with the separate state law which prescribes that is responsible for defining general state policies, policy making for the state electricity transmission system operation and basic principles of the national energy sector. Also, it is responsible for coordination of activities and harmonization of different entity plans with the obligations taken from different international institutions and international commitments in the field of energy.
- MIER – The Ministry of Industry, Energy and Mining of Republika Srpska – is in charged to perform administration related to energy sector on the territory of the Republika Srpska entity. MIER is responsible for energy policy, planning and managing the energy policies and strategies, electricity balancing and long-term planning, granting concessions for research, construction and exploitation of power plants, geological research and exploitation of natural and technological mineral resources, supervision over the operation of public and other companies as majority governmental (entity) property from within the sectoral competence, taking part in the development and issuance of technical regulations governing the sectoral competence and their harmonisation with the EU legislation, and other affairs in the field of industry, energy, mining and geology.
- FMERI – Federal Ministry of Energy, Mining and Industry – is in is in charged to perform administration related to energy sector on the territory of the FBIH entity. FMERI is exercising the competences in the fields of industry, energy, mining, geological research and entrepreneurship. In addition, as FBIH is consisted of cantons (10 in total) which in line with their respective cantonal constitutions also have the jurisdiction related to the adoption of certain regulations on local energy generation facilities and ensuring their operation and availability. FMERI is responsible for defining

energy policies (including inter-cantonal distribution matters and the supply and maintenance of their infrastructures), implementation of adopted policy and enforcement of the law and supervision of law and other regulations.

- SERC – State Electricity Regulatory Commission – is responsible for regulation of transmission of electricity, electricity transmission system operation, international trade in electricity, approval of indicative generation plans, long-term transmission network development plans, regulation of generation, distribution and supply of electricity for customers in BD BIH. SERC is exclusively responsible for the mentioned activities and has no jurisdiction in the gas sector.
- RERS – Regulatory Energy Commission of Republika Srpska – is authorised for providing regulation of the RS territory with following responsibilities: monitoring and regulation of relationships between generation, distribution and customers of electricity including traders of electricity; monitoring of the electricity and natural gas market; providing methodology and criteria for determination of both, the price for using distribution grid and for supply of non-eligible customers with electricity; methodology for determination of the fee for connection to the electricity distribution grid and methodology for calculating grid connection costs of natural gas; providing methodology for calculating the costs of production, transmission, distribution, storage and supply of natural gas; adoption of tariff system for selling electricity and using distribution grid; adoption of tariff system for calculating prices for use of the production, transmission, distribution, natural gas storage and tariff system for calculating the natural gas prices for the supply of tariff consumers; determination of electricity tariff rates for distribution system users and tariff rates for non-eligible customers; licencing in electricity and natural gas sectors; enabling general conditions for delivery of electricity; determination of status of qualified natural gas consumers; approval of the operating rules of the system operators and the general requirements for the natural gas supply; granting approval of the electricity generation prices at the plant outlet and consent to energy entities to the prices of services and the price of natural gas supply; handling customer complaints and decision on appeals against the decisions on grid connection of the transmission and distribution system operators.
- FERK - Regulatory Commission for Energy in the Federation of Bosnia and Herzegovina - is authorized for providing regulation of the FBIH territory with following responsibilities: monitoring and regulation of relationships between generation, distribution and customers of electricity including traders of electricity; monitoring of the electricity; prescribing methodology and defining tariffs deadlines and conditions for usage of distribution systems, prescribing methodology and defining prices for service of public supply; prescribing methodology for connection to distribution grid; licensing of electricity generation, distribution, supply and trade and for RES and efficient cogeneration Operator; issuing a prior consent for the construction on direct power lines; definition of Electricity Supply and Network Rules for distribution grid; methodology to determine FIT; electricity supply switching rules; setting methodology for supply of non-eligible customers. There is currently no gas regulator in the Federation of Bosnia and Herzegovina. Each canton is responsible for monitoring the relation between gas supply and demand in its respective area, forecasts of consumption and available supply, planning of additional capacity and development of the

distribution gas system. FMERI is responsible for regulations in the gas sector and licensing on the gas sector in FBIH.

- Government of Brcko District of BIH - Activities related to supply of BD BIH with electricity are performed by its Department of Communal Affairs.

BIH’s complex structure (BiH, RS, FBiH and BD BIH) requires energy legislation to be adopted on all levels and there are a large number of laws, bylaws and regulations from the relevant authorities. Here below, are listed the basic and most important laws and regulations concerning BIH energy sector:

BIH level

- Law on Transmission of Electric Power, Regulator and Electricity System Operator in BIH,
- Law on Establishing the Company for the Transmission of Electric Power in BIH,
- Law establishing and Independent System Operator for Transmission System in BIH.

Republika Srpska level

- Energy Law,
- Law on electricity,
- Law on gas,
- Law on Pipeline Transport of Gaseous and Liquid Hydrocarbons and Distribution of Gaseous Hydrocarbons,
- Law on Renewable Sources,
- Law on energy efficiency.

Federation of BIH level

- Electricity Law,
- Regulation on the Organization and Regulation of Gas Industry Sector,
- Law on Exploration and Exploitation of Oil and Gas in Federation of Bosnia and Herzegovina,
- Law on the Use of Renewable Energy Sources and Efficient Cogeneration,
- Law on energy efficiency.

Brcko District of BIH level

- Electricity Law,
- Law on General Conditions for Electricity Supply,
- Law on Tariff System for Sale of Electricity,
- Law on Communal Activities.

Law on Transmission of Electric Power, Regulator and System Operator of Bosnia and Herzegovina is defining the competencies and responsibilities for the electricity transmission system policy making, regulation, maintenance, operation, transmission gird and assets management and international trade of electricity. However, the mentioned law is not in line with the EU Third Energy Package which prevents enabling of the organised internal energy markets, establishing short-term markets and unbundling the electricity transmission system operator. The draft of the new Law on the Regulator of Electricity and Natural Gas, Transmission and Electricity Market, which is prepared back in 2015, with the intention to transpose EU Third Energy Package in both electricity and natural gas sectors is still being discussed and whole process is burdened with the political tension and disagreement of the stakeholders in decision making process from both entities.

The Law on Energy of Republika Srpska is legal act which regulates energy related activities. The Law on Electricity regulates electricity generation and distribution, as well as domestic trading the territory of Republika Srpska. The new Law on Electricity, adopted in June 2020, is intended at unbundling distribution and deregulating prices throughout transition period from 2022 until 2024. The Law was amended in July 2022 in order to provide basis for adoption of the entities NECP. In February 2022, Republika Srpska adopted a new Renewables Law which prescribes market premiums and full balancing responsibility for all power plant installation above 500kW. The mentioned law also introduced net metering and net billing scheme for self-consumers with installed capacity below 10,8kW and installations between 10,8 and 50kW, respectively. The existing Law on energy efficiency enforced in Republika Srpska is not fully transposing relevant EU directives in the sector.

The Electricity Law of FBIH is key legal act which regulates electricity sector related activities as functioning of sector, electricity market development and regulation, electricity supply, planning and development, reconstruction and maintenance of power plants. The FBIH Law on the use of renewable energy sources and efficient cogeneration, from 2013, regulates the promotion of the use of RES and efficient cogeneration, increasing RES share in final energy consumption and usage in transport, incentive measures for RES and regulatory framework and technical infrastructure for RES and efficient cogeneration. The RES incentive model in FBIH is feed-in tariff with guaranteed price and renewable generation is fully released from balancing responsibility. In FBIH there is still no renewables self-consumers scheme adopted. The existing Law on energy efficiency enforced in FBIH is not transposing the relevant EU directives in the sector. In July 2022, FBIH drafts of the Law on energy and regulation of energy activities in the FBiH, the ne Law on electricity in the FBiH and the Law on the use of renewable energy sources and efficient cogeneration which are being discussed and after adoption should transpose relevant EU acquis in the respective fields of regulation. Brčko District does not have legislation in the area of renewables and EE, although draft Energy Efficiency Law is being discussed.

At the moment there is no law which regulates organization and functioning of the gas sector on the level of BIH, FBIH and BD BIH. However, Republika Srpska in 2018 adopted Law on gas which transposes the EU Third Energy Package in gas sector. The gas sector in FBIH is regulated by the Regulation/Decree on the Organization and Regulation of the Gas Sector in FBIH from 2007 which is not transposing basic principles of the gas acquis such as regulated third party access or market opening and eligibility of all customers. BIH is not compliant with both Second and Third EU Energy Package in gas sector, as the needed regulations are adopted across only one entity.

3.2.6.3 Montenegro

The institutional framework of the Montenegrin energy sector is determined by the Energy Law, which is the primary legislation act which in detail regulates energy related activities in electricity, gas, oil and district heating sectors. In addition, to the local legal and regulatory acts, development of the energy sector in Montenegro is also determined by internationally undertaken obligations by membership in the Energy Community and the process of accession to the EU, under which Montenegro is obliged to implement EU regulations in its energy sector.

The Energy Law was passed in order to implement reforms in the energy sector in line with the EU Third Energy Package. The law regulates the generation, transmission and distribution of energy, unbundling of the transmission and system operation, authorisations for the performance of energy activities and licensing for construction of new power plants; regulated prices, tariffs, fees; renewable energy; specific rules for various activities in the energy sector; access to the transmission and distribution grid systems; transposition of connection network codes; balancing market and balancing responsibility; quality of delivery and supply of energy; security of supply; energy trading. In July 2020, existing Energy Law adopted in 2016 was amended and is expected to enable continuation of reforms in the energy sector. The amendments of the Energy Law address further liberalization of the energy market, development of NECP, self-consumption scheme, conditions for the appointment of a nominated electricity market operator (NEMO) and functioning of the short-term markets. Principles of capacity allocation and congestion management in cross-border trade are covered Law on Cross-Border Exchange of Electricity and Natural Gas adopted in 2016. Regulation on wholesale energy market integrity and transparency is governed by the Law on Surveillance of the Wholesale Electricity and Natural Gas Market adopted in January 2022. The gas sector in Montenegro is mainly regulated by the Energy Law and several by-laws which are all in line with the EU Third Energy Package. However, Montenegro does not have gas grid or access to any gas market at the moment. Exploration, extraction, production of natural gas and oil, as well as construction of mining facilities and mining works, are governed by Law on Mining, Law on Hydrocarbon Exploration and Law on Safety Measures in Offshore

Regulatory framework in relation to renewables is governed by the Energy Law. The new amendments of the Law have prescribed obligation to introduce renewables support schemes based on the competitive market-based conditions (auctions) for projects above 1 MW, and FIT are applicable for projects up to 1 MW. However, this is not implemented at the moment. Currently RES producers under support mechanism are exempted from paying imbalances costs. The new amendments have introduced renewables self-consumers option under net-metering scheme, where the suppliers are obliged to purchase excess electricity produced after the annual settlement at the price from the supply contract concluded. It is important mentioning that the new law on renewables is under preparation which should regulate competitive procedure for construction of new renewables power plants.

The Law on the Efficient Use of Energy, adopted in 2014, prescribe the obligation to introduce and implement energy efficiency policy and measures in order to enable efficient energy consumption by final users, At the moment, the Law through adoption of large number of by-laws is almost aligned with the EED, EPBD and Energy Labelling Regulation. In addition, amendments to the Law on Efficient Use of Energy and several by-laws are under discussion, which should introduce the 2030 energy efficiency policy framework and integrated planning through the country's draft NECP and finalize the transposition of relevant existing EU *acqui*s in the sector.

Jurisdiction in the countries energy sector falls under:

- MoCI - Ministry of Capital Investments (Directorate of Energy and Energy Efficiency) and
- REGAGEN - The Energy and Water Regulatory Agency of Montenegro.

Ministry of Capital Investments through Directorate of Energy and Energy Efficiency is in charged to perform state administration related to: energy, energy policy and planning of energy development in the field of electricity, gas, oil and oil derivatives, countries energy balance, strategy and policy of energy security, development of annual and medium/and -term programs of energy action plans development and security and providing material and other conditions for the implementation of these programs, mandatory and other reserves of energy sources, production, rational use of energy and energy efficiency, renewable energy, environmental protection and climate change in the field of energy, coordinating activities in connection with investments in the energy sector, as well as other duties specified by Energy Law.

REGAGEN is the state regulatory body for the energy sector (area of electricity, oil and natural gas), as well as in the area of water supply and wastewater utility regulation. It was established back in 2004 as Energy Regulatory Agency of Montenegro, but since then it evolved with it competencies and since 2017 it is regulating also communal utilities on water and wastewater. REGAGEN is mandated and operates based on Energy Law, Law on communal utilities adopted in 2016 and the Law on monitoring of wholesale electricity and natural gas markets adopted in 2022. REGAGEN is responsible for approval and setting of regulatory allowed income and prices/fees for regulated electricity utilities and price approval of price proposals by water supply and wastewater utilities; licensing of companies in electricity, gas, oil, sectors, water supply, wastewater sectors and monitoring/supervision of their activity; approval to market and technical rules, approval of investment and system development plans for TSO and DSO; approval of rules on allocation of cross-border capacities; monitoring of wholesale electricity market; annual reporting on energy sector and on activities related to the water supply and wastewater utilities; annual analysis on share of renewable energy sources and high-efficiency cogeneration in total electricity generation and consumption; annual benchmarking report of water supply and wastewater utilities.

3.2.6.4 North Macedonia

The institutional framework of the North Macedonian energy sector is determined by the Energy Law, which is the primary legislation act which in detail regulates energy related activities. The Law regulates setting of the objectives and implementation of energy policy; energy facilities construction; competence of the energy regulatory agency; electricity, natural gas, heat energy markets, as well as the crude oil, oil derivatives and transport fuels market; providing obligations for public service on the energy sector and users of the energy systems; generation, transmission and distribution of energy; promotion of the use of renewable energy sources and other issues in the energy field. In addition, to the local legal and regulatory acts, development of the energy sector in North Macedonia is also determined by internationally undertaken obligations by membership in the Energy Community, Energy Charter and the process of accession to the EU, under which N. Macedonia is obliged to implement EU regulations in its energy sector.

The Energy Law, adopted in 2018 and amended in 2019, enabled implementation of reforms in the energy sector in line with the EU Third Energy Package. The Law address further liberalization of the electricity and gas market; legal basis for the NECP adoption; introduction of electricity storage as new energy activity, and the Cyber Security provisions will be provide in the third amendment of Energy Law which is in Governmental procedure for its adoption); third party access; energy security; energy supply conditions; unbundling of the transmission and system operation; authorisations for the performance of energy activities and licensing for construction of new power plants; regulated prices, tariffs, fees; methodology for network access, transposition of connection network codes, quality of delivery and supply; transparency regulation; balancing market and balancing responsibility, principles of capacity allocation and congestion management in cross-border trade; conditions for the appointment of a nominated electricity market operator (NEMO), definition of prosumers and self-consumption scheme; renewables support mechanism; quality of delivery and supply of energy; security of supply; energy trading. The gas sector is also governed by the Energy Law, however the implementation of EU *acquis* in gas sector is lagging behind as it lacks proper implementation of the unbundling, network codes, capacity allocation and congestion management, tariffs, balancing, interoperability and cooperation with neighbouring transmission system operators.

Regulatory framework related to renewables is also governed by the Energy Law, which is fully aligned by RED. The Law and relevant by-law documents enable renewables support mechanism and self-consumption scheme (net-billing), but capacity caps are in place per type of renewables. TSO and DSO operators are obliged to ensure priority connection to the systems and priority in the dispatching for renewable energy generators. The Law prescribes two types of support measures for renewables administratively set FIT and competitive FIP which is offered on auctions.

FiTs are provided up to maximum capacity of 10 MW installed capacity per plant for hydropower, up to 50 MW for wind power and up to 1 MW for biomass and biogas plants. The maximum installed capacity cap for all plants that receive FiTs are as follows: 160 MW for wind power plants, 20 MW for biogas and 10 MW for biomass thermal power plants. For hydropower plants the quota is determined through tenders for concessions published by the government. In the past, there were FiTs for PV plants, for total capacity of 18 MW, but these were used up until 2015, and new ones are not planned so far.

FIPs are awarded for solar PV plants and wind power plants up to 30 MW and 50 MW, respectively. The maximum installed capacity cap for all PV plants that receive FIP is limited to 200 MW. FiPs for photovoltaic power plants are obtained through public tenders issued by the Ministry of economy. Tenders for premium tariffs for wind power plants have still not been conducted.

Producers on actions bid for FIP, which are added on the top of the price realized by the sale of each kWh on the wholesale electricity market. The government can decide to change the capacity caps in case there is a need. The renewable producers supported by FITs are exempted of balancing responsibility, while those on FIP's are not. Net -billing scheme is enabled with limited installation capacity for self-consumers of 6kW for households and 40kW for other small consumers.

The Law on Energy Efficiency, adopted in 2020, transposes the Energy Efficiency Directive, Energy Performance of Buildings Directive, Regulation on Labelling of energy related products, and Directive on Eco-design of energy related products, but it lacks implementation through adoption of implementing secondary legislation. The Law prescribes the obligation to introduce and implement energy efficiency policy and measures in order to enable efficient energy consumption by final users; increase of the energy codes for buildings; setting up the Energy Efficiency Fund; promotes use of RES in buildings; end-to-end energy supply; transmission and distribution of energy; targets large energy users, including the public sector, traders and providers of energy services.

Jurisdiction in the countries energy sector falls under:

- MoE - Ministry of Economy – Energy Department
- EA - Energy Agency of North Macedonia and
- ERC - Energy and Water Services Regulatory Commission of Republic of North Macedonia.

Ministry of Economy through its Energy Department is in charged to perform state administration related to energy sector with following competencies: strategic planning; development of relevant legislation in the energy sector; implementation of energy policy including energy efficiency and RES; use of new technologies; data related to energy production, supply and demand. In addition, some competencies related to energy sector belongs to the Ministry of Environment and Physical Planning and to the Ministry of Transport and Communications.

Energy Agency of North Macedonia is institutional body which provides support to Government of North Macedonia in the implementation of the energy policy. EA is responsible for: drafting mid-term and long-term strategies and development plans; preparation of the long-term and short-term programs; energy efficiency and use of RES; preparatory and coordinative activities for implementation of investment projects; regional cooperation and coordination of regional projects; drafting legislative proposals for primary and secondary legislation and technical regulations in the field of energy; as well as other activities in the area of energy supply, as prescribed by the Energy Law.

The Energy and Water Services Regulatory Commission of the Republic of North Macedonia (ERC) is the state regulatory body for the energy sector and was established in 2003, as an independent regulatory body in the field of electricity, natural gas, oil/petroleum products and heat. ERC is mandated and operates based on Energy Law and is responsible for: monitoring of energy markets; adoption of methodologies and tariff systems setting for regulated energy activities; adoption of methodologies and tariff systems for the supply of specific types of energy and tariff customers; adoption of decisions on prices and tariffs; approval of grid codes of TSOs and DSOs; adoption of market rules for energy supply; adoption of market rules for electricity and gas sectors; decisions on exemption from the obligation for third party access; keeping a register of energy producers and approval status of energy producers; rights of customers and users of energy systems; licencing; stimulation measures for competition on energy markets; approval of development plans and plans for construction of transmission and distribution systems and monitoring their implementation; decision on disputes between entities performing regulated activities and their users, including cross-border disputes. ERC is an independent non-profit legal entity and independent authority organization and every year submits annual report to the Government and to the Parliament of the Republic of North Macedonia about ERC activities for the previous year

3.2.6.5 Serbia

The institutional framework of the Serbian energy sector is determined by the Energy Law, as the basic legal act which in detail regulates energy related activities. In addition, to the local legal and regulatory acts, development of the energy sector in Serbia is also determined and very much influenced by internationally undertaken obligations by membership in the Energy Community and the process of accession to the EU. The Energy Community Treaty was signed in 2005 and it is the first treaty between Serbia and the EU under which Serbia undertook the obligation to implement EU regulations in its energy sector.

The Energy Law was passed in order to implement a provision aimed at liberalizing the internal electricity and gas market, as foreseen in the EU Third Energy Package. In April 2021, Energy Law adopted in 2014 was amended and is expected to enable continuation of reforms in the energy sector. Beside amendments to the Energy Law at the same time National Parliament has adopted package of laws on renewable energy sources, energy efficiency and mining. The amendments of the Energy Law address further liberalization of the electricity and gas market, third party access, unbundling of the transmission and system operation, methodology for network access, transposition of connection network codes, quality of delivery and supply, transparency regulation, balancing market and balancing responsibility, principles of capacity allocation and congestion management in cross-border trade, conditions for the appointment of a nominated electricity market operator (NEMO), define electricity storages, aggregators, aggregation and the category of prosumers. With the new amendments to the Energy Law in the natural gas sector wholesale supply additionally opens in such a way that companies that are not registered in the Republic of Serbia can perform these activities on the local market, as well as definitions to the new fuels planned to be used in Serbia such as liquefied natural gas and hydrogen.

Exploration, extraction of natural gas, production, processing and refining of oil, as well as construction of mining facilities and mining works, are governed by Energy Law and the Mining and Geological Exploration Law. Regulatory framework in relation to transportation pipelines and associated infrastructure (such as natural gas processing and storage facilities) are also governed by Energy Law and the Law on Pipeline Transportation of Gaseous and Liquid Hydrocarbons and Distribution of Gaseous Hydrocarbons.

The Renewable Energy Sources Law (April, 2021) adopted in Serbia for the first time, is seen as the enabler of large investments in the construction of solar power plants and wind farms, which will accelerate the decarbonization of Serbia's energy sector and increase the share of renewable sources in energy consumption. The Law introduced auctions for the award of premiums, creates conditions for the development of the renewable energy market, and allows citizens and companies to produce electricity for their own consumption and become prosumers. The Law also introduced the possibility for the state to launch tendering for strategic partnership for investments in green energy, but also retained solutions, such as FiT for small-scale facilities (power plants below 500 kW and wind power plants below 3 MW). Self-consumption scheme is in two set-ups - net metering for households which installed capacity cannot be more than 10,8 kW and net-billing (for industry and small consumers) where the installed capacity of the plant has to be less or equal to the approved power capacity of the customer facility/building. The Law prescribes that RES producers in Serbia have priority in grid connection and dispatching of generation, but are also exempted from the balancing responsibility until the intraday market is liquid. Still there is no by-law on balance responsibility of renewables which would implement provisions from the Law. This is the reason why first wind auction has not been launched under the 400 MW quota and ceiling price of 5,57 cEUR/kWh. It is worth mentioning the Law introduced a ban on the construction of hydropower plants of any type and capacity in protected areas.

At the moment, Serbia is working on adaptation of changes of the Renewable Law in line with the European regulation "Clean Energy Package (2019/941-944)", therefore further changes could be expected on the renewable regulations.

The Law on Energy Efficiency and Rational Use of Energy, adopted in 2021, prescribe the obligation to reduce energy losses of energy entities performing energy activities of transmission, transport and distribution of electricity and natural gas. In addition, The Law on Energy Efficiency and Rational Use of Energy rolls-out the subsidies for citizens to replace windows and doors, install wall and roof insulation, as well as to replace heating systems (stoves and water heaters) with devices that are more efficient and use fewer polluting fuels. In order to implement all these activities, an energy efficiency administration has been established in 2021. Serbia’s alignment with the EED, EPBD and Energy Labelling Regulation is in advanced stages.

Jurisdiction in the countries energy sector falls under:

- MoME - Ministry of Mining and Energy and
- AERS - Energy Agency of the Republic of Serbia.

Ministry of Mining and Energy is in charged to perform state administration related to: energy, energy policy and planning of energy development in the field of electricity, natural gas, oil and oil derivatives, countries energy balance, strategy and policy of energy security, development of annual and medium/and -term programs of energy action plans development and security and providing material and other conditions for the implementation of these programs, mandatory and other reserves of energy sources, production, rational use of energy and energy efficiency, renewable energy, environmental protection and climate change in the field of energy, coordinating activities in connection with investments in the energy sector, as well as other duties specified by Energy Law.

AERS is the state regulatory body for the energy sector and was established in 2005 in order to promote and support the development of the energy market on the principles of non-discrimination and effective competition. AERS is mandated and operates based on Energy Law in implementing its main task - provision of stable regulatory framework. AERS is responsible for approval and setting of tariffs and regulated prices, licensing of companies in electricity and gas sectors and monitoring of their activity, approval to market and technical rules, system development plans, brings the methodology for determining the price for access to the transmission or distribution system, rates of access to transport, distribution and storage of natural gas, prices for guaranteed electricity supply and prices for natural gas public supply, and the cost of access to the system of oil transport pipelines and systems for the transportation of oil derivatives, and handling customer complaints. AERS is an independent non-profit legal entity and independent authority organization and every year they report to Serbian National Assembly about AERS activities for the previous year.

3.2.6.6 Croatia

As a new member of the EU, since 1st July 2013, Croatia is focused on fully adjusting its energy legal framework with the EU Acquis Communautaire. The EU Acquis Communautaire along with the international agreements which Croatia has signed with the EU form the basis of the legal framework of the energy sector. In this respect, Croatia has obligated itself to implement all accepted legal solutions, taking into consideration its particularities in a need to ensure economic and social development. The legal framework for the energy sector includes other international agreements ratified in accordance with the Constitution of the Republic of Croatia. These are: the Energy Charter Treaty, the Energy Community Treaty, the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects, the Convention on Nuclear safety, etc. Also, Croatia is a party to the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Paris Agreement and regularly submits greenhouse gas inventory reports as well as national reports to the Secretariat of the Convention to address the challenges of decarbonisation and climate change.

Energy legislation and climate legislation are aligned with the EU Acquis Communautaire. At the implementation level, energy and climate fall within the competence of two ministries - the Ministry of the Environment and Energy and the Ministry of Construction and Physical Planning. The development of the new **Energy Development Strategy has begun in 2018.** In view of the increasingly stringent restrictions on greenhouse gas emissions and the need for long-term energy planning, the Energy Development Strategy covers the period up to 2030, with an outlook to 2050.

Croatia's final **integrated national energy and climate plan (NECP)** sets a 2030 target for greenhouse gas (GHG) emissions not covered by the EU Emissions Trading System (non-ETS) of 7% below 2005 levels. This target is in line with the Effort Sharing Regulation (ESR). Croatia projects to overachieve this target already with a continuation of current policies and achieve 18.5% emission reductions with planned policies, but does not set a corresponding national target. The plan does not include considerations on which planned level of overachievement could be cost-efficient or how the projected overachievement could be used for transfers to other Member States. No information is provided on how to achieve the no-debit commitment (i.e. accounted emissions do not exceed accounted removals) set out in the regulation on land use, land use change and forestry (LULUCF).

Croatia has set a contribution to the EU's 2030 **renewable energy target at** the level of 36.4% in gross final energy consumption. The overall figure is considered sufficiently ambitious as it is above the 32%.

For **energy efficiency**, the Croatian contribution to the EU 2030 target has remained unchanged from its draft plan. This contribution is considered to show 'low ambition' and amounts to 8.2 Mtoe for primary energy and 6.9 Mtoe for final energy consumption. In terms of policies and measures, the final national energy and climate plan mostly relies on implementing and scaling up an energy efficiency obligation scheme. However, after a correction of the quantitative savings goal (see section 3.2), the policies and measures described do not seem sufficient to ensure the attainment of the overall goal. The final plan contains substantial information on buildings, including a plan to increase the renovation rate from the current 0.7% per year to 3% in 2021-2030. Croatia has not yet submitted its long-term renovation strategy.

In its final plan, Croatia sets objectives for **energy security** with regard to its forecast energy mix until 2050, national preventive action plan and national emergency plan for the natural gas sector, and further measures and investments in energy storage. Measures promoting security of supply mostly focus on gas infrastructure (new liquefied natural gas terminal under construction, development of the gas storage system). However, the NECP does not include considerations on cybersecurity or reflect a common long-term strategy between Croatia and Slovenia with respect to their joint nuclear reactor.

Regarding the **internal energy market**, the final NECP describes some goals to achieve further market integration with neighbouring countries by connecting the electricity day-ahead markets. The plan does not include a specific electricity interconnectivity level for 2030. However, Croatia's current electricity interconnection capacity is 30%, a figure that already exceeds the 15% target for 2030.

3.2.6.7 Slovenia

The goal of Slovenia's energy and climate policy is to ensure a reliable, secure and competitive energy supply in a sustainable way in such a way as to ensure the transition to a climate-neutral society and achieve sustainable development goals by, among other things, establishing an environment that stimulates economic development and creating jobs with high added value, improving the quality of life, increasing environmental responsibility and providing acceptable energy services for Slovenia’s population and economy.

The main task of the development of energy in Slovenia is to ensure a balance between the three fundamental pillars of energy policy: climate sustainability, security of supply and competitiveness of the energy supply. Slovenia has undertaken in the long term to uphold the Paris Agreement commitments and, by reducing greenhouse gas emissions, to keep the global temperature rise below 2°C and to limit the rise in temperature to 1.5°C compared to the pre-industrial era. Slovenia ratified the Paris Agreement in 2016. In May 2019, the Government of the Republic of Slovenia endorsed the goal of **achieving net-zero greenhouse gas emissions in the EU by 2050**. In terms of adaptation to climate change, in December 2016, Slovenia adopted a **strategic framework for adaptation to climate change c**ontaining guidelines for adaptation to climate change in Slovenia.

In the area of transport and transport infrastructure up to 2030, the fundamental document in Slovenia is the **Transport Development Strategy in the Republic of Slovenia** up to 2030. In recent years, many measures have already been carried out to develop rail infrastructure and public transport as well as in the area of sustainable mobility. **Energy efficiency measures** have positive effects both for final consumers and the economy and also for the environment, while at the same time having particularly favourable macro-economic effects, such as stimulating economic growth, creating jobs and reducing dependency on fossil fuel imports.

Security of supply is one of the three fundamental pillars of energy policy and is linked to climate sustainability and competitiveness of the energy supply. To create a secure energy supply, Slovenia will ensure a sufficient supply of energy resources and sufficient capacity and diversification of supply routes, sufficiently powerful and regularly maintained networks, appropriate cross-border connections, and operationally reliable and efficient cooperation between energy systems, diverse sources of electricity and energy storage.

Slovenia's **final integrated national energy and climate plan sets** a 2030 greenhouse gas emission target for sectors outside the EU emissions trading system (non-ETS) of -20% compared to 2005. This is more ambitious than the target under the Effort Sharing Regulation (ESR)2 of -15% below 2005 levels by 2030. It is underpinned by indicative sectoral targets varying between -70% for buildings and an expected 12 % increase for the transport sector between 2005 and 2030. However, additional policies and measures to reach the target and meet the no-debit commitment (i.e. accounted emissions do not exceed accounted removals) of the land use, land-use change and forestry (LULUCF) Regulation have not been quantified, nor have considerations of a cost-efficient generation of possible transfers to other Member States. The analytical basis describes the current situation with existing measures.

Slovenia's national contribution to the 2030 **EU-wide renewable energy target** is 27% of gross final energy consumption. This is considered to be low in ambition as it is below the 37% target calculated.

Slovenia's national contribution to the 2030 EU-wide **energy efficiency target** is of modest ambition for primary energy consumption, amounting to 6.4 Mtoe, and of low ambition for final energy consumption, amounting to 4.7 Mtoe. The final national energy and climate plan includes substantial information on buildings, including a target to reduce final energy consumption by 20% by 2030 compared to 2005. Slovenia has not yet submitted its long-term renovation strategy.

In its plan, Slovenia sets **energy security objectives**, specifically to produce at least 75% of its electricity supply from national sources by 2030, and to maintain or improve the present reliability level of its electricity supply.

As regards the **internal energy market,** Slovenia aims to improve the electricity distribution network's resilience to disruptions by increasing the share of the underground medium voltage network from the current 35% to at least 50%. Furthermore, it intends to support the implementation of pilot projects on the production of synthetic methane and hydrogen, suggesting an indicative objective of a 10% share of methane or hydrogen from renewable sources in the transmission and distribution network by 2030. Slovenia has already overachieved the interconnectivity goal of 15% by 2030, with a level of 83.6% in 2017.

3.2.6.8 Italy

Italy is one of the countries that are most committed to pursuing the objectives that aim to environment protection, energy security, and the reduction of polluting and climate-changing emission laid down by the European Union. Called upon to draw up a proposal for the 2030 National Energy and Climate Plan, Italy has created an ambitious strategy that will allow the country to contribute in a massive way to the achievement of the goals set by the Energy Union.

Italy's final **integrated national energy and climate plan** (NECP) sets a 2030 reduction target for greenhouse gas (GHG) emissions not covered by the EU emissions trading system ('nonETS') at -33%, as compared to emissions in 2005. Italy aims to exceed this target, with planned measures expected to reduce Italian GHG emissions in the Effort Sharing Regulation (ESR) sectors by 35% in 2030 compared to 2005. The NECP also estimates the cumulative additional reduction effort in relation to the existing policies and measures projection between 2021 and 2030. The plan lacks precise indications on how Italy intends to achieve the land use, land use change and forestry (LULUCF) 'no-debit' commitment (i.e. that accounted emissions do not exceed removals).

The NECP identifies the objectives of Italy's national adaptation strategy for the energy sector, and refers to **the ongoing preparation of the national adaptation plan**. Italy sets a contribution of 30% (as a share of gross final consumption) to the 2030 EU renewable energy target, maintaining the same level indicated in the draft NECP.

For **energy efficiency** the Italian contribution to the collective 2030 EU target is sufficient and amounts to 125.1 Mtoe for primary energy and 103.8 Mtoe for final energy consumption. The contribution has not changed in comparison to the draft plan. The final plan provides substantial information on the actions and national goals to renovate the building stock. Italy has not yet submitted its long-term renovation strategy. The final NECP sets new objectives for energy security. The NECP aims at reducing the level of dependency (from 77.7% in 2016 to 75.4% in 2030 and to 74.6% in 2040) and sets out levels for additional storage (almost 1000 MW by 2023, split between hydroelectric and electrochemical production, and 6 000 MW in addition to 4 000 MW distributed storage by 2030).

On the **internal energy market**, the final plan includes objectives, policies and measures such as removing price distortions or including measures to ensure the non-discriminatory participation of new market participants in the deployment of the second generation of smart metering systems and the phasing-out regulated prices.

On **electricity interconnectivity**, Italy expects to increase its interconnectivity level to 10% by 2030.

3.2.6.9 Greece[11]

The Greek NECP provides a roadmap for substantial reduction in greenhouse gas emissions (GHG). The core objective is set for 40% reduction in GHG emissions in 2030 compared to 1990, or more than 55% compared to 2005 levels. The policy measures foreseen for GHG emissions reduction and removal include:

- Shutdown of lignite-fired power plants and interconnection of autonomous island systems;
- Promoting natural gas as an intermediate fuel for reducing the carbon footprint of the energy system;
- Promoting renewable energy sources (RES), storage systems and fuel production from RES;
- Improvement in energy efficiency of buildings, industry and infrastructures;
- Reduction in emissions in the transport sector.

[11] Please note that the Greek NECP is undergoing revision, which is expected to be concluded within the first semester of 2023. Set objectives including on RES share and energy effectiveness are expected to be revised upwards.

The final plan states that Greece is committed to proportionally support the European objective of climate neutrality by 2050, consistent with its national long-term strategy. Specifically, the longterm strategy sets out a GHG reduction target of about 95% by 2050 compared with 1990 (for the 1.5 degrees Celsius target scenario) or of about 85% (for the 2 degrees Celsius target scenario). It also sets the **target for renewable share in power generation** at above 95%. The final plan does not yet include information on how Greece would achieve its commitment that by 2030 land use, land use change and forestry (LULUCF) emissions do not exceed accounted removals.

Greece has a national adaptation strategy. The NECP does not specify Greece's adaptation goals and only refers to the existing strategy.

Greece's renewable energy contribution to the EU target for 2030 is 35% of gross final energy consumption without cooling from heat pumps. This is more ambitious than the contribution of 31% specified in the draft NECP. This increased ambition is linked to the planned increase in the renewable energy share in the electricity, heating and cooling sectors.

For energy efficiency, Greece specified that it would achieve energy consumption levels of 20.6 Mtoe for primary energy consumption and 16.5 Mtoe for final energy consumption. While more ambitious than in the draft plan, those figures are still of modest and low ambition respectively. The energy efficiency first principle is applied, acknowledging the overall importance of energy efficiency goals and considering energy efficiency policies as a horizontal priority throughout the NECP. The final NECP provides further information on the energy efficiency of buildings including a plan to renovate 600 000 homes by 2030. Greece has not yet submitted its long-term renovation strategy.

In its plan, Greece set objectives **for energy security**, aiming to ensure security of supply and the further development of the internal energy market. These two objectives are strongly interlinked and include a new market design, market coupling with neighbouring countries, interconnection of islands, new gas infrastructure projects as well as a new gas trading platform. Some of the objectives lack quantification and/or time frames.

Greece aims to reach an **electricity interconnectivity target of 21% by 2030** and to expand its cross-border infrastructure with neighbouring countries for both electricity and gas to this end. Under the plan, this target should already be met by 2025.

3.2.7 State of adoption of EU directives and regulations

As mentioned in previous chapter by signing the Energy Community Treaty, Western Balkans countries members of EUSAIR made legal commitments to harmonize its national legislation with the legislation of the EU (Acquis Communautaire) in all the agreed areas of harmonization. Decisions to adopt new acquis and amend existing are voted by majority on the Ministerial Council (members are ministers of all CPs) based on European Commission proposal. In November 2021, following the positive decision of the Ministerial Council voting first set of Clean Energy Package acts were included into the Energy Community acquis.

One of the main driving factors in the process of adoption of the EU Acquis Communautaire is mostly related to both the aspirations to a membership in the EU and to an awareness that without major investments in generation and transmission capacities, consumers might suffer from future supply shortages. Therefore, a stable legal framework capable of ensuring certainty and transparency over the long run is necessary to attract investments.

The state of adoption of EU directives and regulations for each sector is compiled based on the Energy Community Secretariat assessed implementation performance in 2021 (status 1 November 2021) and presented in the table below.

This table includes only countries participating in the Energy Community since it’s assumed that the EU Member States have already adopted and implemented the EU directives and regulations. According to the governance of the energy union and climate action rules, which entered into force on 24 December 2018, EU Member States are required to prepare integrated national energy and climate plans that cover the five dimensions of the energy union for 2021–2030.

Acquis on Cross- cutting		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Regulation (EU) 2018/1999 of 11 December 2018 on the Governance of the Energy Union and Climate Action	30 December 2022	NA[12]
Commission Delegated Regulation (EU) 2020/1044 of 8 May 2020 supplementing Regulation (EU) 2018/1999 with regard to values for global warming potentials and the inventory guidelines and with regard to the Union inventory system	30 December 2022	
Commission Implementing Regulation (EU) 2020/1208 of 7 August 2020 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999	30 December 2022	
Acquis on Electricity		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market for electricity[13]	30 December 2023	AL: 66% BIH: 60% MNE: 78% NM: 82% SER: 75%
Directive 2009/72/EC of 13 July 2009 concerning common rules for the internal market in electricity	general deadline 31 December 2014; Article 9(1) 31 May 2016; Article 9(4)31 May 2017; Article 1131 December 2016;	
Regulation (EC) 714/2009 of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity	31 December 2013	

[12] The overall implementation performance in % is not published by the EnCS, as these acts were included in the Acquis Communautaire after publishing the Annual Implementation Report for 2020/2021.

[13] The subject act is not included in the overall implementation performance in % as published by the EnCS, as these acts were included in the Acquis Communautaire after publishing the Annual Implementation Report for 2020/2021.

Regulation (EU) 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to transmission charging	31 December 2013	
Regulation (EU) 543/2013 of 14 June 2013 on submission and publication of data in electricity markets and amending Annex I to Regulation (EC) 714/2009	23 December 2015	
Regulation (EU) 2016/1388 of 17 August 2016 establishing a network code on demand connection	general implementation deadline 11 July 2021; Articles 4(2)(a)(b), 6(4), 56, 57 deadline 11 July 2018; Article 51(1) deadline 11 March 2019;	
Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators	general implementation deadline 11 July 2021; Articles 4(2)(a)(b), 7(4), 58 and 59 deadline 11 July 2018; Articles 68(1) and 69(1) deadline 11 July 2018; Article 61(1) deadline 11 March 2019;	
Regulation (EU) 2016/1447 of 26 August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules	general implementation deadline 11 July 2021; Articles 4(2)(a)(b), 6(4), 51(1), 56 and 57 deadline 11 July 2018 Article 78(1) deadline 11 March 2019	
Regulation (EU) 1227/2011 of 25 October 2011 on wholesale energy market integrity and transparency	28 May 2020	
Acquis on Gas		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Directive 2009/73/EC of 13 July 2009 concerning common rules for the internal market in natural gas	general deadline 31 December 2014;	AL: 52% BIH: 25%

	Article 9(1) general 31 May 2016; Article 9(4) 31 May 2017;	MNE: 34% NM: 38% SER: 36%
Regulation (EC) 715/2009 of 13 July 2009 on conditions for access to the natural gas transmission networks	general deadline 31 December 2013; ANNEX I deadline 30 September 2018	
Regulation (EU) 703/2015 of 30 April 2015 establishing a network code on interoperability and data exchange rules	30 September 2018	
Regulation (EU) 2017/459 of 16 March 2017 establishing a network code on capacity allocation mechanisms in gas transmission systems	27 February 2020	
Regulation (EU) 2017/460 of 16 March 2017 establishing a network code on harmonized transmission tariff structures for gas	27 February 2020; Chapters II, III and IV deadline 30 May 2021	
Regulation (EU) 312/2014 of 26 March 2014 establishing a network code on gas balancing of transmission networks	11 December 2020	
Regulation (EU) 1227/2011 of 25 October 2011 on wholesale energy market integrity and transparency	28 May 2020	
Acquis on Security of Supply		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Regulation (EU) 2019/941 of 5 June 2019 on risk-preparedness in the electricity sector	30 December 2023	**NA**[14]
Regulation (EU) 2017/1938 of 25 October 2017 concerning measures to safeguard the security of gas supply	30 December 2022	
Acquis on Oil		

[14] The overall implementation performance in % is not published by the EnCS, as these acts were included in the Acquis Communautaire after publishing the Annual Implementation Report for 2020/2021.

Legal act	Implementation deadline	Overall implementation score per area in %
Directive 2009/119/EC of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products	31 December 2022	AL: 50% BIH: 15% MNE: 25% NM: 75% SER: 75%
Acquis on Climate		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Regulation (EU) 2018/1999 of 11 December 2018 on the Governance of the Energy Union and Climate Action	30 December 2022	NA[15]
Acquis on Environment		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, , as amended by Directive 2014/52/EU	1 January 2019	AL: 75% BIH: 44% MNE: 73% NM: 60% SER: 65%
Directive (EU) 2016/802 of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels	29 June 2018	
Commission Implementing Decision (EU) 2015/253 of 16 February 2015 laying down the rules concerning the sampling and reporting under Council Directive 1999/32/EC as regards the sulphur content of marine fuels	1 January 2018	
Directive 2001/80/EC of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants	31 December 2017	
Chapter III, Annex V and Articles 72(3)-(4) of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)	1 January 2018	

[15] The overall implementation performance in % is not published by the EnCS, as this act was included in the Acquis Communautaire after publishing the Annual Implementation Report for 2020/2021.

Article 4(2) of Directive 79/409/EEC on the conservation of wild birds	30 June 2006	
Directive 2004/35/EC of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, as amended by Directive 2006/21/EC, Directive 2003/31/EC	1 January 2021	
Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment	30 March 2018	
Acquis on Renewable Energy		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Directive 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources	30 December 2022	NA[16]
Acquis on Energy Efficiency		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Directive 2012/27/EU of 25 October 2012 on energy efficiency	30 December 2022	AL: 48% BIH: 46% MNE: 81% NM: 62% SER: 73%
Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings	30 September 2012	
Regulation (EU) 2017/1369 setting a framework for energy labelling and repealing Directive 2010/30/EU	1 January 2020	
Acquis on Infrastructure		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure	31 December 2016	AL: 28% BIH: 8% MNE: 38% NM: 12% SER: 12%

[16] The overall implementation performance in % is not published by the EnCS, as this act was included in the Acquis Communautaire after publishing the Annual Implementation Report for 2020/2021.

Acquis on Competition		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Annex III of the Treaty: EC Competition Rules	1 January 2007	Applied as mandatory by signing the ECT

Acquis on Statistics		
Legal act	**Implementation deadline**	**Overall implementation score per area in %**
Regulation (EU) 2016/1952 of 26 October 2016 on European statistics on natural gas and electricity prices	1 March 2018	AL: 59% BIH: 88% MNE: 73% NM: 83% SER: 96%
Regulation (EC) 1099/2008 of 22 October 2008 on energy statistics	30 December 2013	
Implementing Regulation (EU) 2019/803 of 17 May 2019 concerning the technical requirements regarding the content of quality reports on European statistics on natural gas and electricity prices pursuant to Regulation (EU) 2016/1952	14 June 2022	

3.2.8 Main data sources

The data used are available on Eurostat database on energy statistics17 and on EEA air emission inventories[18].

Data sources in domain of energy sector governance and regulation are based on the analyses of the regulatory framework of each EUSAIR member state, official EU documents as well as implementation reports from international institutions as Energy Community Secretariat.

3.3 Innovative solutions for implementing a common energy market

In all European countries the energy transition requests massive investments that are at the same time extremely urgent and complex in terms of financial architecture. This is requesting the involvement of public financial institutions for mobilizing funds for large projects as well as the active role of private sectors with small investments and start up initiatives. Some initiatives make sense only if they are at macro regional level and therefore, they become feasible thanks only to the involvement of the large European financial institution. The realization of large infrastructure energy networks is a prerequisite in order to achieve an integrated common energy market where electricity and gas networks represent a kind of physical backbone on which to build integration, competition, efficiency where it will be possible to exploit the huge potentialities of renewable energy sources existing in the EUSAIR region. The decarbonization process relies on the introduction of carbon pricing in the region, to be integrated with the Emission Trading System already active since 2003 in the EU. It will be working only within a well-integrated common energy market in the EUSAIR region. Innovative finance has been a condition that favoured the development of liquidity on the European Emission Trading System.

At the same time, the fact that the energy transition is achievable only through a total involvement of small consumers points out the need to have better condition for finance through innovative financial instruments in the private sector in order to support energy efficiency and renewable energy sources productions. Energy communities are an innovative architecture for consumers that are expected to become also producers, the so-called prosumers bringing important environmental and economic benefits. In this respect small and medium size enterprises are expected to play a key role in providing finance and assistance for technological innovation and digitalisation.

The reform of the European energy markets implemented in the last three decades are aiming at the involvement of private entities in order also to boost competition among different players reducing, when requested, the dominant position of incumbents. At the same time some strategic infrastructures among different countries are feasible only with the guarantees and the commitment of public institutions.

The huge instability in energy prices brought by the 2022 crisis has caused uncertainty in the process of financing new projects, especially those with a long-term perspective as it happens normally for gas

[17] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_bal_c

[18] https://ec.europa.eu/eurostat/databrowser/view/ENV_AIR_GGE__custom_2889604/default/table?lang=en

and electricity grids. However, the rise in price on gas and electricity on wholesale markets is of such intensity in 2022 that a return to the levels prevailing before 2022 is unlikely in the short term. The most likely scenario is that of relatively high prices for long and this will be a support for overcoming all different impediments and complexities in implementing investments in the realization of new gas and electricity infrastructures.

The traditional difficulties to source private investments in the EUSAIR countries could find easier solutions in this context of higher prices, renovated urgency to strengthen energy security and boost the production from the renewable energy sources that are abundant in the region. This is an opportunity also for joint capacity building among the countries in the Region since the projects already identified are at the starting point from which the new and reinvigorated energy grid strategy will start in each single country.

Security of supply suddenly became again a key element in 2022 after the energy crisis and this gives more value to existing power generation relying on carbon intensive fuels such as coal. Despite remaining a final target, the reduction of coal consumption in the EUSAIR region is now less urgent and, for the time being, they remain a temporary instrument on which to build a common system to improve energy security. As repeated in several official documents, the transition from coal to cleaner energy sources will be implemented taking into consideration all social and economic aspects among which also guarantees for investments made in the past.

4 Section 4 – Power systems and networks in the Adriatic-Ionian Region

4.1 Overview and description of the EUSAIR countries national power system

4.1.1 Total electricity generation capacity and electricity production

The **total generation capacity** of the EUSAIR countries amounts to a total of approximately 157 GW, of which 71% is installed in Italy alone, what is equal to more than 111 GW, next is Greece with 12% of total installed capacity or around 19 GW. All other countries except Serbia which has near 8 GW participate with less than 5% in total installed capacity of the EUSAIR region.

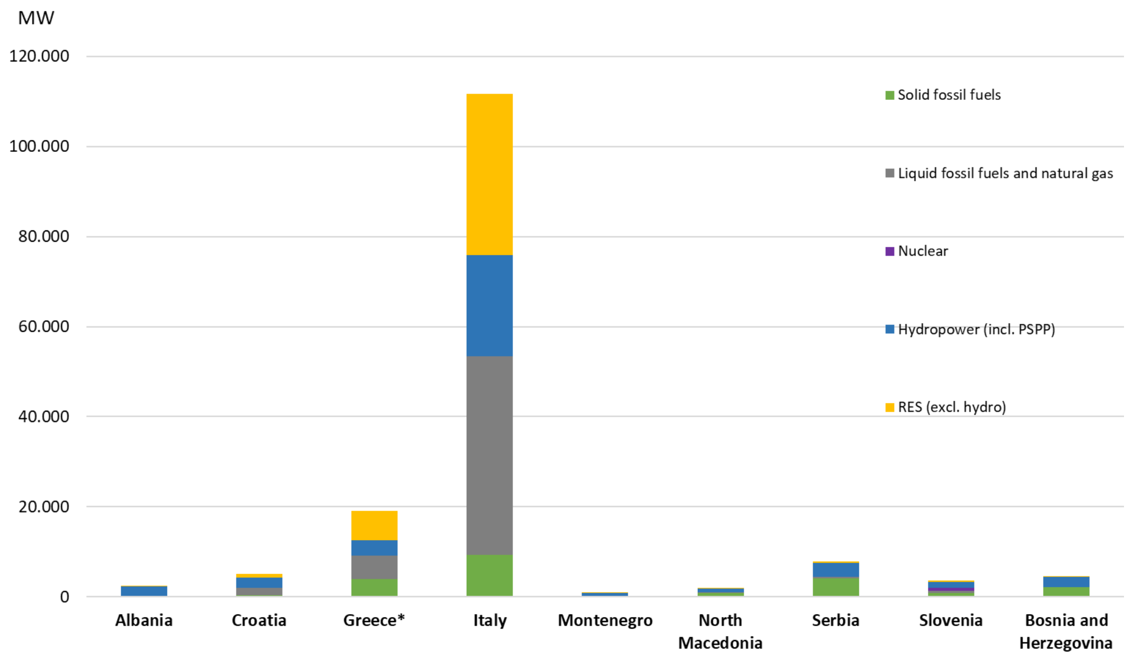


Figure 21 - Total generation installed capacity per source in 2019

Source: Consultant's elaboration on IRENA and ENTSO-E Transparency Platform19 data

[19] https://transparency.entsoe.eu/generation/r2/installedGenerationCapacityAggregation/show

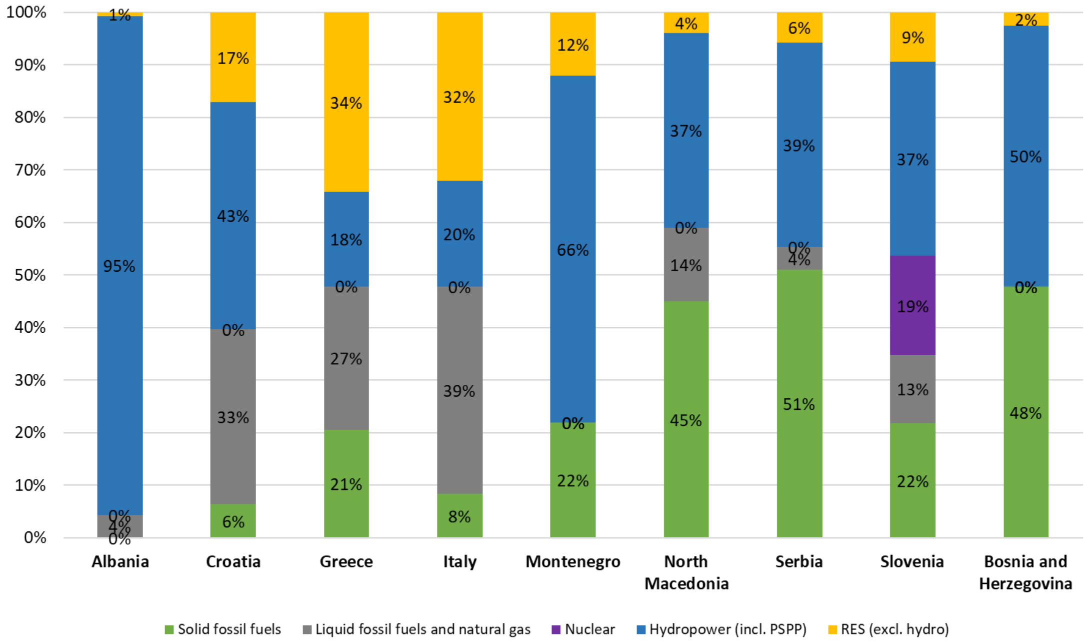


Figure 22 - Total generation installed capacity per sector in 2019

Source: Consultant's elaboration on IRENA and ENTSO-E Transparency Platform data

When analyzing the existing types of power generating units and their shares in total electricity production capacity the region is still dominated by the fossil fuels capacities. Almost 47% of all installed capacities are solid or liquid fossil fuels and natural gas fired power plants. List of countries is leaded by N. Macedonia and Serbia, where 59% and 55% of all capacities are fossil fueled. These two countries are followed by Bosnia and Herzegovina, Italy and Greece with approximately 48% of fossil fuel capacities installed in each country. In other countries, like Croatia and Slovenia these values are still high 40% and 35%, while Montenegro has 22% and Albania 4% of installed capacities in fossil fuels.

While in EU EUSAIR countries like Italy, Greece and Croatia the fossil fuels sources are linked to mainly natural gas and oil in non-EU EUSAIR countries like Serbia, Bosnia and Herzegovina and N. Macedonia these sources are linked to utilization of solid fossil fuels like low-quality lignite which is burned in inefficient boilers what increases the effects of electricity generation originated air-pollution. Albania has one fossil fueled (oil fueled) power plant which is not operational, therefore practically all domestic generation is renewable. However, due to the fact that Albania is net importer of electricity and these imports are typically sourced from the Western Balkans region and are thus more carbon-intensive what in fact also do not release Albania from this influence.

It is interesting that none of the EUSAIR countries have nuclear power plants, except Slovenia with installed cca 700 MW in one nuclear plant which makes 19% of its total installed capacity.

The remaining renewable capacities in all countries are dominated by hydropower except in Italy and Greece where renewable capacities are mainly consisted of other renewables sources excluding hydro. Hydropower installed capacity are especially dominant in Albania and Montenegro, where they amount to 95% and 66% of generation installed capacities what makes these two countries especially exposed to risk of low precipitation and climate change.

The **total electricity generation** of the EUSAIR countries amounts to a total of approximately 29,64 Mtoe (about 345 TWh), of which 57% was produced in the Italian regions, 14% in Greece, 11% in Serbia.

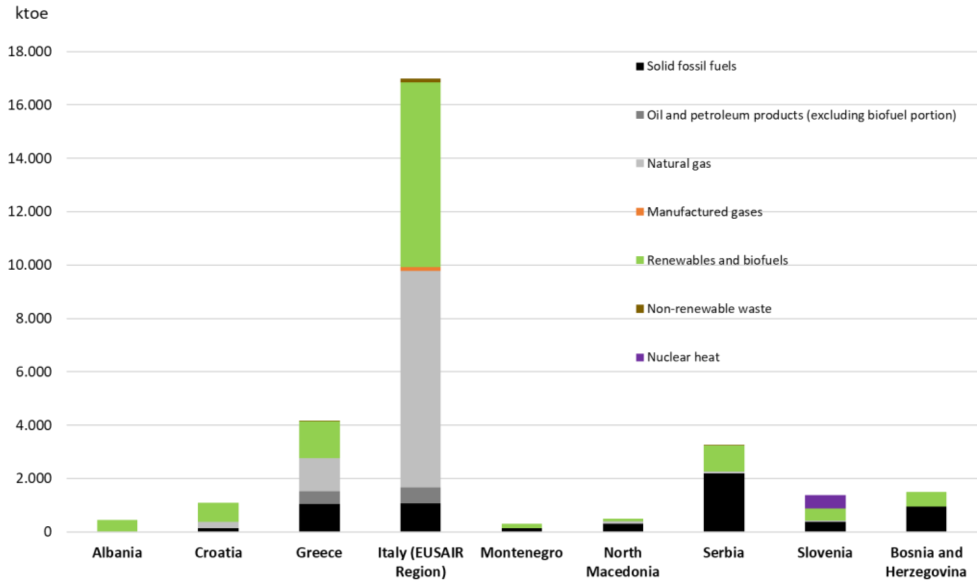


Figure 23 - Gross electricity generation per source in 2019

Source: Consultant's elaboration on Eurostat data

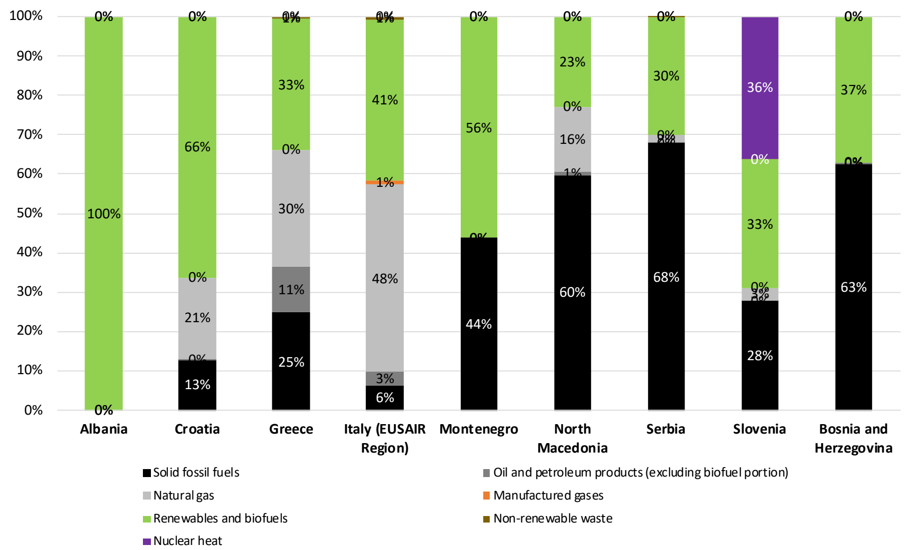


Figure 24 - Gross electricity generation per source in 2019 (%)

Source: Consultant's elaboration on Eurostat data

Serbia, Bosnia and North Macedonia are still closely linked to coal in domestic electricity production (over 60%), while Italy and Greece have focused more on natural gas.

Overall, most countries use fossil fuels to produce more than 50% of their electricity, while Albania, Croatia and Montenegro use more renewables for electricity generation.

Slovenia is the only country to have a nuclear power plant, which covers approximately 36% of the total national electricity production.

4.1.2 Renewable generation and shares of renewable energy sources in total electricity production

The **total renewables generation capacity** of the EUSAIR countries amounts to more than 82 GW, where the situation is identical like in case of total installed capacities and 71% or 58 GW of all renewable capacities belongs to Italy. Greece follows with 12% of total installed capacity or around 10 GW. All other countries except Serbia which has near 3,5 GW participate with less than 4% in total renewables installed capacity of the EUSAIR region.

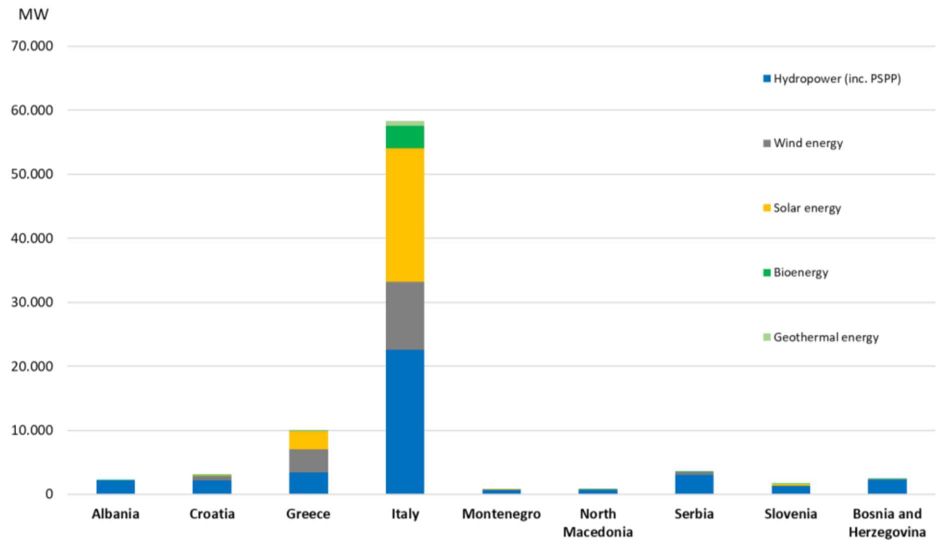


Figure 25 - Total renewables installed capacity per source in 2019

Source: Consultant's elaboration on IRENA data

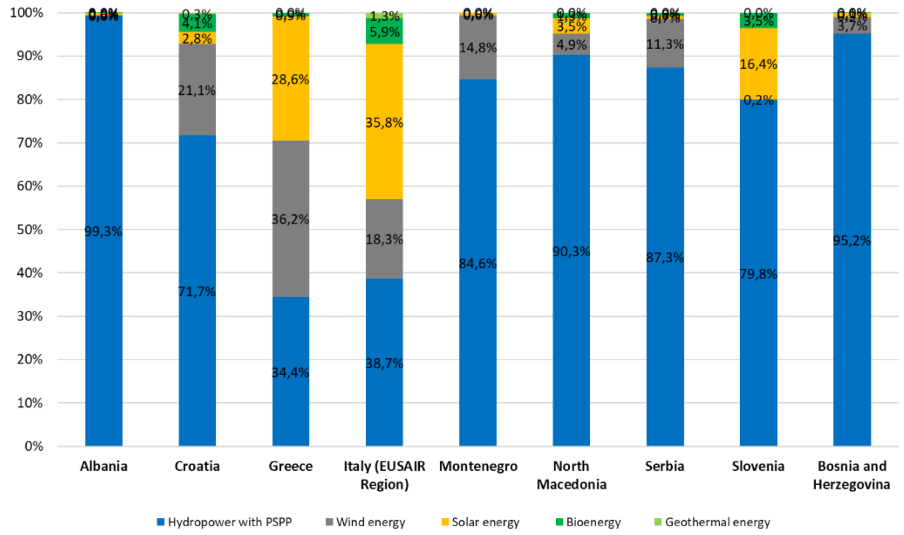


Figure 26 - Total renewables installed capacity per sector in 2019

Source: Consultant's elaboration on IRENA data

Existing renewable power generating capacities in the EUSAIR are dominantly consisted of hydropower which reaches 46% of all installed renewable capacities, and it is followed by 29% of solar, 19% of wind energy and 5% of bioenergy installed capacities. The remaining technologies participate in total mix with negligible amounts like geothermal 1%, which is present mainly in Italy.

As mentioned in previous chapter in all EUSAIR countries hydropower capacities are dominant among renewables, in many of them hydropower participates more than 80% in of total renewable installed capacities. The exception is Croatia with 72% what is also extremely high, together with Italy 39% and Greece 34% which remaining renewables mix are mainly based on wind and solar installed capacities. These hydropower capacities are rather old except in Albania, where medium and large hydropower plants were built in last few years.

Lack of investment in renewables capacities and new technologies like wind and solar is obvious in the non-EU EUSAIR countries where the renewable capacities excluding hydro are very limited (less than 15% like in Montenegro which is the leader among them).

Electricity production from renewable sources in the EUSAIR countries reached 15 Mtoe in 2019 (about 174 TWh), of which 68% was produced in the Italian regions, 9% in Greece and 6% in Serbia. The other countries accounted for less than 5% each.

The Italian regions and Greece are the countries with the greatest differentiation in terms of renewable sources used for electricity generation.

All the other countries are heavily biased towards hydroelectricity, which in some cases (Albania and Bosnia) covers over 90% of their renewable electricity production.

Wind power is significantly present in Greece, Italy, Croatia and Montenegro, while solar photovoltaics are widespread only in Italy and Greece (and in a small amount in Slovenia).

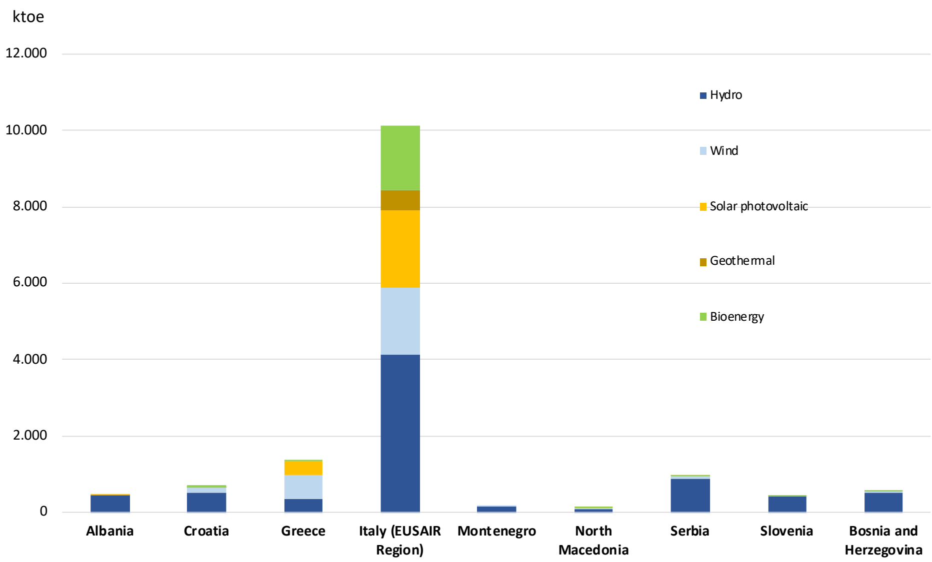


Figure 27 - RES electricity generation per source in 2019

Source: Consultant's elaboration on Eurostat data

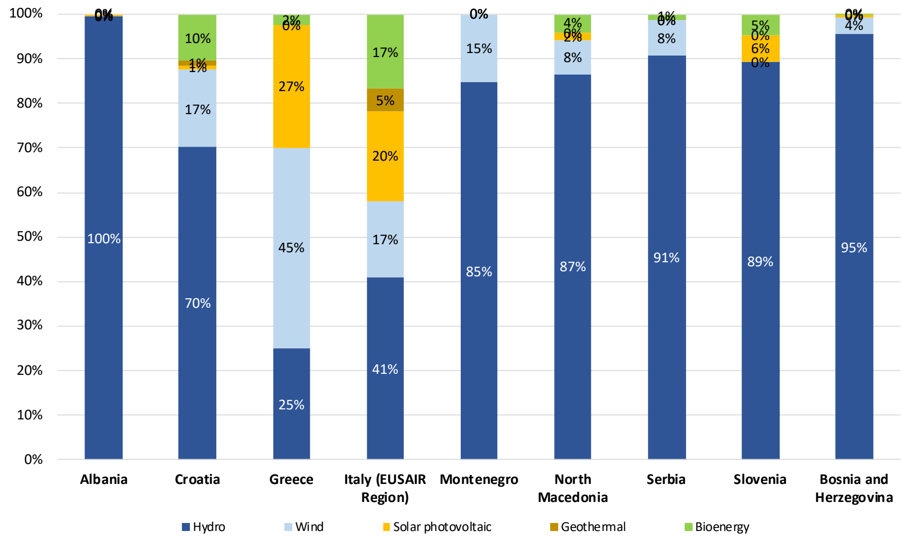


Figure 28 - RES electricity generation per source in 2019 (%)

Source: Consultant's elaboration on Eurostat data

The indicators related to production are very different between different countries.

4.1.3 Electricity demand sectors and their shares in national demand

The **total electricity demand** in different sectors of the EUSAIR countries amounts to a total of approximately 29 Mtoe (or about 337 TWh), of which 60% was consumed in the Italian regions, 15% in Greece, 8% in Serbia and 5% in Croatia.

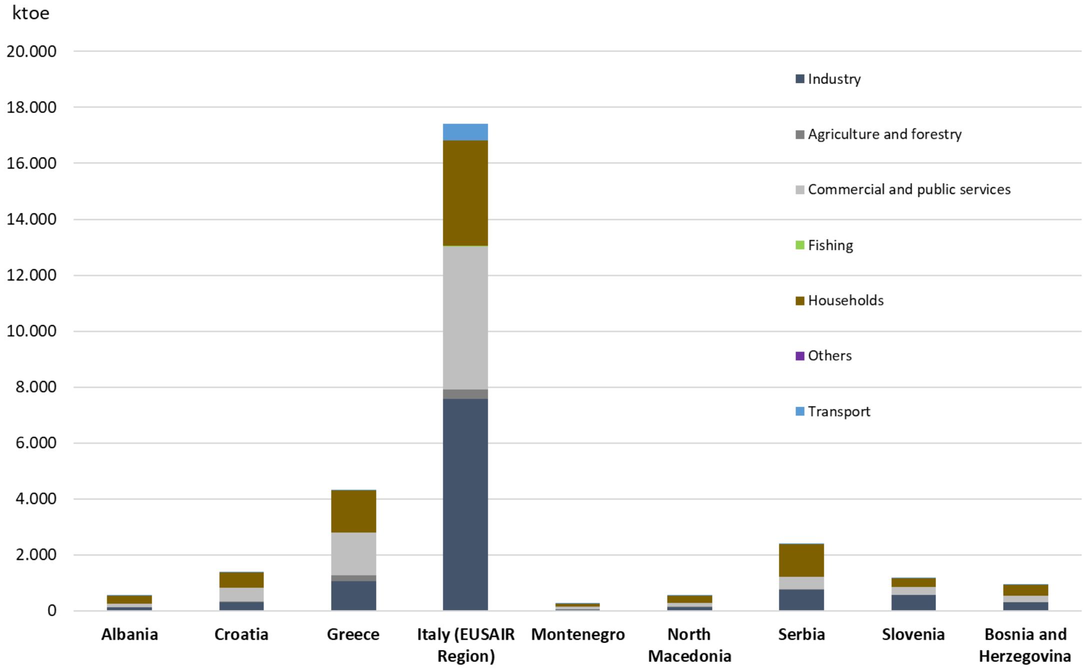


Figure 29 - Final electricity consumption per sector in 2019

Source: Consultant's elaboration on Eurostat data

Total of 29 Mtoe electricity consumed for end uses in the EUSAIR region in 2019, around 10,9 Mtoe (cca. 38%) were used for industry, around 8,28 Mtoe (28,5%) were used in the households' sector, over 8,47 Mtoe (29%) were consumed in the commercial and public services sector, over 0,7 Mtoe (2,5%) were destined for the transport sector and around 0,6 Mtoe (2%) were used for agricultural uses.

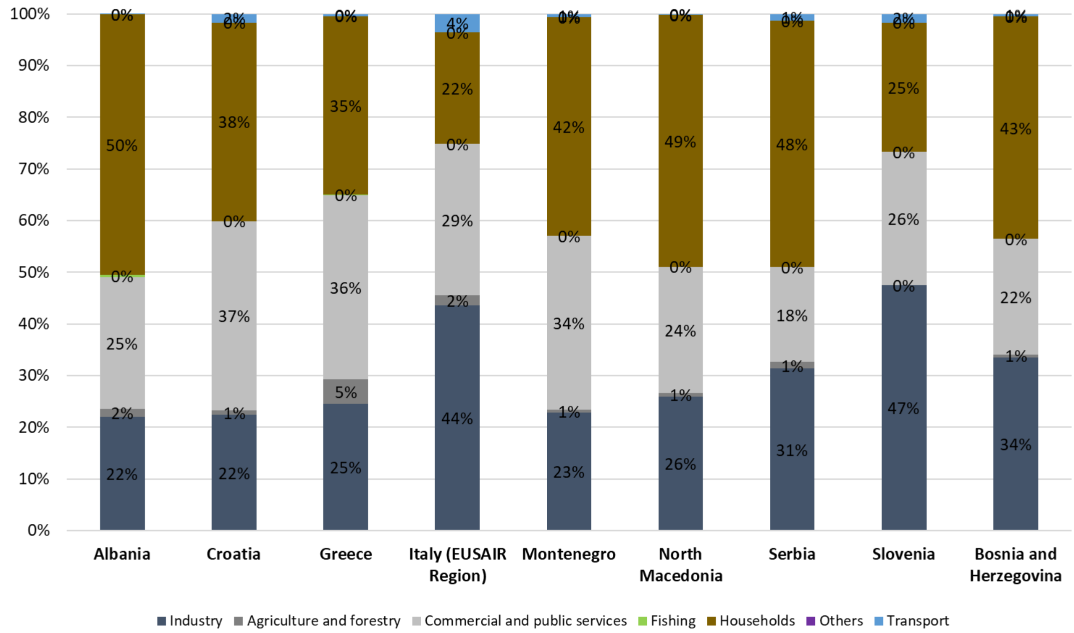


Figure 30 - Final electricity consumption per sector in 2019 (%)

Source: Consultant's elaboration on Eurostat data

The industry sector generally accounts for less than 30% of the electricity demand, except in case of Slovenia and Italy, where it accounts for 47% and 44%, Bosnia and Herzegovina with 34% and Serbia where it accounts for 31% of final electricity consumption. It is evident that electricity consumption of the industry sector is the highest in the two economically most developed EU EUSAIR countries.

The economic sectors combined (industry, services, agriculture and fishing) which on average represent 69% of total final consumption, exceed this threshold again in Italy and Slovenia, where they reach 75% and 73%, respectively. Similarities of the country's economy characteristics corresponds to the final electricity consumption, so on these economic sectors combination in Albania falls out 49% of the electricity consumption, and Serbia and N. Macedonia have the equal percentage of 51%. The consumption is similar also for Greece and Croatia (tourism dependent economies), 65% and 60%, and Montenegro and Bosnia and Herzegovina, 57% and 56%, respectively.

The household's sector is particularly relevant in Bosnia and Herzegovina, Serbia, N. Macedonia; where it is around 50% of total final consumption, while in Italy and Slovenia is particularly low, accounting for 22% and 25% of total final energy consumption, respectively. One of the reasons for such high consumption of the electricity in households, beside less developed industry, is the low price of electricity which is than rather used for heating purposes (through inefficient heaters) than other sources of heating.

The use of electricity in transport is highest in Italy where it amounts around 4%, in other countries this negligible amount around 1% which is mainly used in railway and/or public transportation (trams and trolleybuses), while for example in Albania it practically barely exists as there are no electrified railroads.

The tertiary sector, ranges between 18% and 37% of consumption, is particularly relevant in Greece and Croatia (37% and 36%) as the most tourism developed countries.

4.1.4 Trends for the period 2000-2019 and electricity prices.

In 2019, electricity prices, including taxes and levies, were significantly lower in non-EU countries than in EU member countries of the EUSAIR.

In non-EU countries of the EUSAIR, the electricity market is dominated by the state-owned electricity production companies. Incumbents are still supplying all households keeping available electricity at low prices under a universal service regime.

The gap between household price in the non-EU and the EU-27 countries remains significant. If we consider only the cost of energy and supply, in Serbia it represents 36% of the end-user electricity price, which is the lowest among all EUSAIR countries.

Since 2008, the taxes and levies component has increased for electricity, largely due to support for renewable energies and CHP (Combined Heat and Power). In addition, the taxes and levies component include all kinds of country-specific costs that are added to prices based on government decisions such as social, nuclear, system and market operation, energy efficiency, security of supply and environmental taxes etc. Value added taxes on household retail prices are applied as percentages of the total retail price, including the sum of all other taxes and levies. Their nominal effect rose with increasing total prices. Some countries additionally raised the percentages of the value added tax. The total effect of the taxes and levies component on energy retail prices depends on the energy fuel~~,~~ the energy use and the consumer groups depending on total consumption, grid connection and electricity cost intensity.

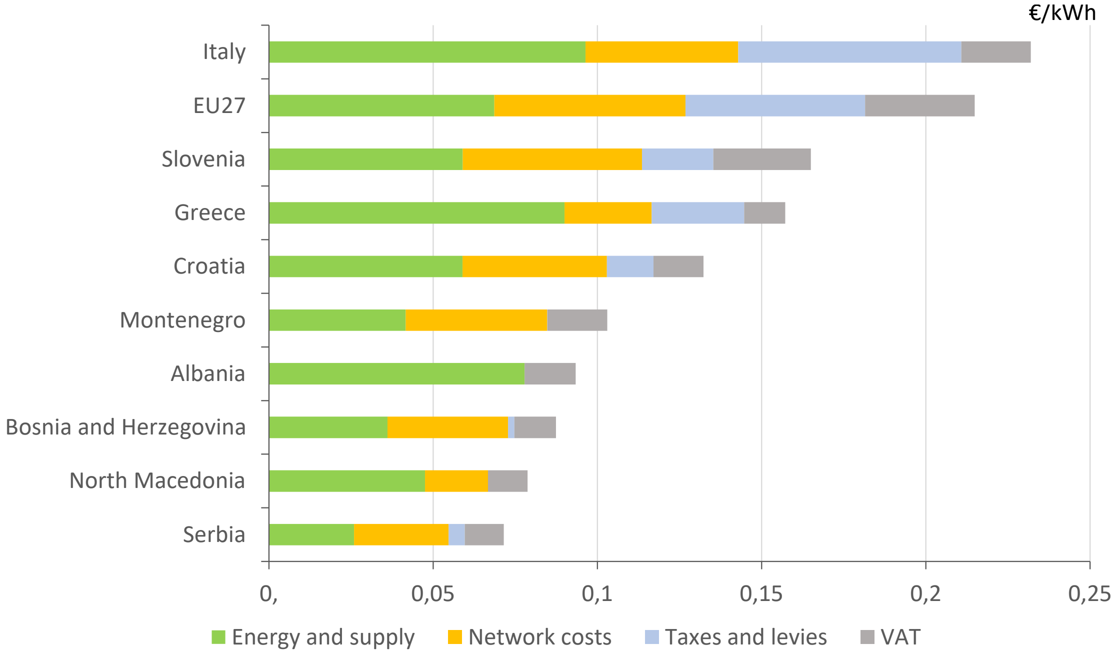


Figure 31 - Electricity prices in EUSAIR countries, residential, I semestar 2019[20]

Source: Consultant's elaboration on Eurostat data

It is interesting to analyse the differences between nominal prices and purchasing power standards (PPS)[21], the differences in income and living costs between countries. Using PPS adjusts the prices in national currency to allow for a comparison on the basis of purchasing the same amount of goods and services. However, price differences across countries mean that different amounts of national currency units are needed for the same goods and services depending on the country. PPS are derived by dividing any economic aggregate of a country in national currency by its respective purchasing power parities.

As regards households' prices, the lowest nominal prices are found in Serbia, North Macedonia and Bosnia and Herzegovina and but these rankings change when relative purchasing power is taken into account. In PPS terms, the countries with the highest difference are North Macedonia, Albania, Montenegro, Bosnia and Herzegovina and Serbia. Although their nominal prices appear low, once

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[20] Residential consumers, consumption 2500-5000 kWh

[21] Source: Eurostat https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_204/default/table?lang=en and https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_205/default/table?lang=en

these are adjusted for local income, they become much more expensive. For example, Macedonian and Albanian prices are 119% and 106% respectively higher expressed in purchasing power parity.

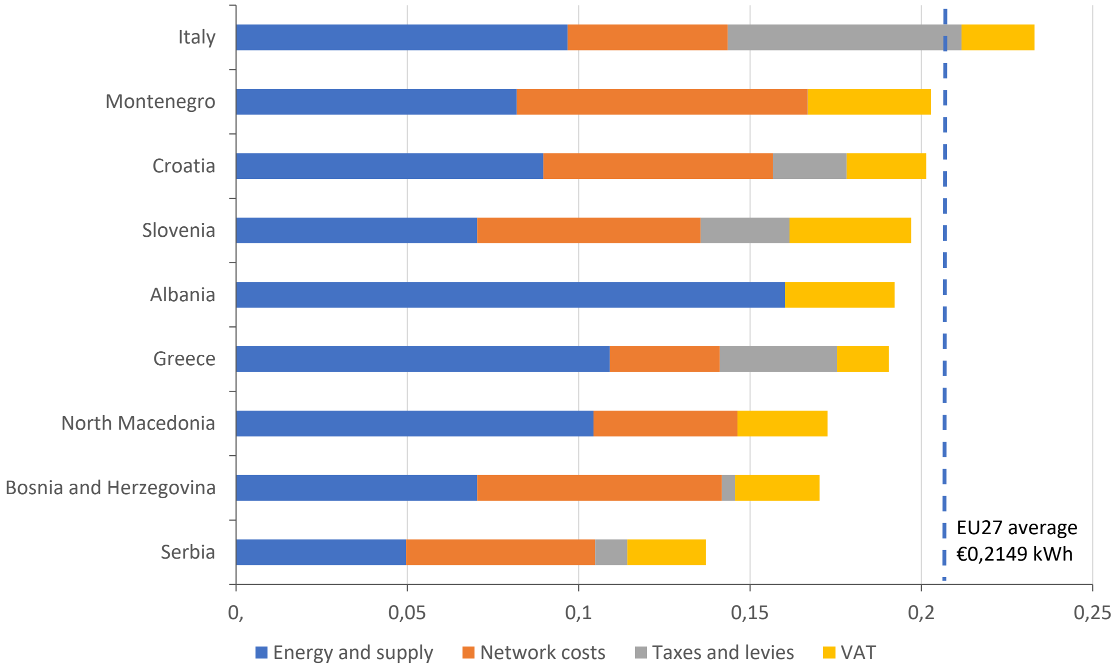

Figure 32 - Residential electricity prices including taxes at PPS, I semestar 2019[22]

Source: Consultant's elaboration on Eurostat data

The prices charged to households consuming annually between 2500 and 5000 kWh has decreased from 2013 to 2019 in North Macedonia, Albania and Croatia, while the most significant increase was registered in Serbia (25%).

[22] Residential consumers, consumption 2500-5000 kWh

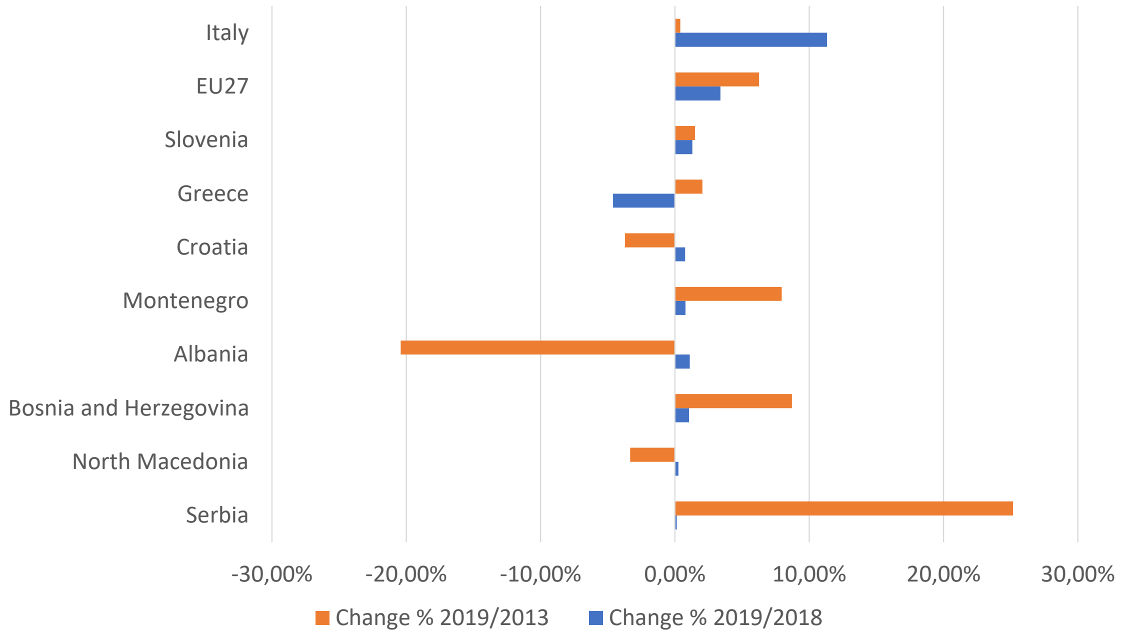

Figure 33 – Change of final electricity prices, 2019/2027 and 2019/2013, in %, residential[23]

Source: Consultant's elaboration on Eurostat data

Other EUSAIR countries, Italy, Slovenia, Greece, Montenegro and Bosnia and Herzegovina have registered an increase on average by 4% between 2013 and 2019.

[23] Residential consumers, consumption 2500-5000 kWh

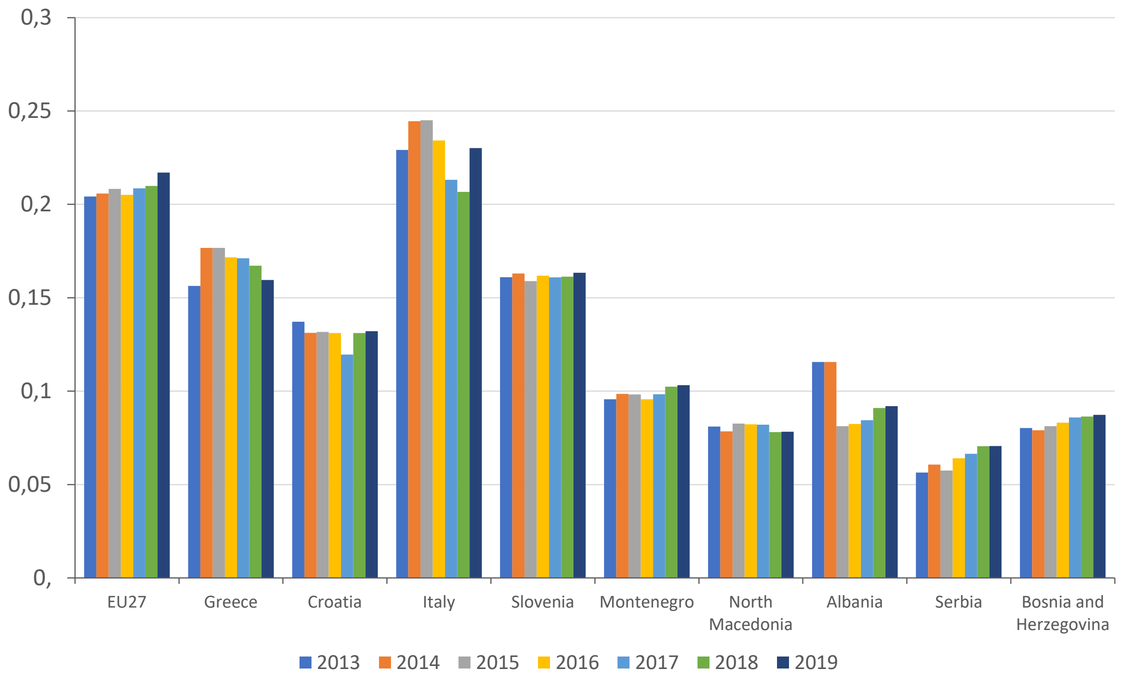

Figure 34 – Final electricity prices for residential sector, 2013-2019, in €/kWh

Source: Consultant's elaboration on Eurostat data

As regards the prices to industry, the electricity prices without taxes and charges in non-EU is close to EU-27 or even exceeds it. In Albania, for example, is 31% higher than in the EU-27.

The gap between industrial prices in non-EU countries and EU is still wide due to the share of taxes and levies in the final price. Since taxes and levies make 47% of the final price in the EU-27, final prices including all charges and levies in the non-EU are still significantly lower than in the EU.

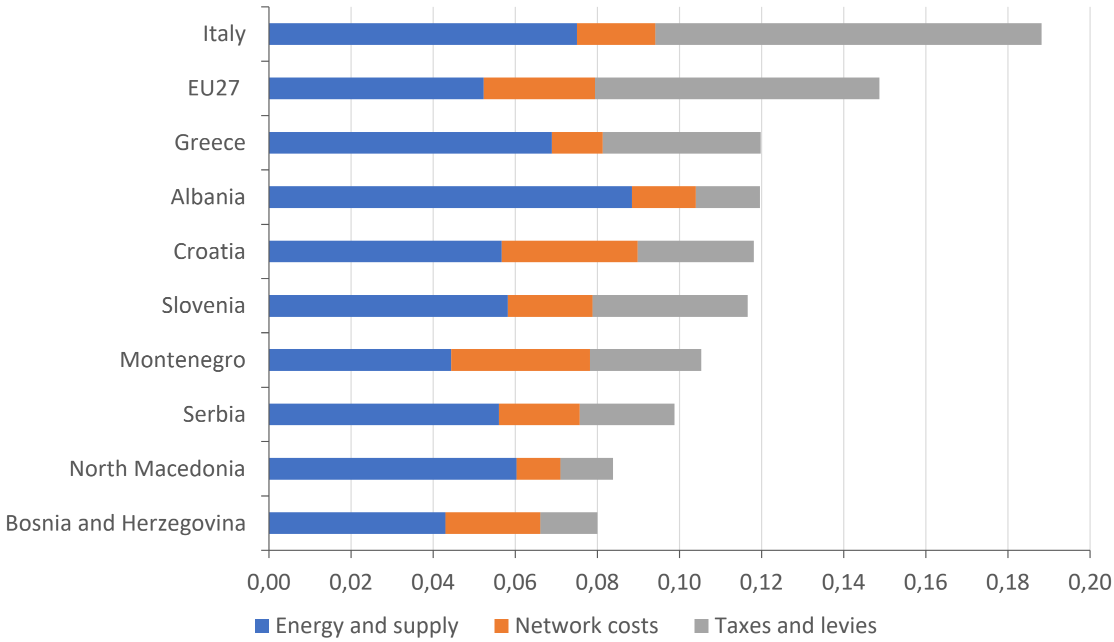

Figure 35 – Industrial electricity prices in EUSAIR countries, I semester 2019, in €/kWh[24]

Source: Consultant's elaboration on Eurostat data

As regards industrial prices, the lowest prices in PPS terms are found in Slovenia and Greece and generally in EU-27 average meaning that these countries become less expensive in comparison to Albania, Montenegro and North Macedonia that become much more expensive when it comes to adjustment for local income.

[24] Industrial consumers, consumption 500-2000 MWh

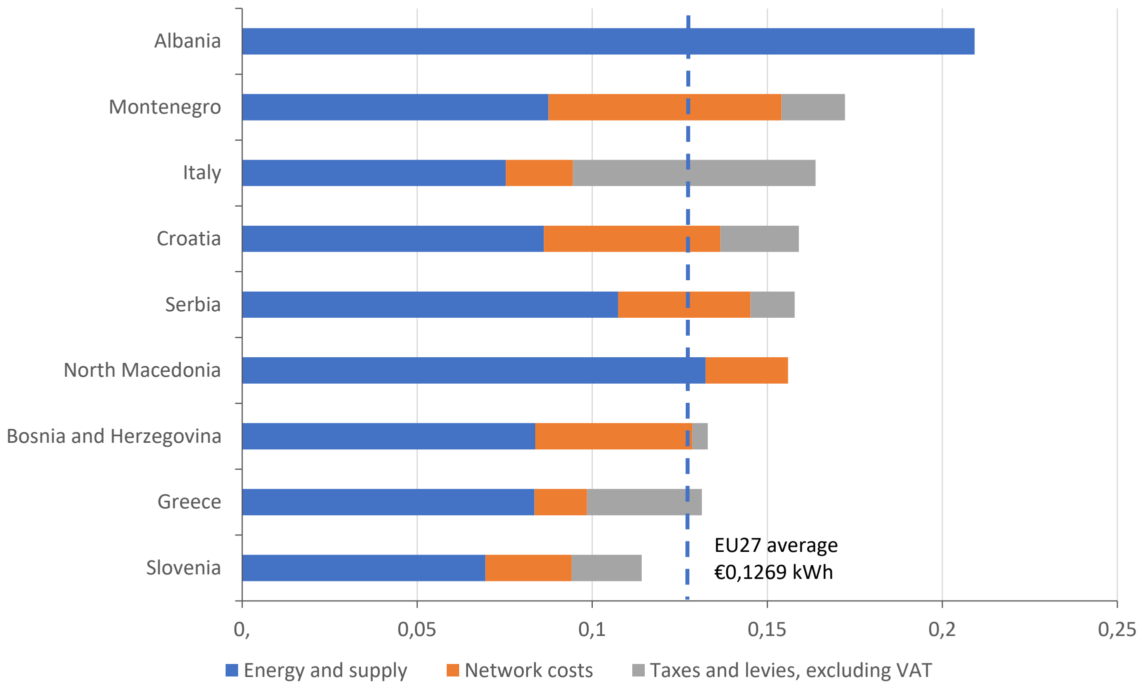

Figure 36 – Industrial electricity prices including taxes, excluding VAT at PPS

Source: Consultant's elaboration on Eurostat data

Figure below shows how the evolution of industrial electricity prices in the EUSAIR Countries for the consumption of 2500 to 5000 kWh, which is the most common value of households.

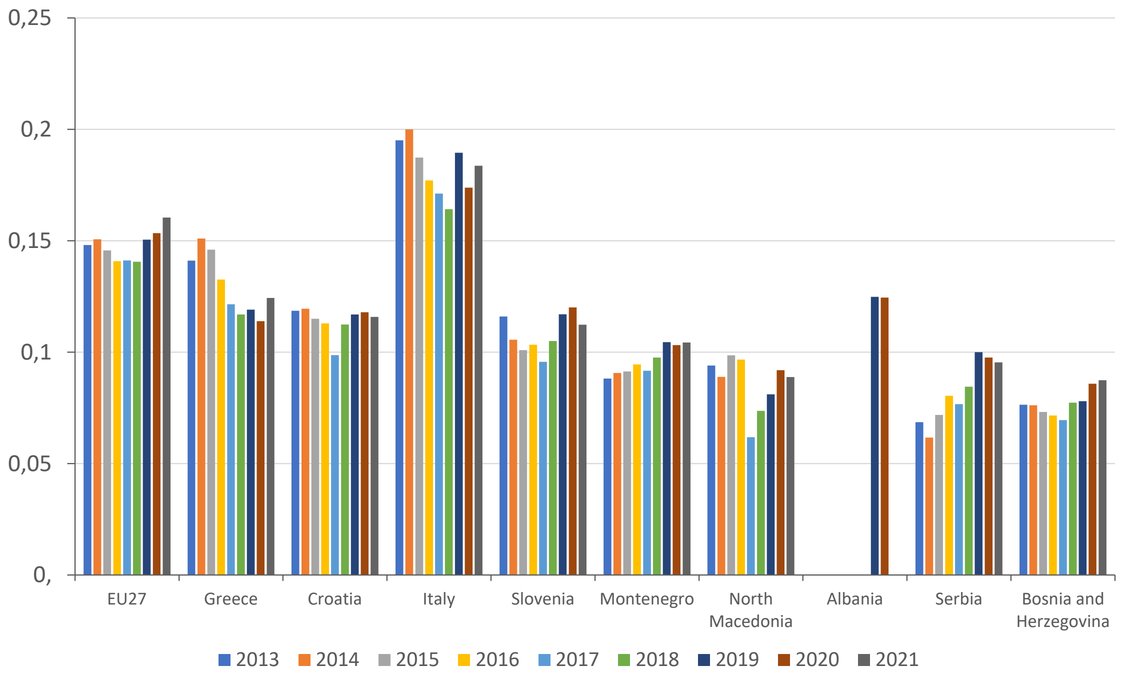

Figure 37- Final electricity prices for industry, 2013-2019, in €/kWh

Source: Consultant's elaboration on Eurostat data

4.2 Abridged description of national electricity power systems

4.2.1 Albania national electricity sector overview

The Albanian electricity market is largely state owned and consists of following main participants:

Albania	
Generation	KESH, Lanabregas HPP - state owned companies under PSO Kurum International, Ayen As Energji, Devoll Hydropower - Independent producers (on the open market, 436 MW in 2021) Priority producers and electricity self-producers (under the supporting schemes, 170 producers with 227 power plants and 721 MW in 2021)
Transmission and Distributors	OST - TSO OSHH - DSO
Power Market Operator	OST - TSO (besides TSO function OST also perform Market Operator role) ALPEX - Albanian Power Exchange (DAM and IDM organized market operator market founded but still not in operation)
Regulatory Authority	The Energy Regulatory Entity (ERE) Albanian Competition Authority (ACA)
Ministry or institution for planning and supervision	MIE - Ministry of Infrastructure and Energy AEE - Energy Efficiency Agency AKBN - National Agency of Natural Resources

KESH is a 100% state - owned energy company established in 1995 and back in 2016 it officially became solely an electricity generation company, when it officially was unbundled from the wholesale public supply activities. KESH currently provides around 70% of total domestic generation from its three large hydropower plants located in the Drina River with 1,350 MW of installed capacity. KESH is under obligation to generate the electricity for supply of regulated customers, cover network losses and act as major provider of balancing services in Albania. This obligation is imposed under public service obligations (PSO) that requires it to provide electricity supply to OSHEE (DSO and retail supplier) in order to: supply regulated customers at a price bilaterally agreed between the parties and approved by the common shareholder (MIE for both KESH and OSHEE) and to provide electricity for covering the losses in the distribution grid. In case of energy surpluses after supplying OSHEE, KESH is allowed to operate on the free market, although due to PSO it is present with low quantities. It is important mentioning that PSO is in conflict with the Power Sector Law which liberalized generation and is in breach of Energy Community Treaty due to its non-compliance with Article 26 of Electricity Directive 2009/72/EC. However, this is deemed to be transitional solution and temporary measure until ALPEX (Albanian Power Exchange) is operational and short-term market mechanism is enabled which would replace PSO.

OSHEE is state-owned electricity distribution and retail supply company. OSHEE acts as supplier of all regulated customers, acts as the supplier of last resort for unregulated customers, responsible for operation and maintenance of the distribution grid assets, energy imports to meet domestic demand (which can't be produced from KESH and IPPs), but also serves as the guaranteed off-taker of electricity produced by most of the IPPs in Albania. OSHEE unbundling process started in 2018, where company was owned subsidiaries: FSHU (the retail supplier for regulated customers and supplier of last resort for liberalized/unregulated customers), OSSH (the distribution grid operator) and FTL (the supplier to unregulated customers, importer of electricity and IPP off-taker). FSHU and OSSH tariffs and prices are regulated by ERE. Complete functional unbundling of the distribution system operator OSHEE is still pending due to the uncompleted transfer of activities, assets and staff to the new companies. Currently GoA is working on establishment of the RES Operator which would take the responsibility for off taking all IPP generation in line with IPP PPAs from OSHEE. It is expected that RES Operator is to become operational in upcoming period. Electricity market is still not fully liberalised. All customers connected to levels below 35 kV have been on regulated supply.

OST is state-owned electricity transmission system operator of Albania, market operator and performs central dispatching of the electricity loads. Form 2014, OST is member of ENTSO-E community and Albanian electricity transmission system is in permanent synchronous operation with the continental European system. OST is fully legally and functionally unbundled company. Cross-border capacities are allocated through SEE CAO, except split auctions applied with EMS of Serbia. Allocation of capacities on the 400 kV interconnection line with Kosovo∗ is pending implementation of the recently signed connection agreement between the TSO of Kosovo∗ (KOSTT) and the ENTSO-E.

Albania is in the process of establishing a power exchange – Albanian Power Exchange (ALPEX) together with KOSTT (Kosovo∗ TSO). According to the plan, the operation of ALPEX and market coupling of Kosovo∗ and Albania should go live simultaneously by the end of 2022, however the precondition is the implementation of CACM Guideline and adoption of procedures for nomination of NEMO which has been initiated by ERE.

Albania has competitive balancing market which is operational from April 2021 and is defined by the balancing rules approved by the ERE in 2020, which allow for cross-border trading of balancing services, enabling market-based procurement of balancing services and imbalance price formation. ERE has transposed all three Network Codes on network connections. OST is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation still has been transposed and is to be started with implementation.

The security of supply in Albania is highly vulnerable to unfavourable hydrological conditions and climate impacts as it relays almost exclusively on hydropower for electricity generation which is not

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∗ Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

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sufficient to meet its current and future needs. Immediate diversification of power generation sources away from hydropower is required. This should be done by deploying its vast renewables potential mainly in solar and wind resources. It is also needed to interconnect with neighbouring countries and in set up an integrated regional energy market. It is also needed to resolve the problems with Vlora TPP oil-fired energy generation plant which never put into operation due to technical problems and connect it to TAP with the 40 km natural gas pipeline in order to have stable generation capacity during drought period as well as to serve as a balancing capacity for intermittent sources to be constructed.

The OST has adopted TSO defense plan in case of an emergency situation. System defense plan is connected with an emergency situation and consists of a series of coordinated measures, which aim to guarantee the integrity of the system, in case of the conditions resulting from serious defects.

The security of transmission system operation is maintained in cooperation with Security Coordination Center - SCC (Regional Security Coordinator for SEE), through a contract as a user of the services of SCC headquartered in Belgrade.

In 2017 Albania has established National Authority for Electronic Certification and Cyber Security (NAECCS), which is responsible for cybersecurity of all sectors of the economy, including also energy sector. The NAECCS is set as main national focal point, which acts as cybersecurity regulator and the single Computer Security Incident Response Team (CSIRT). All Critical Information Infrastructure (CII) operators are required by the Law to establish CSIRT teams and then shall be supervised by NAECCS. However, energy-specific CSIRT does not exist in Albania.

4.2.1.1 Electricity HV infrastructure

The Albanian transmission grid is consisted of the high voltage network of 110 kV, 150 kV, 220 kV and 400 kV with a total line length as follows:

Voltage level (kV)	Transmission line length (km)	
400 kV	445,7	
220 kV	1.250	
150 kV	34,4	
110 kV	1.701	
Total	**3.431,1**	
Voltage level - high (kV)	**Number of SS (pieces)**	**Sn (MVA)**
400/x kV	4	2.085
220/x kV	10	2.336
150/110 kV	1	80
Total	**15**	**4.501**

At the moment Albania has cross-border interconnections to three countries (with total 6 interconnection lines) at the moment Montenegro, Kosovo∗ (UNMIK/Serbia) and Greece, with one 400 kV interconnection line under construction towards North Macedonia which is expected to be operational in 2023. Cross-border interconnection capacity accounts for an equivalent of more than 182% of total installed generation capacity.

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[25]

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Zemblak (Albania) – Kardia (Greece)	1350	1215
400	Tirana (Albania) – Podgorica (Montenegro)	1330	1197
400	Tirana (Albania) – Prishtina (Kosovo∗)	1317	1185
220	Fierza (Albania) – Prizren (Kosovo∗)	300	270

[25] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

220	Koplik (Albania) – Podgorica (Montenegro)	300	270
150	Bistrica (Albania) – Myrtos (Greece)	120 - 140	130
400[26]	Elbasan (Albania) – Bitola (N. Macedonia) – under construction	1330	1195

Table 1 - Albanian power interconnection lines (existing and under construction)[27]

The peak load value of Albanian system is reaching 1400 MW, and minimum load value going down to cca. 400 MW[28].

4.2.2 Bosnia and Herzegovina national electricity sector overview

The Bosnia and Herzegovina electricity market is largely state/entity owned and consists of following main participants:

Bosnia and Herzegovina	
Generation	PU ERS - "MH Elektroprivreda Republike Srpske a.d." (EPRS) - on the territory of Republika Srpska PU EPBIH - "JP Elektroprivreda Bosne i Hercegovine - d.d." PU EPHZHB - "JP Elektroprivreda Hrvatske Zajednice Herceg Bosne d.d." - (the two latter on the territory of Federation BiH) EFT RiTE Stanari – largest IPP Priority producers and electricity self-producers
Transmission and Distributors	"Elektroprenos - Elektroprijenos Bosne i Hercegovine" a.d. Banja Luka – TSO ISO BIH - Independent System Operator 5 DSOs in the RS (ZP Elektrokrajina a.d. Banja Luka, ZP Elektro Doboj a.d. Doboj, ZP Elektro Bijeljina a.d. Bijeljina, ZP Elektrodistribucija Pale a.d. Pale, ZP Elektro-Hercegovina a.d. Trebinje) PU EPBIH and PU EPHZHB - DSO in the FBIH Komunalno Brčko - DSO in the Brcko District BIH
Power Market Operator	None performs functions of market operation (ISO BiH administers only a small part of the market)
Regulatory Authority	SERC – State Electricity Regulatory Commission RERS – Regulatory Energy Commission of Republika Srpska FERK - Regulatory Commission for Energy in the Federation of Bosnia and Herzegovina

[26] expected to be in operation in/from 2023

[27] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

[28] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

Ministry or institution for planning and supervision	MOFTER - The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina MIER – The Ministry of Industry, Energy and Mining of Republika Srpska FMERI – Federal Ministry of Energy, Mining and Industry Government of Brcko District of BIH Competition Council of BIH

In contrary to other countries in the region where only one dominant incumbent utility dominates the market, BiH has three vertically integrated utilities that each serve their geographic area. Three public utilities (PU ERS, PU EPBIH and PU EPHZHB) are the most relevant players on the BIHs electricity market. They are majority owned by the respective entities/public shareholders and are in principle state owned energy companies. In Republika Srpska, PU ERS is mixed holding company, as the parent company, has in its composition five companies dealing with generation and five companies for distribution of electricity, also through its affiliated companies ERS performs trade and supply of electricity as well. Generation portfolio is composed of capacities in hydropower plants and thermal power plants (firing coal/lignite from opencast mines). In Federation BiH, PU EPBiH and EPHZHB, as the parent companies, perform generation, trade, supply and distribution functions. Generation portfolio of EPBiH is composed of capacities in hydropower and thermal power plants (firing coal/lignite and black from opencast and deep mines), and of EPHZHB of hydro capacities only which exposes this utility to the risk of climate change. In Brcko District BIH, there are no generation facilities. Distribution and supply of electricity to end consumers is performed by the PU Komunalno Brcko. The three utilities as mentioned generate electricity for wholesale supply and trade, supply of regulated customers and act as major provider of balancing services in BIH. Surpluses are sold on the market; it is worth mentioning that BIH is next exporter of energy and is strong player on the regional free market. In addition, the fourth major player in the market is the 300 MW coal-fired TPP Stanari, an independent power producer owned by the EFT Group.

These power utilities are still not unbundled (except for transmission) from the distribution system operation or wholesale public supply activities, except in Republika Srpska. There unbundling of the distribution system activities was completed but not entirely as distributed generation and functional unbundling are yet to be finalised. Unbundling of the distribution system in PU EPBIH and PU EPHZHB is still not implemented, although relevant provisions are partially transposed in the respective Electricity Law. Komunalno Brčko is exempted of unbundling of the distribution and supply activities as it serves less than 100.000 consumers. In BIH there is no operational short-term market mechanisms, as there is no regulatory framework which transposes the necessary EU Third Energy Package and which would enable creation of power exchange. The retail markets in the two entities are formally open, however three utilities still dominate the retail market. The three utilities (through its functional units that are not separate affiliated companies) act as supplier of all regulated customers, the supplier of last resort for unregulated customers, but also serves as the guaranteed off-taker of electricity produced by most of the privileged renewable IPPs in BIH. The prices and tariffs are still regulated and do not reflect costs. The energy sector is heavily subsidised by direct and indirect subsidies.

Elektroprenos BiH is state/entities-owned electricity transmission system operator of BiH, which performs transmission of electricity, transmission network operation, development planning and maintenance. Elektroprenos is not unbundled in a manner compliant with the EU Third Energy Package.

ISO BiH is state/entities-owned independent electricity system operator of BiH, which performs system operation and balancing. ISO BiH is member of ENTSO-E community and BiHs electricity transmission system is in permanent synchronous operation with the continental European system through SHB control block. Cross-border capacities are allocated through SEE CAO, except split auctions applied with EMS of Serbia. BIH has competitive balancing ancillary services market which is operational from 2016 and is defined by the market rules approved by the SERC, which allow for cross-border trading of balancing services, enabling market-based procurement of balancing services, bilateral exchanges of balancing energy and imbalance price formation. BIHs has transposed all three Network Codes on network connections. ISO BIH is publishing data on the ENTSO-E Transparency Platform, but full implementation requires improvement of the software. The REMIT Regulation still has been transposed and is being implemented.

In order to ensure the security of supply of electricity system in BIH it is needed to consider redirecting the efforts from coal to renewables, following the planned coal fired units shut-down to come (in line with LCPD). Further strong dependency on coal is not in line with the country’s commitments and internationally taken obligations to align with the EU emissions trading system (ETS) and introducing other carbon pricing instruments to promote decarbonisation.

The security of transmission system operation is maintained in cooperation with Security Coordination Center - SCC (Regional Security Coordinator for SEE), as ISO BIH is one of the founders of SCC headquartered in Belgrade.

In BIH there is no national authority, which is responsible for cybersecurity of the energy sector. The cybersecurity developments are more advanced in Republika Srpska than in Federation of BIH where are fragmentary and delayed. There is no common CSIRT structure in BIH, but Republika Srpska has it own from 2015. However, energy-specific CSIRT does not exist nowhere in BIH.

4.2.2.1 Electricity HV infrastructure

The BIH transmission grid is consisted of the high voltage network of 110 kV, 220 kV and 400 kV with following parameters:

Basic Data on the Transmission System

transmission lines

Nominal voltage of transmission lines	Length (km)
400 kV	865.93
220 kV	1,520.09
110 kV	4,037.08
110 kV – cable line	34.66

interconnections

Nominal voltage of transmission lines	Number of interconnectors
400 kV	4
220 kV	10
110 kV	23
Total	*37*

substations

Type of substation	Number of substations	Installed capacity (MVA)
SS 400/x kV	10	5,980.5
SS 220/x kV	8	1,423.0
SS 110/x kV	135	5,662.0

transformers

Transmission ratio of transformers	Number of transformers	Installed capacity (MVA)
TR 400/x kV	14	4,900.0
TR 220/x kV	13	1,950.0
TR 110/x kV	250	6,215.5

Source: SERC Annual Implementation Report

At the moment BIH has cross-border interconnections to three countries (with total 37 interconnection lines) Serbia, Croatia and Montenegro, with one 220 kV interconnection line with Croatia which is radially operated. Cross-border interconnection capacity accounts for an equivalent of around 165% of total installed generation capacity.

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[29]

[29] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Ugljevik (BIH) – S. Mitrovica (Serbia)	1329	1196
400	Ugljevik (BIH) – Ernestinovo (Croatia)	1329	1196
400	Mostar (BIH) – Konjsko (Croatia)	1329	1196
400	Trebinje (BIH) – Lastva (Montenegro)	1329	1196
220	Visegrad (BIH) – Vardiste (Serbia)	301	271
220	Sarajevo 20 (BIH) – Piva (Montenegro)	365	329
220	Trebinje (BIH) – Perucica (Montenegro)	301	271
220	Tuzla (BIH) – Djakovo (Croatia)	301	271
220	Gradacac (BIH) – Djakovo (Croatia)	301	271
220	Prijedor (BIH) – Medjuric (Croatia)	301	271
220	Prijedor (BIH) – TPP Sisak (Croatia)	301	271
220	Mostar (BIH) – Zakucac (Croatia)	301	271
220	Trebinje (BIH) – Plat (Croatia)	491	442
220	Trebinje (BIH) – Dubrovnik G2 (Croatia) - radially operated line	491	442

Table 2 - BIH power interconnection lines (existing)[30]

The peak load value of BIH system is reaching 2000 MW, and minimum load is cca. 700 MW[31].

4.2.3 Croatia national electricity sector overview

The Croatia electricity market is largely state owned and consists of following main participants:

Generation	HEP - Hrvatska Elektroprivreda d.d. Priority producers and electricity self-producers (under the supporting schemes, cca 1400 power plants and 1100 MW in 2020)
Transmission and Distributors	HOPS - Croatian Transmission System Operator HEP-ODS - Croatian DSO
Power Market Operator	HROTE - Croatian Energy Market Operator CROPEX - Croatian Power Exchange
Regulatory Authority	HERA - Croatian Energy Regulatory Agency

[30] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

[31] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

Ministry or institution for planning and supervision	Ministry of Environmental Protection and Energy Ministry of Economy and Sustainable Development Environmental Protection Agency Croatian Competition Authority (CCA)

HEP - Hrvatska Elektroprivreda state - owned energy company is the biggest electricity generation company. HEP currently provides around 80% of total domestic generation and installed capacity. Generation portfolio is composed of capacities in hydropower plants and thermal power plants (firing natural gas or oil in CHP plants). HEP is the only provider of balancing and the largest provider of ancillary services in Croatia.

HEP through its affiliated companies (HEP-Opskrba d.o.o. and HEP ELEKTRA d.o.o.) is still dominant retail supply company. The retail electricity market in Croatia is completely liberalized. These two suppliers held 84% of in the supply of all customers. Electricity prices and tariffs are fully deregulated, including the price of electricity under the universal service but excluding the guaranteed supply.

HEP-ODS provides the public service of electricity distribution and acts as distribution system operator, and is responsible for operation and maintenance of the distribution grid assets. HEP-ODS is functionally unbundled company, as HEP-ODS has decision-making powers independent of the parent company HEP d.d. HEP-ODS carries out procurement of necessary quantities of energy to cover losses in the distribution grid. Incentives for electricity production from renewable energy sources and high efficiency cogeneration are obtained based on a contract concluded with HROTE (the Croatian energy market operator) in line with the regulations on promoting electricity production from renewable sources and cogeneration.

HOPS is state-owned electricity transmission system operator of Croatia, which performs transmission of electricity and transmission system operation, management, development planning and maintenance of the transmission grid assets. HOPS is fully legally and functionally unbundled company from its parent company HEP d.d. Cross-border capacities are allocated through regional auction offices – JAO for borders with Slovenia, Hungary and Serbia, and SEE CAO for the border with Bosnia and Herzegovina – where yearly, monthly and daily auctions are organised. At the border with Slovenia, an implicit capacity allocation regime was established by the coupling of the Croatian and Slovenian day-ahead markets. From 2019, Croatian borders with Slovenia and Hungary are included in the intraday market coupling of EU countries through the XBID project. HOPS is in responsible for bilateral allocation of total intraday capacities in both directions on the border with Bosnia and Herzegovina, while the Serbian transmission system operator (EMS) is in charge of organising intraday allocations on the border with Serbia.

Croatia has operational power exchange – Croatian Power Exchange (CROPEX) together. HOPS is the co-founder of CROPEX with 50% of ownership shares. HROTE is the other co-founder with an equal share in ownership. Day-ahead market coupling was achieved only at the border with Slovenia. The

Croatian and Slovenian day-ahead markets are currently coupled under the IBWT[32], this results in high correlation between the prices on DAM in two countries. Further coupling is expected with Hungary.

Croatia has competitive balancing and ancillary services market which are defined by the relevant market rules, which allow for cross-border trading of balancing services, enabling market-based procurement of balancing services and imbalance price formation. All three Network Codes on network connections are transposed. HOPS is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation is transposed and implemented.

The security of supply in Croatia is highly vulnerable to unfavourable hydrological conditions and climate impacts as well to natural gas and liquid fossil fuels burned in majority if the thermal power plants. Although the supply of electricity from renewable and distributed energy sources (other than hydropower) increased in Croatia in recent years it is needed to continue with deployment in renewable sources, efficient use of interconnection capacities and continue market coupling efforts and in set up an integrated regional energy market.

The HOPS has adopted TSO defense plan in case of an emergency situation. System defense plan is connected with an emergency situation and consists of a series of coordinated measures, which aim to guarantee the integrity of the system, in case of the conditions resulting from serious defects. The security of transmission system operation is maintained in cooperation with TSCNET Services (Regional Security Coordinator for the TSOs in Central and South Eastern Europe.

Croatia has adopted Cyber Security Act and the National Cybersecurity Strategy and Action Plan for the Implementation of the Strategy, which is aimed in protection of cybersecurity of all sectors of the economy, including also energy sector. The Office of the National Security Council – UVNS was appointed as single national point of contact and Computer Security Incident Response Team (CSIRT) was nominated - Information Systems Security Bureau – ZSIS and the National CERT (computer emergency response team).

4.2.3.1 Electricity HV infrastructure

The Croatian transmission grid is consisted of the high voltage network of 110 kV, 220 kV and 400 kV with following parameters:

Voltage level (kV)	Transmission line length (km)
400 kV	1.246
220 kV	1.268
110 kV	5.254
MV	11

[32] Italian Borders Working Table – an initiative which aims to implement day-ahead market coupling; Croatia is included via the border with Slovenia.

Total		**7.779**	
Voltage level - high (kV)	**Number SS (pieces)**	**Number transformers (pieces)**	**Sn (MVA)**
400/x kV	6	13	4.400
220/x kV	15	25	3.770
110/x kV	165	297	9.876
Total	**186**	**335**	**18.046**

At the moment Croatia has cross-border interconnections to four countries (with total 33 interconnection lines) Bosnia and Herzegovina, Serbia, Slovenia and Hungary, with one 220 kV interconnection line with BIH which is radially operated. There is total seven 400 kV, eight 220 kV and eighteen 110 kV interconnection lines. Cross-border interconnection capacity accounts for an equivalent of around 185% of total installed generation capacity.

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[33]

[33] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Ernestinovo (Croatia) – Ugljevik (BIH)	1329	1196
400	Konjsko (Croatia) – Mostar (BIH)	1329	1196
400	Ernestinovo (Croatia) – Sremska Mitrovica 2 (Serbia)	1329	1196
2x400	Zerjavinec (Croatia) –Hévíz (Hungary)	-	IMPORT[34]++ 2.000 EXPORT 2.000
2x400	Ernestinovo (Croatia) – Pecs (Hungary)	-	
400	Melina (Croatia) – Divaca (Slovenia)	-	IMPORT++ 1.600 EXPORT 1.600
2x400	Tumbri (Croatia) – Krsko (Slovenia)	-	
220	Pehlin (Croatia) – Divaca (Slovenia)	-	
220	Zerjavinec (Croatia) – Cirkovce (Slovenia)	-	
220	Djakovo (Croatia) – Tuzla (BIH)	301	271
220	Djakovo (Croatia) – Gradacac (BIH)	301	271
220	Medjuric (Croatia) – Prijedor (BIH)	301	271
220	TPP Sisak (Croatia) – Prijedor (BIH)	301	271
220	Zakucac (Croatia) – Mostar (BIH)	301	271
220	Plat (Croatia) – Trebinje (BIH)	491	442
220	Dubrovnik G2 (Croatia) – Trebinje (BIH) - radially operated line	491	442

Table 3 - Croatia power interconnection lines (existing)[35]

na – not available for the moment to be further investigated

The peak load value of Croatia system is reaching cca 3200 MW, and minimum load is cca. 1100 MW.

[34]Import and export cross-border capacity taken from Regional Investment Plan 2020 Continental South East (note marked ++) https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2020/Foropinion/RegIP2020_CSE.pdf

[35] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

4.2.4 Greece national electricity sector overview

The electricity market in Greece consists of following main participants:

Greece	
Generation	Public Power Corporation S.A. (PPC), Heron S.A., MYTILINEOS S.A., ELPEDISON S.A., NRG, ATTIKI GSC, VOLTERRA, WATT AND VOLT, ZENITH, VOLTON Priority/privileged producers (under the supporting schemes) and electricity self-producers
Transmission and Distributors	IPTO - Independent Power Transmission Operator (ADMIE) Hellenic Electricity Distribution Network Operator SA (HEDNO)
Power Market Operator	LAGIE - Hellenic Electricity Market Operator (HEDMO) Hellenic Energy Exchange S.A. (HEnEx) – NEMO Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP S.A.)
Regulatory Authority	Regulatory Authority for Energy (RAE)
Ministry or institution for planning and supervision	Ministry of Environment, Energy and Climate Change Hellenic Competition Commission (HCC)

Like in almost all EUSAIR countries, in Greece as well the vertically integrated state-owned electricity company Public Power Corporation S.A. (PPC) is dominant player the electricity sector, both generation and wholesale. It accounts for more than 70% of all installed capacities and over 60% of generation in the country. PPCs generation portfolio is mainly consisted of large lignite and hydro assets. Other large private generators – IPPs are only engaged in gas-fired generation and renewables. PPC is planning large-scale decommissioning of lignite fired power plants, which will shut-down 55% of lignite units by 2030, in line with EU air pollution requirements. PPC maintains the dominant share on the retail market. The distribution part of PPC was unbundled into a new independent company in 2012, called the Hellenic Electricity Distribution Network Operator SA (HEDNO).

HEDNO is electricity distribution company. HEDNO is in charge of operation, maintenance and distribution grid development. In addition, HEDNO is also the system and market operator of the non-interconnected islands (NIIs), and is a 100% subsidiary of PPC.

Greece electricity market has been fully liberalised from 2013, including different factors as supply and demand, generation, transmission, and distribution. Despite full market liberalisation, some regulation continues to exist under PSOs, like supplier of last resort and the universal service supplier. The supplier of last resort provides a temporary supply to customers who lost their previous supplier for reasons that were not their fault. These contracts are limited to three months. Under the universal service obligation, regulated tariffs are offered to customers that either have not chosen a supplier of their own or are unable to conclude a new contract due to their poor payment record. The PSO programme includes vulnerable consumers benefiting from social tariffs and consumers on the NIIs.

Renewable Energy Sources Operator & Guarantees of Origin (DAPEEP S.A.) is responsible for renewable Energy Markets of Greece's National Interconnected System (Transmission System and

Distribution Network of Mainland and Interconnected Islands) and manages the Guarantees of Origin (GOs) of electricity from RES and Combined Heat and Power Units (CHP).

IPTO - Independent Power Transmission Operator (ADMIE) is state-owned electricity transmission system operator of Greece. IPTO owns and operates Greek transmission grid and is responsible for operation, control, maintenance and development to ensure the country's supply with electricity in an adequate, safe, efficient and reliable manner, as well as the operation of the electricity market for transactions and performs central dispatching of the electricity loads. IPTO is member of ENTSO-E community and Greece electricity transmission system is in permanent synchronous operation with the continental European system. IPTO, as of 2019 is fully legally and functionally unbundled company. Cross-border capacities are allocated through SEE CAO on the borders with Albania, N. Macedonia and Turkey, while IPTO uses JAO for allocation of capacities on the border with Italy and Bulgaria.

Greece has established its own power exchange in 2018 called - Hellenic Energy Exchange S.A. (HEnEx). HEnEx has been designated by the Greek Regulatory Authority for Energy as the Nominated Electricity Market Operator (NEMO) and is operating the Greek day-ahead market, while working on the creation of an intraday electricity market and an energy derivatives market, but it is also responsible for organising and operating gas and environmental markets. HEnEx is full member of the Price Coupling of Regions (PCR) initiative and is working towards the EU's target model and coupling its market with neighbouring countries.

Greece has competitive balancing market and also participates on the European IGCC platform for the imbalance netting process since June 2021, while it is an active member in the implementation projects regarding the establishment of the European platforms MARI and PICASSO for the exchange of balancing energy from manual and automatic frequency restoration reserves[36]. Greece has transposed all three Network Codes on network connections. IPTO is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation has been transposed and implemented.

For many years the production of lignite is considered significant for the Greek's energy security, as lignite is the only domestic fossil fuel resource in Greece. Following the PPC announced a large-scale decommissioning schedule until 2030, Greece may find itself in serious security of supply challenges due to the combined retirement of about 3000 MW of old lignite plants. Security of electricity supply cannot be guaranteed, notably during extreme weather situations as Greek power market has limited flexibility. Greece is especially exposed to risk of limited flexibility considering its large investment in gas-fired capacity in previous period due to the potential effect which gas supply shortages can have on electricity supply security. Therefore, it is needed to carefully asses the 2030 supply-demand outlook and to take into account all possibilities to improve security of electricity supply. Key considerations should be further integration of renewable energy sources (which has been advancing in satisfactory manner in last few years), increasing transfer capacities with neighbouring countries towards market coupling, storage capacities, flexible hydro plants and demand response options.

[36] https://www.admie.gr/en/market/general/description

The security of the Greek transmission system operation is maintained by the Regional Security Coordinator in Thessaloniki, (SEleNe CC). SEleNe CC was established by the TSOs of Greece (IPTO), Italy (TERNA SpA), Romania (Transelectrica) and Bulgaria (ESO-EAD).

Greece has transposed NIS Directive. Greece has established National Cyber Security Authority (General Secretariat of Telecommunications and Post - Ministry of Digital Governance) which serves as single point of contact, national competent authority for DSPs and for OES. National CSIRT is Hellenic Cyber Security Incident Response Team (CSIRT).

4.2.4.1 Electricity HV infrastructure

The Greek transmission grid is consisted of the high voltage network of 66 kV, 150 kV and 400 kV with following parameters[37]:

Voltage level (kV)	Transmission line length (km)	
400 kV	2.898,85	
150 kV	10.162,3	
66 kV	114,04	
Total	**13.175,19**	
Voltage level - high (kV)	**Number SS and switchgear plants (pieces)**	**Sn (MVA)**
400/x kV	84	24.643
150/x kV	765	36.637,81
66/x kV	3	75
Total	**852**	**61.355,81**

Greece has cross-border interconnections in five directions (with total 7 interconnection lines) towards Italy, Bulgaria, N. Macedonia, Albania and Turkey. There is total six 400 kV (one 400 kV is DC) and one 150 kV interconnection line.

[37] https://www.admie.gr/sites/default/files/attached-files/type-file/2022/06/performance-report-2021.pdf

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[38]

38 Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Kardia (Greece) – Zemblak (Albania)	1350 (1100-1400)39++	1215
400	Melita (Greece) – Bitola 2 (N. Macedonia)	860 (1100-1400)++	774
400	Thessalonica (Greece) – Dubrovo (N. Macedonia)	860 (1100-1400) ++	774
400	Thessalonica (Greece) – Blagoevgrad (Bulgaria)	1100-1400++	na
400	Nea Santa (Greece) – Babaeski (Turkey)	1600-2000++	na
400 (dc)	Arachthou (Greece) – Galatina (Italy)	-	500
150	Myrtos (Greece) – Bistrica (Albania)	120 - 140	130

Table 4 - Greece power interconnection lines (existing)[40]

na – not available

The peak load value of Greece power system is reaching 10 GW.

4.2.5 Italian national electricity sector overview

The electricity market in Italy consists of following participants:

Italy	
Generation	Enel, Eni, Edison, A2A, EPH (the generators with 5% of capacity and above) Large number IPPs and priority/priviliged producers and electricity self-producers
Transmission and Distributors	Terna - Rete Elettrica Nazionale SpA + additional with negligible share less than 0,5% transmission system infrastructure (Megareti, Edyna Transmission, Arvedi Trasmissione, Seasm, El.It.E., Nord Energia and Eneco Valcanale) 126 DSOs in total, of which 10 serve more than 100,000 customers. Four of them serve at least 500,000 delivery points: e-distribuzione (Enel group), Unareti (A2A group), Areti (Acea group) and Ireti (Iren group).
Power Market Operator	GME - Gestore dei Mercati Energetici S.p.A (Italian Power Exchange - IPEX) Gestore dei Servizi Energetici S.p.A. (GSE)

[39] Note marked ++ available at: https://www.admie.gr/sites/default/files/attached-files/type-file/2022/06/performance-report-2021.pdf

[40] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

Regulatory Authority	RegulatoryAuthority for Energy, Networks and the Environment (ARERA - Autorità di Regolazione per Energia Reti e Ambiente)
Ministry or institution for planning and supervision	Ministero dell'Ambiente e della Sicurezza energetica Ministero dell'Economia e delle Finanze (Ministry of Economic Affairs and Finance) Ministero dello Sviluppo Economico (Ministry of Economic Development) National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) Italian Competition Authority (AGCM)

The Italian electricity sector is characterized with large number of producers including different IPPs and recent years large number of RES privileged producers and self-consumers. In 2019 the total net installed power was above 110 GW, which is divided between 48% thermal power plants and 52% renewable. However, in Italy there are five dominant generation companies/groups with a net installed capacity share of more than 5%: Enel (cca 16%), Eni (9%), Edison (7 %), A2A (6%) and EPH (cca 5%). The share of gross generation of the top three corporate groups (Enel, Eni and Edison), covers between 30-35% of all domestic generation. The two remaining generators from top five A2A and EPH, participate in the country's gross generation with around 5% together. In 2020 the total net power was 116.4 GW (provisional figure), which is divided between 48% renewable and 52% thermoelectric.

Although the market is fully liberalized and unbundled some companies like Enel group, beside generation are dominant, as a legacy of its previous incumbent status, and present all across the electricity market value chain, wholesale, retail and distribution business.

As mentioned on the retail electricity market, the Enel group remains the dominant operator in the entire Italian electricity market. Albeit this share that has been declining slightly in last few years, Enel still holds around 35% of the retail market. The second supplier Edison Group which holds second position for years, was present on the market with an overall share of 6% in 2020. Other respectable suppliers like (Hera Group, A2A, Axpo, Eni group, Acea, Duferco, Alperia, Engie group, Iren, Green Network and CVA) remain far behind Enel in the overall market shares.

The electricity distribution grid in Italy in 2020 was owned/split between 126 distribution system operators (DSOs), which operate on the basis of concessions granted by the Ministry of Economic Development and the Provinces of Trento and Bolzano (64). These operators differ greatly as a result of the size of the territory served, only 10 serves more than 100.000 customers. However, four main DSOs deliver most of the electricity and they operate more than 500,000 delivery points: e-distribuzione (Enel group), Unareti (A2A group), Areti (Acea group) and Ireti (Iren group). All of them have been obliged to change their names in 2016 to comply with the provisions on functional unbundling, which obliged distribution companies belonging to a vertically integrated corporate group, to distinguish themselves from other group companies in terms of identity, brand and communication policies.

Terna S.p.A. fulfils the role of national transmission system operator TSO and ISO under government concession. Terna's tasks include managing the high and very high voltage network, maintaining network infrastructure, planning for network development and construction, and dispatching, namely managing flows of electricity on the network, ensuring system balance. Beside Terna, in 2020 there was additional 10 companies that own assets of the National Transmission Grid (NTG), but there share in the transmission infrastructure assets was less than 0,5%.

Gestore dei Servizi Energetici S.p.A. (GSE) is company owned entirely by the Ministry of Economic Affairs and Finance and carries out its activities in accordance with the guidelines given by the Ministry of Economic Development, GSE is responsible for managing and monitoring the support mechanisms for renewable energies in all sectors and energy efficiency. The GSE group is made up of the companies Ricerca sul Sistema Energetico S.p.A. (RSE), Gestore dei Mercati Energetici S.p.A. (GME - the Italian energy market operator) and Acquirente Unico S.p.A. (AU). RSE is a company specialising in analysis, study and applied research covering the entire energy sector, with a particular focus on national strategic projects of general public interest, financed by the system research fund and international funding. AU performs the function of guaranteeing the supply of electricity to customers in the protected market, and manages a consumer help desk for providing support to end electricity and gas customers.

GME is responsible for the economic organisation and management of the electricity market, environmental markets, natural gas and fuels in accordance with neutrality, transparency and objectivity criteria, and also manages the platform for registering fixed-term energy trade agreements concluded outside of the market. GME manages the electricity markets, Day Ahead Market, Intra-day Market, Daily Products Market, Forward Electricity Market and collects bids on the Dispatching Services Market/platform for ancillary services managed by Terna. GME has been nominated as NEMO for the DAM and IDM in Italy. GME is also a founding member of PCR, the Price Coupling of Regions project launched by the major European PXs to provide a technical solution for the coupling of EU DAM, subsequently integrated within the Single Day-ahead Coupling (SDAC) activities. GME is also a founding member of the XBID project for the delivery of an intraday continuous trading solution for the coupling of intraday EU markets which is now integrated within the Single Intra-Day Coupling (SIDC).

Italy has competitive balancing market and participates on the European balancing market, which allows for cross-border trading of balancing services, enabling market-based procurement of balancing services and imbalance price formation. With regard to trade in balancing capacity and balancing energy Italy has adopted relevant criteria for the harmonisation of settlement mechanisms between TSOs and the criteria for calculating the value of imbalances. All three group of Network Codes on network are transposed and implemented. TERNA is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation has been transposed and implemented.

It should be noted that electricity demand in Italy has been stable for some time. However, the recent energy crises; followed by lower gas imports from Russia; shut-down of coal capacities by 2025; and shift in governmental policies towards promotion of electrification in transport, heating and industry; climate change causes a lot of reasons for to increase the electricity supply security. It is expected in the near future that to the rising electricity demand, which will most likely outpace the growth in electricity generation, increase Italy's reliance on imports of electricity. It is planned that increased demand will be covered by additional variable renewables capacity (in order to comply with the EU's Fit-for-55 package, and meet its own long-term decarbonisation goals), what will again cause serious concerns about generation availability given the relatively high share of variable renewable sources in total installed generation capacity. Therefore, it is necessary to significantly improve planning and investment in the grid, increase of the interconnection capacities, introduce innovative market mechanisms, as well as balancing and storage capacities.

The security of transmission system operation for the Italy North and Greece-Italy regions are maintained in cooperation with Regional Security Coordinator (RSC), namely Coreso and TSCNET in rotation for the Italy North region and SEleNe CC for the Greece-Italy region (Terna is a direct shareholder of Coreso and SEleNe CC).

Italy has transposed the NIS Directive. The nominated single point of contact is the National Cybersecurity Agency (ACN) - CSIRT. Terna has a dedicated unit, Computer Emergency Readiness Team (TERNA-CERT) to respond in case of cybersecurity threats, which would coordinate all activities in case of a cyber-attack on the electricity system. However, appropriate procedures how to respond to potential cyber-attacks and comprehensive risk assessment on the vulnerability of the electricity system to cyber-attacks has not been carried out.

4.2.5.1 Electricity HV infrastructure

The Italian transmission grid is consisted of the high voltage network of 150 kV, 220 kV, 380 kV and 500 kV with following parameters:

Voltage level (kV)	Length of circuits (km)	Transmission line length (km)
380 kV	12.873	11.692
220 kV	11.852	9.487
≤ 150kV	50.130	46.876
Total	**74.855**	**68.055**
Overhead	**70.849**	**64.048**
Underground cables	**2.244**	**2.244**
Submarine cables	**1.762**	**1.762**
DC connections (200 - 400 - 500kV)	2.440	2.120

Table 5 - Details of electricity power lines owned by the Terna Group[41]

Voltage level - high (kV)	Number SS (pieces)	Sn (MVA)
380/x kV	167	121.408

[41] Terna Annual Report – Integrated Report 2021, available at: https://download.terna.it/terna/Terna_2021_Integrated_Report_8da18ab57d1d0e4.pdf

220/x kV	150	33.710
≤ 150/x kV	579	4.388
Total	**896**	**159.506**

Table 6 - Details of electricity substations owned by the Terna Group

Source: ©IEA 2022 - Italy's electricity infrastructure, 2022. Available at https://www.iea.org/articles/italy-electricity-security-policy, last accessed at 15/11/2022.

Italy has cross-border interconnections to seven countries, with Switzerland, France, Austria, Slovenia, at the country's northern border and Greece, Malta, and Montenegro on the southern border. Cross-border interconnection capacity accounts for an equivalent of about 10% of total installed generation capacity[42]. There total four lines with France, twelve with Switzerland, two with Austria, two with Slovenia and one with each Montenegro, Malta and Greece. Cross-border interconnection capacity accounts for an equivalent of around 10% of total installed generation capacity.

<table>
<tr><th>Voltage level (kV)</th><th>Interconnection line</th><th>Pn (MW)</th></tr>
<tr><td>500 (dc)</td><td>Villanova (Italy) – Lastva (Montenegro)</td><td>600</td></tr>
<tr><td>400 (dc)</td><td>Galatina (Italy) – Arachthou (Greece)</td><td>500</td></tr>
<tr><td>380</td><td>Redipuglia (Italy) – Divaccia (Slovenia)</td><td rowspan="2">IMPORT
Winter: 730
Summer: 515
EXPORT
Winter: 660
Summer: 620</td></tr>
<tr><td>220</td><td>Padriciano (Italy) – Divaccia (Slovenia)</td></tr>
<tr><td>220</td><td>Soverzene (Italy) – Lienz (Austria)</td><td rowspan="2">IMPORT
Winter: 315
Summer: 270
EXPORT
Winter: 100
Summer: 80</td></tr>
<tr><td>132</td><td>Tarvisio (Italy) – Greuth (Austria)</td></tr>
<tr><td>380</td><td>Cagno (Italy) – Mendrisio (Switzerland)</td><td rowspan="12">IMPORT
Winter: 4.240
Summer: 3.420
EXPORT
Winter: 1.810
Summer: 1.440</td></tr>
<tr><td>380</td><td>Musignano (Italy) – Lavorgo (Switzerland)</td></tr>
<tr><td>380</td><td>Bulciago (Italy) – Soazza (Switzerland)</td></tr>
<tr><td>220</td><td>Pallanzeno (Italy) – Serra (Switzerland)</td></tr>
<tr><td>220</td><td>Ponte (Italy) – Provenance (Switzerland)</td></tr>
<tr><td>220</td><td>Valpelline(Italy) – Riddes (Switzerland)</td></tr>
<tr><td>220</td><td>Avise (Italy) – Riddes (Switzerland)</td></tr>
<tr><td>220</td><td>Mese (Italy) – Gorduno (Switzerland)</td></tr>
<tr><td>220</td><td>Gorlago (Italy) – Robbia (Switzerland)</td></tr>
<tr><td>220</td><td>S. Fiorano (Italy) – Robbia (Switzerland)</td></tr>
<tr><td>150</td><td>Tirano (*)(Italy) – Campocologn (Switzerland)</td></tr>
<tr><td>132</td><td>Villa di Tirano(Italy) – Campocologn (Switzerland)</td></tr>
</table>

[42] https://www.iea.org/articles/italy-electricity-security-policy

<table>
<tr><td>2x380</td><td>Rondissone (Italy) – Albertville (France)</td><td rowspan="5">IMPORT
Winter: 4.350
Summer: 3.900
EXPORT
Winter: 1.995
Summer: 1.870</td></tr>
<tr><td>380</td><td>Venaus (Italy) – Villarodin (France)</td></tr>
<tr><td>220</td><td>Camporosso (Italy) – Trinité Victor (France)</td></tr>
<tr><td>150</td><td>SACOI2 (Sardinia–Corsica–Italy): Santa Teresa Gallura (Italy) – Bonifacio (France)</td></tr>
<tr><td>200</td><td>SACOI2 (Sardinia–Corsica–Italy): Codrongianos (Italy) – Lucciana (France)</td></tr>
<tr><td>220</td><td>Ragusa (Italy) – Maghtab Malta</td><td>200</td></tr>
<tr><td>2x400(dc)</td><td>Piossasco (Italy) – Grande Ile (France) – Under construction</td><td>1200</td></tr>
<tr><td>220</td><td>Glorenza (Italy) – Nauders (Austria) – Under construction</td><td>300</td></tr>
</table>

Table 7 - Italy power interconnection lines (existing and under construction)[43]

na – not available

The peak load value of Italy power system is between 55 - 60 GW, absolute record reached 60.5 GW in 2015.

4.2.6 Montenegro national electricity sector overview

The Montenegro electricity market is largely state owned and consists of following main participants:

Montenegro	
Generation	EPCG - Elektroprivreda Crne Gore Priority/privileged producers (under the supporting schemes) and electricity self-producers
Transmission and Distributors	CGES - Crnogorski Elektroprenosni Sistem AD (TSO) CEDIS - Crnogorski Elektrodistributivni Sistem (DSO)
Power Market Operator	COTEE - Electricity Market Operator of Montenegro BELEN - Montenegro Power Exchange
Regulatory Authority	REGAGEN - The Energy and Water Regulatory Agency of Montenegro
Ministry or institution for planning and supervision	MoCI - Ministry of Capital Investments (Directorate of Energy and Energy Efficiency) Agency for Competition Protection (ACP)

EPCG is state - owned energy company dominant/only electricity generation company in the country besides the privileged and electricity self-producers. HEP currently holds more than 80% of total

[43] Source: Terna https://www.arera.it/it/dati/eemtras.htm

installed capacity and more than 85% of domestic generation. EPCG generation portfolio us is composed of two large hydropower plants, several SHHPs and one coal fired thermal power plant. The TPP is constantly in operation, currently under environmental rehabilitation FGD plant is being built (although the period for opt-out declared earlier in line with LCPD has been expired) what will extend it further operation. EPCG is the only provider of balancing service in Montenegro.

CEDIS is Montenegrin electricity distribution company, which is responsible for operation and maintenance of the distribution grid assets. Although CEDIS is owned by EPCG as a parent company, unbundling process is finalized in line with the EU acquis. Despite the fact that the both wholesale and retail electricity markets are formally liberalised and all customers are eligible to choose their supplier, EPCG market concentration remains very high with the incumbent covering the whole retail market. EPCG also acts as the universal supplier as well as the electricity supplier of last resort, as well as vulnerable customers.

CGES is state-owned electricity transmission system operator, which performs transmission of electricity, transmission network operation, development planning and maintenance and central dispatching of the electricity loads. CGES is legally and functionally unbundled company in line with EU Third Energy Package. Cross-border capacities on all borders with are allocated through SEECAO, while on border with Serbia joint auctions are performed in an annual, monthly, daily, and intra-day level. The Electricity Market Operator of Montenegro - COTEE was formally established in 2010 and is responsible for organising and managing the electricity and electricity balance market in Montenegro. In addition, COTEE acts as a single buyer for supported renewable energy and an issuing body for Guarantees of Origin. BELEN national power exchange has been established. BELEN has signed service agreement for the implementation of the day-ahead trading, clearing and settlement platform services to a consortium of EPEX SPOT and BSP. Montenegro is participating in a market coupling project with

Albania, Italy and Serbia (AIMS), which has been stalled for years.

Montenegro has competitive balancing services market. The balancing reserve price is determined by the regulator until sufficient competition is in place. The price of balancing energy is not regulated. Also, market-based cross-border exchange of balancing energy is implemented for the time being only with the TSOs of Serbia and Bosnia and Herzegovina on a bilateral basis. Network Codes on network connections are transposed. The Transparency Regulation is transposed but its implementation is still to be fully completed. The REMIT Regulation has been transposed and implemented.

The security of supply in Montenegro is highly vulnerable to unfavourable hydrological conditions and climate impacts as it relays almost exclusively on hydropower for electricity generation which is not sufficient to meet its current and future needs. Immediate and strong diversification of power generation sources away from hydropower is required. Although, there are some activities recently in renewables (solar and wind), these have to be intensified together with investment in new resources to provide flexibility and balancing capacity for intermittent sources to be built.

In Montenegro the Law on Information Security partially transposes the NIS Directive, and identification of critical infrastructure in the energy sector is in place. CIRT-ME is established as a unit within the National Security Authority operating under the Ministry of Public Administration, as the main contact point which provides cybersecurity services and coordinates assistance in case of cybersecurity incidents.

4.2.6.1 Electricity HV infrastructure

The Montenegrin transmission grid is consisted of the high voltage network of 110 kV, 220 kV, 400 kV and 500 kV with following parameters:

Voltage level (kV)	Number of lines	Transmission line length (km)
400 kV	6	355,3
220 kV	8	338
110 kV	42	723,37
Total	**56**	**1.416,67**
Voltage level - high (kV)	**Number SS (pieces)**	**Sn (MVA)**
400/x kV	4	2.335
220/x kV	2	616
110/x kV	19	1.215,6
Total	**25**	**4.166.6**

Considering its size Montenegro is very well connected to neighbouring systems and has cross-border interconnections in five directions (with total 12 interconnection lines) towards Italy, Bosnia and Herzegovina, Serbia, Albania and Kosovo∗. There is total three 400 kV, one 500 kV (HVDC), five 220 kV and three 110 kV interconnection lines. Cross-border interconnection capacity accounts for an equivalent of more than 540% of total installed generation capacity.

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[44]

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
500	Lastva (Montenegro) – Villanova (Italy)	-	600
400	Lastva (Montenegro) – Trebinje (BIH)	1329	1196
400	Ribarevina (Montenegro) – Pec 3 (Kosovo∗)	1317	1185
400	Podgorica (Montenegro) – Tirana2 (Albania)	1330	1197
220	Piva (Montenegro) – Sarajevo 20 (BIH)	365	329
220	Perucica (Montenegro) – Trebinje (BIH)	301	271
220	Podgorica (Montenegro) – Koplik (Albania)	300	270
220	Pljevlja (Montenegro) – Bajina Basta (Serbia)	274	247
220	Pljevlja (Montenegro) – Pozega (Serbia)	274	247

Table 8 - Montenegro power interconnection lines (existing)[45]

[44] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

[45] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

The peak load value of Montenegro system is reaching cca 700 MW, and minimum load is cca. 230 MW.

4.2.7 North Macedonia national electricity sector overview

The electricity market in N. Macedonia is largely state owned and consists of following main participants:

North Macedonia	
Generation	ESM - Elektrani na Severna Makedonija (JSC Power Plants of North Macedonia) IPPs - AD TEC Negotino, TE – TO Skopje, EVN Makedonija Elektrani Priority/privileged producers (under the supporting schemes) and electricity self-producers
Transmission and Distributors	MEPSO - Transmission System Operator of the Republic of North Macedonia Elektrodistribucija DOOEL Skopje and AD ESM Skopje - DSO
Power Market Operator	MEMO - National Electricity Market Operator
Regulatory Authority	ERC - Energy and Water Services Regulatory Commission of Republic of North Macedonia
Ministry or institution for planning and supervision	MoE - Ministry of Economy – Energy Department EA - Energy Agency of North Macedonia CPC - Commission for Protection of Competition

State-owned AD ESM Skopje is the largest electricity producer in the North Macedonia. It is followed by IPPs: AD TE – TO Skopje (natural gas CCPP), AD TEC Negotino (fuel oil TPP)[46] and EVN Makedonija Elektrani (small RES plants) which managed power plants with installed capacity higher than 10 MW. ESM power generation portfolio mainly relies on lignite and hydropower. ESM has significant operational problems with coal fired units, and is planning gradual phase-out of coal fired units till 2027. Phase-out of coal fired units according to the Energy development strategy initially was planned until 2027. Due to the latest developments and energy crisis, the phase out was postponed to 2030. However, ESM needs to improve the operation and maintenance of existing old generation fleet before sufficient replacement capacity is built. ESM is a generation company and it is unbundled from other market activities. Although ESM performs function of DSO in two municipalities (100,000 users are connected) on the area of the industrial complex of former steel plant “Rudnici i Zelezarnica – Skopje”,

[46] TEC Negotino with 210 MW installed capacity, is supplied by liquid fossil fuel (heavy fuel oil), but has not been operational for the past 10 years, and served as a “cold reserve”. It was put into operation at the end of 2021 and in 2022, due to the energy crisis.

these activities are done through separate functional unit where ESM is parent company. ESM acts as dominant provider of balancing and ancillary services in N. Macedonia.

Elektrodistribucija DOOEL Skopje is a sole legal entity, established by the EVN Makedonija AD Skopje to perform the activity of electricity distribution, and does not possess a license for performing energy activities referring to production, transmission, organization and governance of the Electricity Market, the trade and/or supply of electricity. Elektrodistribucija is responsible for operation and maintenance of the distribution grid assets. They take the electricity from the transmission system operator and through the distribution network system they distribute it to the final consumers.

Elektrodistribucija's unbundling process is finalized in line with the EU acquis. Electricity market is fully liberalised. Both wholesale market, and also the retail market in North Macedonia underwent a complete transformation, that is, became a fully liberalised market. The full liberalization of the retail market began in 2019, making each customer eligible to choose its own electricity supplier, and to arrange mutual terms on supply and price of electricity. The market liberalization for the industry began in 2007 and was finished in 2019. The regulated energy activity, the universal supplier as well as the electricity supplier of last resort, stayed in accordance with the Third Package, in order to ensure protection of small customers and households when they fail to choose a supplier on the free market or when, due to some circumstances, they remain without electricity supplier. The retail prices are deregulated, except for the universal services which are approved by ERC (prices for transmission and distribution of electricity and organization of the electricity market). The price for the supplier of last resort is based on the HUPX reference market. EVN HOME DOO Skopje is the strongest player the wholesale electricity market, performing the activity of electricity supply, to whom obligations for providing the universal service are prescribed in the license. EVN HOME DOO Skopje is a universal electricity supplier and electricity supplier of the last resort.

MEPSO is state-owned electricity transmission system operator, which performs transmission of electricity, transmission network operation, development planning and maintenance and central dispatching of the electricity loads. MEPSO is legally and functionally unbundled company in line with EU Third Energy Package. The ownership of MEPSO was transferred to the Ministry of Transport and Communications. Cross-border capacities on the borders with Greece and Kosovo∗ are allocated through SEECAO, while on border with Serbia and Bulgaria joint auctions are performed in an annual, monthly, daily, and intra-day level.

MEMO was established in 2018 and acts as separate legal entity owned by MEPSO. From 2020 MEMO acts as NEMO and in the meantime, it conducted a tender for a service provider of the trading platform for the day-ahead market coupling.

The measure represents an increase in the competitiveness of the electricity market, as it implies the day-ahead coupling of the electricity markets between North Macedonia and Bulgaria.

At the moment, all procedures for this measure have been completed and the online test period has begun.

The tender for the procurement of the software required to make the coupling work has been completed and installed in the organized market operator MEMO. The trial period of work is in progress. Due to difficulties in applying the CACM regulation between an EU member state and a non-member state, MEMO joined the SDAC (Single day ahead coupling) as an observer member. Therefore, this trial period may last until a solution is found at the state level to regulate the sales tax.

An amendment was made to the Law on Energy, which was adopted in the Parliament, the market rules for an organized market were drawn up, the training process is ongoing, but until a solution is found for what I mentioned earlier, the work mode will be trial. After that, a regular mode of operation will occur between the two electricity exchanges, when we expect a larger and smoother flow of energy between the two countries.

This is expected to happen at any moment, but no later than spring 2023 and there is ongoing live mode between MEMO and IBEX. At the moment there is need of changes of Law of VAT. Therefore, MEMO is continuing its efforts to establish DAM and couple with Bulgaria after years of delay. In addition, MEMO is obligated to purchase the total of electricity produced by the privileged producers and takes over balancing responsibility for these producers.

N. Macedonia has competitive balancing services market. The prices of these services are procured on the market, albeit only with two registered balancing service providers. In N. Macedonia Network Codes on network connections are still not effectively implemented. The Transparency Regulation is transposed but its implementation is still to be completed. The REMIT Regulation was transposed with the latest amendments of the Energy Law, adopted in November 2022 (OG 96/18, 96/19 and 236/22).

North Macedonia's power generation mainly relies on lignite and hydropower and is dependent on electricity imports. Due to operational problems with coal fired units and dependency on hydrological conditions, North Macedonia relies on electricity imports supported by a number of interconnection lines towards all of their neighbours except Albania (what should be changed after the on-going construction of the interconnection Bitola - Elbasan). Generation development plans in North Macedonia are mostly related to the integration of renewables (WPPs, SPPs and HPPs) and gradual phase-out of coal fired units till 2030. The on-going energy crisis created a pressure on the prices of electricity, making the RES favourable for investment. For North Macedonia, in 2021 and 2022 there were a lot of investments in photovoltaic power plants, (the government issued 3 public bids for premium tariff for total of 142 MW built on land, the private sector is investing in rooftop installations for own production, and also the concept of prosumers is becoming attractive both for SMEs and households, since the last regulatory changes enabled the purchase of extra electricity to be done by the universal supplier EVN Home). There are multiple on-going wind power projects, but they will take a lot of time to be constructed and put into operations, since only the obligatory wind measurements are being done for 2 years, and the overall administrative procedure is lengthier compared to the one for photovoltaics. Although, there are activities redirecting the efforts from coal to renewables (solar and wind), these have to be intensified together with investment in new resources. Considering the difficult situation in N. Macedonian power system caused by the current energy crises, on the short-term it is necessary to assess the quantity of coal needed to ensure the good functioning of the Bitola thermal power plant. It is needed to invest in further electricity infrastructure, storage/balancing plants (like Cebren HPP) and work on energy efficiency and demand-response solutions.

N. Macedonia has not transposed the NIS Directive, which should be done through adoption of a compliant cyber security law which is pending. At the moment there is ongoing project for Cyber security. The leading institutions for the project are MISA, USAID and DEA. The purpose of these project is to define critical infrastructures and in this moment one of the critical infrastructures is Energy (Electricity, Gas and Oil). Ministry of economy, three Energy department is a part of this project.

At the moment, Agency for Electronic Communications, hosting the MKD-CIRT. The CIRT acts as the point of contact for reporting and coordination in dealing with security incidents. The draft Cyber security Law, whose adoption is pending, foresees the establishment of a specific energy CIRT.

4.2.7.1 Electricity HV infrastructure

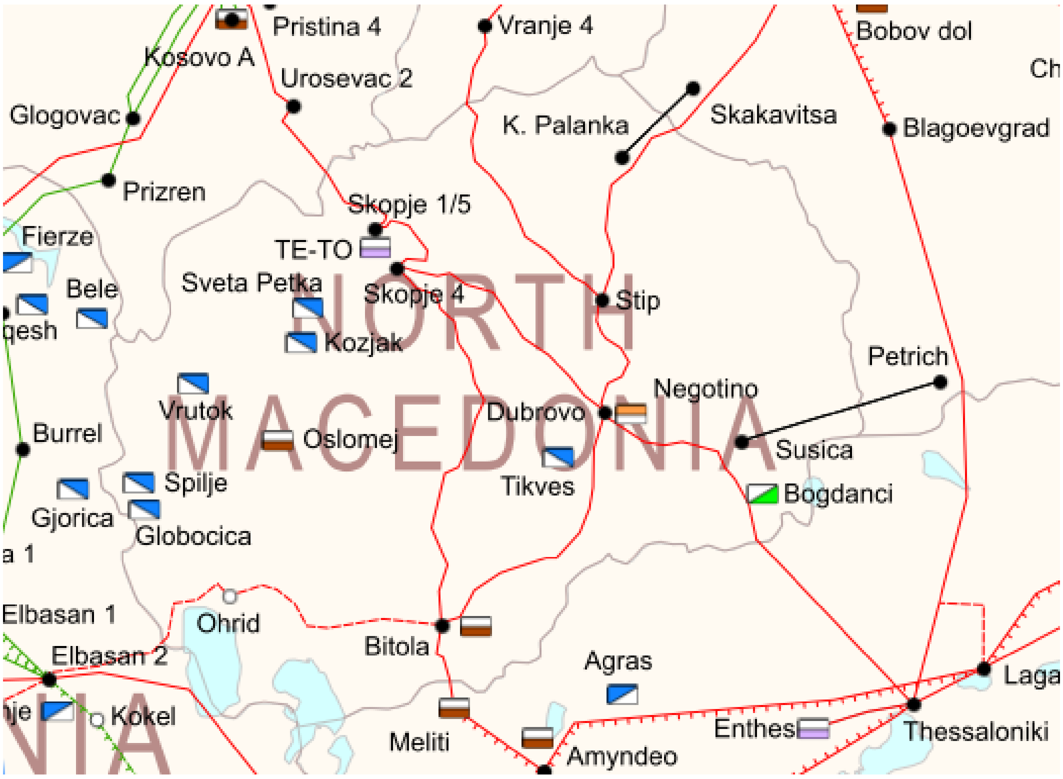
The N. Macedonian transmission grid is consisted of the high voltage network of 110 kV and 400 kV with following parameters:

Voltage level (kV)	Number of lines	Transmission line length (km)
400 kV	na	577,03
110 kV	na	1544,7
Total	**na**	**2.121,73**

Voltage level - high (kV)	Number SS (pieces)	Sn (MVA)
400/110 kV	5	na
110/x kV	73	na
Total	**78**	**na**

na – not available for the moment to be further investigated

North Macedonia has cross-border interconnections in four directions (with total 7 interconnection lines) towards Greece, Serbia, Bulgaria and Kosovo*, and one additional with Albania which is under construction. There is total five 400 kV and two 110 kV interconnection lines. Cross-border interconnection capacity accounts for an equivalent of about 260% of total installed generation capacity.



Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[47]

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Stip (N. Macedonia) – Vranje 4 (Serbia)	1218	1096
400	Bitola 2 (N. Macedonia) – Melita (Greece)	860	774
400	Dubrovo (N. Macedonia) – Thessalonica (Greece)	860	774
400	Stip (N. Macedonia) – Cervena Mogila (Bulgaria)	1218	1096
400	Skopje 5 (N. Macedonia) – Ferizaj/Uroshevac 2 (Kosovo∗)	1218	1096
400	Bitola (N. Macedonia) – Elbasan (Albania) –under construction	1330	1195

Table 9 – North Macedonia power interconnection lines (existing)[48]

The peak load value of North Macedonia system is reaching 1500 MW.

[47] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

[48] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

4.2.8 Serbia national electricity sector overview

The electricity market in Serbia is largely state owned and consists of following main participants:

Serbia	
Generation	PU EPS - Elektroprivreda Srbije IPP - Gazprom Energoholding 180 MW CCGTPP Priority/privileged producers (under the supporting schemes) and electricity self-producers
Transmission and Distributors	EMS - Elektromreža Srbije AD (TSO) EDS - Elektrodistribucija Srbije (DSO)
Power Market Operator	SEEPEX - South-East Europe Power Exchange (DAM and IDM organized market operator - NEMO designated)
Regulatory Authority	AERS - Energy Agency of the Republic of Serbia
Ministry or institution for planning and supervision	MoME - Ministry of Mining and Energy CPC - Commission for Protection of Competition

EPS is a 100% state - owned energy company and in 2021 it officially became solely an electricity generation company, when it officially was unbundled from the electricity distribution activities. EPS performs trade and supply of electricity as well, as a parent company to the respective subsidiaries. EPS currently provides almost all domestic generation from its generation portfolio which is composed of thermal power plants (firing low quality coal/lignite from opencast mines) and capacities in large hydropower plants. EPS as mentioned generate electricity for wholesale supply and trade, supply of regulated customers and acts as only provider of balancing and ancillary services in Serbia.

EDS is state-owned electricity distribution. EDS is responsible for operation and maintenance of the distribution grid assets. EDS unbundling process from EPS, with the transfer of EPS' shares in the distribution company EPS Distribucija to the state ownership, formally ended in 2021. In January 2021, the Government of the Republic of Serbia, now in its capacity as the owner and founder of the distribution system operator, amended its founding act in order to harmonize it with the provisions of the Law on Public Enterprises and the Energy Law. The amendments to the founding act also included rebranding, so the business name was changed to Elektrodistribucija Srbije d.o.o. Beograd. The company was licenced by Energy Agency of the Republic of Serbia on 1 April 2021. Electricity market is still not fully liberalised. The retail market is formally open; however, EPS still dominates the retail market. The prices and tariffs are still regulated and do not reflect costs. The energy production sector in Serbia (like in many EU countries), refers mainly to EPS, is subsidised recently by the Government due to on-going energy crisis. Also, coal mining in PE Underground Exploration of Coal Resavica (JP PEU Resavica) is heavily subsidised by direct state subsidies. Those subsidies are large compared to PEU Resavica incomes and expenses, but again small when compared to e.g., EPS financial balances.

EMS is state-owned electricity transmission system operator of Serbia, performs transmission of electricity, transmission network operation, development planning and maintenance and central dispatching of the electricity loads. EMS is legally and functionally unbundled company by AERS decision. However, this decision is not in line with Energy Community Secretariat opinion who claims that the unbundling process is not in compliance with EU Third Energy Package as decision-making rights for public enterprises responsible for production and supply of electricity and gas remain with the same public body, the Government.

Cross-border capacities on the borders with Croatia and Bulgaria are allocated through Joint Auction Office (JAO). On other borders joint auctions still apply, except split auctions applied with Albania. Allocation of capacities on the 400 kV interconnection line with Kosovo∗ is pending implementation of the recently signed connection agreement between the transmission system operator of Kosovo∗ (KOSTT) and the ENTSO-E. Serbia has established a power exchange back in 2016 – SEEPEX (South-East Europe Power Exchange. SEEPEX acts as DAM and IDM organized market operator it has been designated as NEMO. SEEPEX is coupled with Slovenian power exchange, with plans to undergo market coupling with other neighbouring countries.

Serbia does not have competitive balancing[49] and ancillary services market. The prices of ancillary are still being regulated. Serbia has transposed all three Network Codes on network connections. EMS is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation been transposed and implemented.

Similar to Greece, lignite is significant domestic fossil fuel resource also in Serbia. It is an important component of Serbia's energy security, as more than 50% of all installed capacities and near 70% electricity produced comes from lignite power plants. Unfortunately, in the last few years insufficient quantities and low-quality level of lignite from Serbian opencast mines and problem of ageing power plants, are posing challenges and concerns about security of electricity supply. Serbia until the autumn of 2021 was able to produce electricity to cover domestic consumption in normal circumstances, but recent problems/malfunctions in EPS coal mines and consequently in thermal plants triggered the need to import huge amounts of electricity to cover the national load. In addition, long-term supply-demand forecasts and adequacy considerations beyond 2023 are also challenging. National TYNDP predicts significant increase of peak load in the following ten years and electricity consumption will constantly rise up. Also, lignite production costs have been increasing, what has been heavily subsidies from the state budget. Consequently, and together with the country's commitments to introduce carbon pricing, lignite consumption and production are becoming less attractive. The current energy crisis illustrated the potential effect of insufficient quantities and low-quality lignite shortages and low participation can have on electricity supply security and need for Serbia to diversify it sources.

[49] Currently EPS is the only provider or balancing services in the domestic market. However, the situation could be changed depending on the future role on the market of the recently built 180 MW CCGTPP owned by Gazprom Energoholding.

In order to ensure the security of supply of electricity system in Serbia it is needed to consider redirecting the efforts from coal to renewables, following the planned coal fired units shut-down to come (in line with LCPD). In addition, with the planned shutdown of lignite power plants, new “stable” (baseload) TPP Kostolac B3 will increase the balance capacity of the power system, but other economically justified means of power flexibility in the system will be needed (e.g. pump storage PP, batteries, etc). Serbia also should use its geographical position/transmission system and play crucial role as regional electricity market hub on Balkans and work towards efficient use of existing and increasing transfer capacities with neighbouring countries/control areas for market coupling. It important to mention that national TYNDP, as well as ENTSO-E TYNDP consider new projects for net transfer capacity (NTC) increase on 6 out of 8 Serbian borders in next 15 years. It is needed to invest in further electricity connectivity infrastructure, storage/balancing plants (large potential for flexible hydropower plants) and work on energy efficiency and demand-response solutions.

The EMS has adopted TSO defense plan in case of an emergency situation, which consists of a series of coordinated measures and actions in case of emergency. The security of transmission system operation is maintained in cooperation with Security Coordination Center - SCC (Regional Security Coordinator for SEE) from Belgrade.

Serbia has transposed the NIS Directive. The Regulatory Agency for Electronic Communications and Postal Services (RATEL), is responsible for cybersecurity of all sectors of the economy, including also energy sector. The national computer emergency response team SRB-CERT covers also the ICT security of the energy sector, acts as a focal point, performs risk assessment, shares risk and incident related in formation and coordinates prevention and protection activities.

4.2.8.1 Electricity HV infrastructure

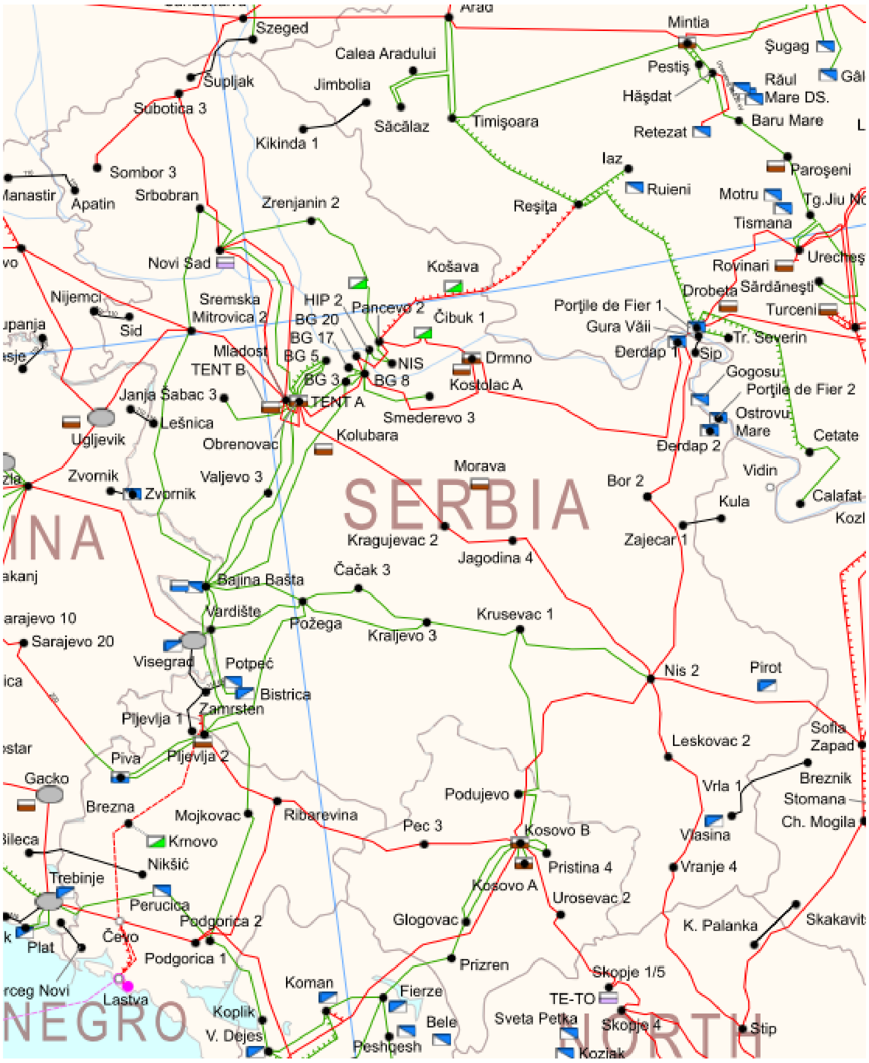
The Serbian transmission grid is consisted of the high voltage network of 110 kV, 220 kV and 400 kV with following parameters[50]:

Voltage level (kV)	Number of lines	Transmission line length (km)
400 kV	38	1.812
200 kV	47	1.754
110 kV	374	6.238
Total	**459**	**9.804**
Voltage level - high (kV)	**Number SS/Number of transformers (pieces)**	**Sn (MVA)**
400/x kV/kV	20/30	9.750
220/x kV/kV	14/29	5.481,5

[50] http://www.ems.rs/page.php?kat_id=642

110/x kV/kV[51]	9/16	659,5
Total	**43/75**	**15.982,5**

Serbia has interconnections to other ENTSO-E separate control areas in eight directions (with total 23 interconnection lines, of which 22 are active) towards Croatia, Hungary, Romania, Bulgaria, North Macedonia, Kosovo*, Montenegro and Bosnia and Herzegovina. Very good geographical position, makes the Serbian transmission system obviously the most important infrastructural part of the regional electricity market in the Balkans. Interconnection capacity towards other ENTSO-E separate control areas accounts for an equivalent of about 115% of total installed generation capacity.



Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[52]

[51] Only operated by EMS as TSO, the remaining 110/x kV/kV SS which are the property of DSO are not included in the table.

[52] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

Voltage level (kV)	Interconnection line	Sn (MVA)	Pn (MW)
400	Sremska Mitrovica (Serbia) – Ernestinovo (Croatia)	1329	1196
400	Sremska Mitrovica (Serbia) – Ugljevik (BIH)	1329	1196
400	Nis (Serbia) – Kosovo∗ B (Kosovo∗)	1317++	1185
400	Nis (Serbia) – Sofia (Bulgaria)	1329	1196
400	Djerdap (Serbia) – Portile de Fiere (Romania)	1273	1146
400	Subotica (Serbia) – Sandorfalva (Hungary)	1329	1196
400	Vranje 4 (Serbia) – Stip (N. Macedonia)	1218++	1096
2x400	Pancevo (Serbia) – Resica (Romania)[53]	2660	2394
220	Vardiste (Serbia) – Visegrad (Bosnia and Herzegovina)	301++	271
220	Pozega (Serbia) – Pljevlja (Montenegro)	274++	247
220	Bajina Basta (Serbia) – Pljevlja (Montenegro)	274++	247
220	Krusevac (Serbia) – Podujeva (Kosovo∗)	300++	270

Table 10 - Serbia power interconnection lines (existing)[54]

++Note: value restricted by neighbouring TSO (compared to data delivered by EMS)

The system peak load values up to 5800 MW[55], regularly occurring during wintertime, with summertime maximum load value in the range of 70% of the peak load and minimum load value in the range of 36% of the peak load.

4.2.9 Slovenia national electricity sector overview

The electricity market in Slovenia consists of following main participants:

Slovenia	
Generation	HSE Group, GEN energija, JPEL Priority/privileged producers (under the supporting schemes) and electricity self-producers

[53] It is expected that from 2025 (already constructed on Serbian side) the 400 kV double line Pančevo – Resiţa will be in parallel operation as currently it is not completed on the Romanian side.

[54] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

[55] The system peak load value of 5,8 GW refers to Serbia without UNMIK/Kosovo∗.

Transmission and Distributors	ELES - Electricity Transmission System Operator (TSO) and ancillary services market operator SODO - Electricity Distribution System Operator (DSO) - electricity distribution activities are performed through five EDCs (DisCOs): Elektro Ljubljana, Elektro Maribor, Elektro Celje, Elektro Primorska, Elektro Gorenjska
Power Market Operator	BSP Energy Exchange LLC (BSP Energetska Borza d.o.o) - NEMO
Regulatory Authority	Slovenian Energy Agency (Agencija za energijo)
Ministry or institution for planning and supervision	Ministry of Infrastructure (Energy Directorate) Slovenian Competition Protection Agency

Electricity generation in Slovenia is dominated with two companies HSE group and GEN-Energija. The two companies are responsible for more than 85% (cca 55%+30%, respectively) of the whole generation and operate more than 75% (cca 50%+25%, respectively) of the all-installed capacities in the country. Both companies' generation portfolio is composed of capacities in hydropower plants and thermal power plants (coal and liquid and gaseous fuels), with exception of GEN-Energija which in addition operates the only NPP in the EUSAIR region (in accordance with an intergovernmental agreement the 50% share of the installed capacity and generation of the NPP Krsko belongs to Croatia).

The electricity market in Slovenia is fully liberalized and unbundled. GEN-I is the most dominant supplier on the market covering more than 20% of final demand. It is followed by, Petrol and ECE which hold 15% of the market each, Energija plus (cca 12%), E3 (cca 11%), Elektro energija (cca 5%), other suppliers market participation share is less than 5%.

Electricity transmission and distribution operator companies are unbundled. The transmission and distribution system operators are 100% owned by the state.

SODO is an electricity distribution system operator (DSO) of Slovenia. SODO performs this service of general economic interest in line with the approval of the Government of the Republic of Slovenia and granted a concession to SODO for a period of 50 years from the date of conclusion of the concession contract (in 2007). DSO function performed by SODO, which does not prepare separate financial statements for regulatory purposes. After signing the concession contract lease contracts were signed on the electricity infrastructure and provision of services for electricity distribution services between SODO and five individual electricity distribution companies (DisCOs): Elektro Celje, d. d., Elektro Gorenjska, d. d., Elektro Ljubljana, d. d., Elektro Maribor, d. d., Elektro Primorska, d. d. and some closed distribution systems in Slovenia. EDCs may engage in other non-electricity-related activities in addition to the activity contractually delegated to them by SODO. Therefore, the distribution companies maintain separate accounting records in their books and draw up separate financial statements for the activity contractually delegated to them by SODO and for their non-electricity-related activities. SODO together with EDCs provides long-term capacity of the electricity network that allows reasonable requests for connection and access to the network while taking into account the standards for quality of supply voltage and quality of electricity supply, assuring the appropriate planning of system development, its construction, management, operation and maintenance.

ELES - Elektro Slovenija is the national transmission system operator (TSO). ELES is responsible for operation of the HV transmission grid, maintaining network infrastructure, planning for network development and construction, and dispatching, namely managing flows of electricity on the network, ensuring system balance. ELES also operates ancillary services market and sources all services from providers in the market; the costs of their provision are covered by the network charge for the transmission system. Cross-border capacities at all Slovenian borders are allocated through the Joint Allocation Office (JAO). All annual and monthly auctions at the Slovenian borders were conducted in accordance with the harmonised auction rules, which also apply at all other borders in the common European electricity market.

Slovenia has its own power exchange BSP Energy Exchange LLC (BSP Energetska Borza d.o.o) which also serves as balancing market operator. BSP has been participating in the pan-European DAM coupling at the borders with Italy, Austria, Croatia; since 2014, 2016 and 2018 respectively. Throughout 2021, the intraday CZC allocation at the Slovenian–Austrian, Slovenian–Croatian and Slovenian-Italian borders took place within the context of European intraday market coupling.

Slovenia has competitive balancing market, which allow for cross-border trading of balancing services, enabling market-based procurement of balancing services and imbalance price formation. Slovenia has transposed all three group of Network Codes. ELES is publishing data on the ENTSO-E Transparency Platform. The REMIT Regulation is transposed and implemented.

Slovenia is net importer of energy. In Slovenia largest share of domestic generation is contributed by TPPs, larger HPPs and the nuclear power plant. Only small part of the country's generation comes from renewable sources other than hydro. Given that hydropower plants play a major role in Slovenian electricity production, country's electricity import dependency varies considerably due to changes in precipitation (hydrological conditions). However, it can be said that on average country's domestic production covers about 80% total demand. Even if electricity demand is to be reduced by means of energy efficiency measures, it is expected to increase due to shift in governmental policies towards promotion of electrification in all areas of economy. In addition, similar to other EU countries Slovenia is phasing out coal, what puts even bigger concerns on the security of the future electricity supply. Therefore, it is necessary to improve usage of excellent international interconnection of its electric power system with already available and innovative markets mechanism. In addition, Slovenia should re-direct its focus on variable renewable energy in combination with new and available balancing and storage capacities in order to tackle future power system reliability challenges as soon as possible.

The security of transmission system operation is maintained in cooperation with TSCNET Services (Regional Security Coordinator for the TSOs in Central and South Eastern Europe.

Slovenia has transposed NIS Directive. The Information Security Act was adopted in 2018, being main legal act to regulate the provision of cyber defence, but it does not address critical infrastructure protection as such, only identifies critical infrastructure providers (including energy sector). The Government has established the Information Security Administration of the Republic of Slovenia (ISA) which serves as single point of contact. SI-CERT is defined as a national CSIRT, but energy-specific CSIRT does not exist in Slovenia.

4.2.9.1 Electricity HV infrastructure

The Slovenian transmission grid is consisted of the high voltage network of 110 kV, 220 kV and 400 kV with following parameters:

Voltage level (kV)	Transmission line length (km)[56]
400 kV	669,9
200 kV	328,1
110 kV	1.926,8
110 kV cables	30,6
Total	**2.955,4**

Voltage level - high (kV)	Number of SS/Number of transformers/switchgears	Sn (MVA)
400/x kV/kV	66 stations, 51 of which are system substations and 15 switchgears at TPP, NPP, HPP, PSP[57]	5.133 (with phase shifting transformer 6.333)
220/x kV/kV		
110/x kV/kV[58]		
Total	**66**	**5.133**

The transmission power system of Slovenia is well connected to all its neighbours, except with Hungary. Slovenia is interconnected to Austria with two 400 kV and one 220 kV transmission line, one 400 kV line and one 220 kV line to Italy, and three 400 kV, two 220 kV and three 110 kV transmission (what makes total of 13 interconnection lines. There are currently no transmission lines between Hungary and Slovenia; however, a 400 kV interconnection is under construction (section Cirkovce-Pince). Cross-border interconnection capacity accounts for an equivalent of around 120% of total installed generation capacity.

[56] System length of the transmission network conduits owned by ELES. Source: ELES Annual Report https://www.eles.si/Portals/EN/Documents/ELES_LP2021_EN_HR.pdf

[57] https://www.eles.si/Portals/EN/Documents/ELES_LP2021_EN_HR.pdf

[58] Only operated by ELES as TSO, the remaining 110/x kV/kV SS which are the property of DSO are not included in the table.

Source: Consultant's elaboration of Interconnected network of ENTSO-E Map 1:4.000.000[59]

Voltage level (kV)	Interconnection line	Pn (MW)
400	Divaca (Slovenia) – Redipuglia (Italy)	IMPORT[60]++ 730 EXPORT 680
220	Divaca (Slovenia) – Padriciano (Italy)	
2x400	Maribor (Slovenia) – Kainachtal (Austria)	IMPORT++ 950 EXPORT 950
220	Podlog (Slovenia) – Obersielach (Austria)	
400	Divaca (Slovenia) – Melina (Croatia)	IMPORT++ 1.600 EXPORT
2x400	Krsko (Slovenia) – Tumbri (Croatia)	
220	Divaca (Slovenia) – Pehlin (Croatia)	

[59] Available on: https://www.entsoe.eu/data/map/downloads/ (22nd February 2019 - map downloads updated with 2019 version) – accessed on 14/11/2022.

[60]Import and export cross-border capacity taken from Regional Investment Plan 2020 Continental South East (note marked ++) https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2020/Foropinion/RegIP2020_CSE.pdf

220	Cirkovce (Slovenia) – Žerjavinec (Croatia)	1.600
2x400	Slovenia-Hungary/Croatia interconnection[61] - under construction/trial run	1.200 MW in both directions

Table 11 - Slovenia power interconnection lines (existing and under construction)

The peak load value of Slovenian power system is cca 2.200 MW.

[61] The project consists of a new 80km double circuit 400kV OHL in Slovenia (section Cirkovce-Pince) and a new 400 kV substation of Cirkovce(SI). The new double 400 kV overhead line will be connected to one circuit of the existing double circuit 400kV OHL Heviz(HU)-Zerjavinec(HR). By this two new cross-border lines will be established - Heviz(HU)-Cirkovce(SI) and Cirkovce (SI)-Zerjavinec (HR).

4.3 Regional electricity market challenges

All countries of the EUSAIR region face with serious electricity market challenges. The global surge in energy prices and inflation is threatening the EUSAIR regions security of (electricity) supply. Besides the latest energy crises, there are many other challenges present for many years which in the given circumstances only increase complexity of the current situation.

The EUSAIR countries electricity generation needs investment and modernisation. The non-EU EUSAIR countries have to decide immediately whether they will phase out of the existing coal-fired power plants in the next few years or engage in expensive environmental rehabilitation measures (under LCPD obligation). Availability of financing for coal-based generation is limited. The availability of finance for engaging in replacement (or even rehabilitation) of the current coal base load capacities became de facto impossible, due to green finance agenda and as well as the effect of the State aid rules. Despite the fact that using domestic coal (where available) would have positive effects on the national security of supply, under given circumstances in the non-EU EUSAIR countries staying with high shares of coal-fired generation in the system becomes unprofitable given the age of the plants, its plants efficiency, quality coal availability, costs of its production and carbon pricing mechanisms, which is to be introduced in non-EU EUSAIR countries in the upcoming period.

If gradual phase out of the existing coal-fired power plants would be considered by construction of new natural gas fired and/or nuclear power plants for the most of EUSAIR countries this again raises the challenges of import dependency or additionally like in case of the natural gas to have stranded costs.

The need for replacement of the fossil-fired generation capacity in other parts of the EUSAIR region is also needed (due to natural gas import dependency like in Italy case) with clean resources in order to meet the existing and most likely rising region’s demand (due to increase cross-sector electrification by the EU policies). Shifting from flexible generation from natural gas to innovative storage technologies and market flexibility mechanism are the challenges which have to be tackled if the import dependency is to be avoided.

Complete market deregulation stays a huge challenge. The non-EU EUSAIR countries are burdened with factors such as the low-end consumer price levels which do not reflect high wholesale market electricity costs and urge the need to cross-subsidize the utilities, what lefts lack of fiscal space of governments and state-owned enterprises to invest in new renewable generation capacities and energy efficient technologies. Therefore, it is necessary to develop a clear and transparent programme for transition to fully cost-reflective retail electricity tariffs while continuing to protect vulnerable consumers.

In some other EUSAIR countries market concentration challenge remains, development of competition in the retail market and supplier switching/switching rate even decreasing in some countries.

Shifting from fossil-fired base load generation capacity to variable renewable capacity will require significant economic efforts and may have social and political repercussions to the decarbonization and cause new challenges.

Ramping up intermittent renewable energy sources, will raise challenges and concern of solving system adequacy and rising costs of balancing and flexibility. Especially challenging and of outmost importance is the solving concerns that the non-availability of base load or back-up capacity associated with decarbonization will endanger system adequacy, system balancing and the security of supply, which become even more pressing by disruptions/lowering of the gas supply. This challenge becomes even more concerning when climate change impact due to lack of hydrology/droughts is taken into account, which causes declining reliability and efficiency of hydro power generation.

Efficient usage and full exploitation of interconnectors is unfortunately still an issue due to low cross-border capacity values offered at the borders, leading to restricted market activities in the observed regions. EUSAIR region should increase focus on the efficient usage of the existing interconnectors.

The electricity systems of the non-EU EUSAIR countries are exceptionally well interconnected among each other and with the rest of Europe. Besides, ENTSO-E in its 'Identification of System Needs' report (IoSN study) based on TYNDP 2022 shows further need for investment in the electricity interconnection in the region. The optimal use of this existing and new interconnections would provide the needed flexibility for power systems relying on renewable energy at low costs.

Implementation of the EU electricity target model and improvement of the electricity wholesale and retail competition through the operation of effective intraday, day ahead, balancing, and forward markets is needed all across the EUSAIR region. Especially important role to this challenge belongs to EU EUSAIR countries with huge experience in functioning of organized electricity market.

In addition, it is necessary to provide stable regulatory framework for implementation and promotion of cost-effective flexibility options (demand-side participation, storage, batteries, etc.) for effective renewable system integration.

5 Section 5 - Power system and network planning towards the year 2030

5.1 Overview and description of the New Policies Scenario and Current Policies Scenario in the EUSAIR countries

In this section will be developed and assessed two scenarios for each EUSAIR Country up to 2030, based mainly on the information contained in National Energy and Climate Plans (NECPs):

- the **Current Policy Scenario** (**CPS**) will be based only on existing trends of energy consumption linked to specific variables of each sector of final energy use, without envisaging any new policies nor new significant structural change, both in policies and of consumer technologies or new energy sources: this scenario is much the same as the "*With Existing Measure (WEM)*" scenario contained in NECPs;
- the **New Policy Scenario** (**NPS**) will be developed considering the targets set by each Country in its NECPs, thus taking into account technological changes and the related energy consumption trajectories up to 2030: this scenario is much the same as the "*With Additional Measure (WAM)*" scenario contained in NECPs.

The CPS and NPS scenarios are therefore based on the information available in the NECPs of the individual Countries.

If available, the data from the WEM and WAM scenarios relating to the **consumption of electricity** in the individual sectors of use (industry, residential, tertiary, transport, etc.) are used directly.

In the case of **electricity production**, the RES development scenarios and the evolution of the electricity generation plants over the time horizon of the NECP are used.

If only indirect information is available in the NECPs, the CPS and NPS scenarios are created by processing, where possible, this information, also starting from the reference data for the 2019 base year.

If the NECP information are not available for some EUSAIR countries, for the CPS and NPS scenarios will be used respectively the Stated Policies Scenario (STEPS[62]) and the Sustainable Development

[62] The Stated Policies Scenario (STEPS) is based on 2021's policy settings. In this scenario, GDP also returns to pre-covid 19 levels in 2021, and energy demand in early 2023, but outcomes vary sharply by fuel: renewables meet 90% of the strong growth in global electricity demand over the next two decades, led by continued high levels of solar PV deployment, but global coal use never gets back to previous levels.

Scenario (SDS[63]) of the IEA World Energy Outlook 2020 (WEO 2020[64]). In this case, according to regional groupings in WEO, the scenarios will be related to "European Union" for Italy, Slovenia, Croatia and Greece and "Europe" for Albania, Bosnia and Herzegovina, North Macedonia, Montenegro and Serbia.

The following table reports main energy indicators used for EUSAIR electricity scenarios based on IEA WEO 2020.

	Europe		**European Union**	
	Stated Policies Scenario	**Sustainable Development Scenario**	**Stated Policies Scenario**	**Sustainable Development Scenario**
Total final consumption	0,8	0,9	0,5	0,8
Industry	0,3	0,1	0,2	0,1
Industry final consumption	-1,9	-1,3	-2,4	-1,9
Transport final consumption	9,1	14,1	8,8	13,6
Buildings final consumption	0,5	0,3	0,3	0,1
Other energy sector	-1,0	1,5	-1,4	1,7
Power sector	**-1,0**	**-1,0**	**-1,3**	**-1,2**
Coal	*-8,5*	*-16,5*	*-11,2*	*-19,4*
Oil	*-9,8*	*-11,0*	*-10,5*	*-11,1*
Natural gas	*-0,5*	*-1,9*	*-0,2*	*-1,6*
Nuclear	*-1,9*	*-1,3*	*-2,4*	*-1,9*
Hydro	*1,4*	*1,6*	*1,6*	*1,8*
Bioenergy	*2,0*	*3,3*	*1,7*	*3,0*
Other renewables	*6,4*	*8,6*	*6,9*	*8,9*

Table 12 – CAGR 2019-2030 (%) for electricity consumption in Europe and European Union based on IEA WEO 2020 scenarios

NECPs of Bosnia and Herzegovina, Montenegro and Serbia are still in different phases of development and approvals.

[63] The Sustainable Development Scenario (SDS) sees a near-term surge of investment in clean energy technologies over the next ten years, along with action to reduce emissions from existing infrastructure; this is enough to make 2019 the definitive peak year for global CO_2 emissions.

[64] Available here: https://www.iea.org/reports/world-energy-outlook-2020

5.1.1 National commitments as reflected in the National energy and Climate Plans (NECPs)

5.1.1.1 Albania

Albania has committed to prepare its first NECP 2021-2030 during the year 2020. The development period had to be extended due to the COVID-19 pandemic and the draft of NECP has been published in July 2021.

This NECP builds on the National Energy Strategy and the first NDC and has been aligned with the draft of the revised NDC.

The main targets contained in NECP are the following:

- GHG emission savings (Reduction relat. WEM): -18,7%
- Energy Efficiency (Final Energy Consumption reduction relat. WEM): -8,4%
- Renewable energy share in final energy demand: 54,4% (178% for RES in electricity sector, 34,6% for RES in transport sector and 16,6% for RES in heating and cooling sector)

5.1.1.2 Bosnia and Herzegovina

At the moment, the NECP for Bosnia and Herzegovina is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the NECP[65]. The development of the draft NECP focused on the refinement of the policy and the reference scenarios, in part to reflect the negotiations on the Energy Community 2030 targets for Bosnia and Herzegovina[66]. The legal basis for the NECP, i.e. climate law and accompanying by-laws, as well as the adoption of the entity energy and climate plans, are still pending.

In April 2023, the NECP for Bosnia and Herzegovina (BiH) for the period until 2030 was publicly presented for the first time at the Energy Summit in Neum (BiH)[67]. In accordance with the undertaken obligations towards the Energy Community, the draft NECP is planned to be submitted to the Energy Community Secretariat by the end of June 2023.

The NECP foresees reaching the share of RES in FEC of 43.62%, with FEC of BiH of 4,340 ktoe.

The NECP also envisages decommissioning of coal-fired TPPs with installed overall capacity of 410 MW, ceasing construction of new coal-fired TPP units and switching of some existing capacities to biomass.

Putting into RES power plants with overall capacity of 2,000 MW is foreseen (1,500 MW of solar PV power plants, and the remaining capacities covered by wind, HPPs and biomass).

[65] Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

[66] Energy Community – Bosnia and Herzegovina Annual Implementation Report (November 2022), https://www.energy-community.org/dam/jcr:90f246f0-0e7e-469e-8895-d2bc4538ec58/IR2022_Bosnia_Herzegovina.pdf.

[67] https://balkangreenenergynews.com/rs/predstavljen-nekp-za-bih-gase-se-termoelektrane-a-otvaraju-elektrane-na-obnovljivu-energiju-snage-2-000-mw/.

Policies and measures listed in the NECP include establishing of organized electricity and natural gas markets, introduction of an emission trading scheme (ETS) in accordance with EU ETS, as well as introduction of guarantees of origin. With the Energy Community Secretariat's support, Bosnia and Herzegovina drafted a roadmap for introducing carbon pricing by the end of 2025.

On the basis of the Decision on the implementation of the Directive 2009/28/EZ, an obligatory target for RES share in FEC of 40% in the year 2020 was set for Bosnia and Herzegovina[68.] In this regard, both entities in Bosnia and Herzegovina (Federation of Bosnia and Herzegovina, and Republika Srpska) have drafted their own Renewable Energy Action Plans, and on this basis together with evaluating the situation in the Brcko District, the RE Action Plan on national level (National Renewable Energy Action Plan – NREAP) was drafted and released in 2016[69].

5.1.1.3 Croatia

Croatia submitted its NECP for the period from 2021 to 2030 in December 2020 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

Following are the most important targets that the NECP sets for 2030:

- Reduction in greenhouse gas emissions for the ETS sector, compared to 2005: at least 43%
- Reduction in greenhouse gas emissions for non-ETS sectors, compared to 2005: at least 7%
- Share of RES in gross final energy consumption: 36,4%
- Share of RES in final energy consumption in transport: 13,2%
- Primary energy consumption (total energy consumption without non-energy consumption): 344,38 PJ
- Final energy consumption: 286,91 PJ

Projections of the most important energy and climate indicators included in the WAM scenario in NECP by 2030, are the following:

- Immediate energy consumption is expected to amount to 286.9 PJ in 2030, representing a change of 8.1% and -15% in comparison to 2005 consumption
- The expected reduction in greenhouse gas emissions from energy sources amounts to 31.2% by 2030, compared to 1990 levels
- The renovation rate in the period 2021 to 2030 is growing from the current 0.7% per annum for the period 2014-2019 in steps of 1.1% to 3.0%, reaching a 10-year average of 1.6%. The rate of abandonment of the existing building stock is significantly increased, as evidenced by the increase in temporarily unoccupied units in the period between two consecutive censuses.

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[68] https://www.vladars.net/sr-SP-Cyrl/Vlada/Ministarstva/mper/std/Documents/StrategijaEnergetike2035Latinica.pdf.

[69] https://www.energy-community.org/dam/jcr:ef59bc5d-a6c3-48a8-9653-2a40e5721d58/NREAP_2016_BH.pdf.

- The penetration of electric, hybrid and hydrogen-powered vehicles is expected to reach 3.5% of total road passenger activity in 2030
- Increase in the share of renewable energy sources in gross final energy consumption to 36.4% by 2030
- Decarbonisation of electricity production by increasing the share of renewable energy sources to 63.8% by 2030

Increasing energy efficiency is strongly present in all sectors of consumption, with the strongest effects expected in the building sector and transport.

In the building sector, a continuation of good practices and strengthening of energy efficient of all buildings (residential and non-residential) is expected, targeting renovation according to the nZEB standard, which also implies a greater utilization of RES (photovoltaic systems, solar thermal collectors, biomass boilers, heat pumps).

5.1.1.4 Greece

Greece submitted its NECP for the period from 2021 to 2030 in December 2019 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The NECP has set the following objectives for 2030.

Initially with regard to climate change and emissions, a much higher core objective for **reducing greenhouse gas** (GHG) emissions by more than 42% compared to emissions in 1990 and more than 56% compared to emissions in 2005, thus exceeding even the core EU targets.

Also, in respect of climate change and adaptation policies, the NECP sets out the initiatives to be undertaken in the context of the National Strategy for Adaptation to Climate Change, which defines the general objectives, guidelines and tools for the implementation of necessary climate adaptation measures at national, regional and local levels. It also sets out initiatives for the completion of physical planning, in urban areas in particular with respect to sustainable land use and the promotion of sustainable urban mobility. Waste management is an integral part of the national energy and climate plan, and therefore the relevant initiatives for revising the national and regional waste management plans (NWMP and RWMP) are presented. The objective of these plans is to intensify a number of integrated waste management measures, always in line with the requirements of the circular economy.

Moreover, the circular economy is a core element of Greece's development strategy, and its implementation includes, inter alia, a four-year strategic plan that covers the entire range of the value chain. In this context, the NECP sets out the axes of the relevant policy.

With regard to **renewable energy sources** (RES), the objective concerning the RES share in gross final energy consumption provide for a minimum target of 35%. This is also much higher than the core EU previous objective for RES of 32%.

The energy transformation has to take place especially in power generation, as provision has been made for the RES share in electricity consumption to exceed 60%. In this context specific initiatives are already being promoted and implemented by the government, e.g. simplifying and speeding up the licensing framework, ensuring optimal integration of RES in electricity networks, operating storage systems and promoting electromobility.

With regard to improving **energy efficiency**, there is a quantitative objective for final energy consumption in 2030 to be lower than that recorded in 2017. Therefore, the NECP's objective is fully compatible with the relevant EU indicator. There is also a 38% qualitative energy efficiency improvement achieved in final energy consumption, in accordance with a specific EU methodology, compared to the corresponding core EU objective of 32,5%. Attaining this ambitious objective will strengthen the competitiveness of the Greek economy and the protection of consumers. The NECP sets out a set of energy efficiency improvement measures, the most ambitious ones relating to buildings and transport.

A key objective for the NECP is the highly ambitious, but realistic programme for sharply and definitively reducing the share of lignite in power generation, i.e., the so-called lignite phase-out, by implementing a relevant front-loaded programme in the following decade and putting a complete end to the use of lignite for power generation in Greece by 2028. The NECP also sets out the timeframe for shutting down the lignite-fired power plants that are currently in operation, which will be completed by 2023.

The lignite phase-out plan for power generation in Greece also involves adopting integrated programmes for supporting lignite-producing areas in Greece, to smooth out the transition to the post-lignite era. The Greek government is committed to shutting down lignite-fired plants by 2028 in a well-coordinated and responsible manner. Maintaining jobs and utilising the expertise of human resources in these areas are a top priority.

Lignite phase-out is a sea change in the national energy map, but also a huge opportunity for Greece. The spirit of innovation that was ushered by the use of lignite will be passed on to the clean forms of energy and the new energy mix of the 21st century.

The NECP includes and sets out corresponding measures for other strategic policy priorities such as:

- speeding up the electrical interconnection of the islands;
- launching the new electricity market model without further delay;
- strengthening energy interconnections;
- developing strategic storage projects;
- digitising the energy networks;
- promoting electromobility;
- promoting new technologies;
- coupling the final sectors;

- developing new financial instruments; and
- taking initiatives for research and innovation and for enhancing competitiveness.

5.1.1.5 Italy

Italy submitted its NECP for the period from 2021 to 2030 in December 2019 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The following are the main objectives of the 2030 NECP on renewables, energy efficiency and greenhouse gas emissions:

- Share of energy from RES in the gross final consumption of energy: 30% (22% in transport sector)
- Reduction in primary energy consumption compared to the PRIMES 2007 scenario: -43%
- Reduction in GHG vs 2005 for all plants subject to ETS rules: -43% (EU target)
- Reduction in GHG vs 2005 for all non-ETS sectors: -33%
- Overall reduction in greenhouse gases compared to 1990 levels: -40% (EU target)

With regard to the strategy concerning each of the five dimensions of the Energy Union, a number of main elements contained in NECP are provided below.

Dimension decarbonisation

Italy intends to accelerate the transition from traditional fuels to renewable sources, by promoting the gradual phasing out of coal for electricity generation in favour of an electricity mix based on a growing share of renewables and, for the remainder, gas. Making this transition a concrete reality requires and is subject to the planning and construction of replacement plants and the necessary infrastructure.

Italy will implement the policies and measures needed to achieve the objectives of reducing greenhouse gases agreed at European and international level. For those sectors covered by the European Union Emissions Trading System (EU ETS) – primarily the thermoelectric sector and energy-intensive industries – factors contributing to this goal include: the phasing out of coal, scheduled by the end of 2025, as mentioned within the limits of, and as long as the replacement plants and necessary infrastructure are constructed in good time; a higher CO2 price level than in recent years; and a significant acceleration of renewables and energy efficiency in manufacturing processes. The coal phase-out could be implemented through, among other things, the construction of additional gas-fuelled thermoelectric units, which are necessary in view of the increased proportion of renewables in electricity generation to maintain the system at adequate levels. At present, no gas infrastructure developments are planned, but a temporary increase in gas consumption is envisaged.

For those other sectors included in the objectives established by the Effort Sharing Regulation (ESR), measures that take into account the potential and costs of reducing emissions will be developed; the most important contribution will, in any case, come from the transport and civil (residential and tertiary) sectors, combining measures for using and increasing the efficiency of renewables. For the ESR segments, the involvement of local authorities with direct competence for the transport, residential and services sectors is of fundamental importance.

Italy will promote the further development of renewables while also protecting and enhancing pre-existing products, by exceeding, if possible, the 30% target set, which must, in any event, be assumed to be a contribution towards meeting the EU target. This will be achieved through the use of instruments calibrated on the basis of the sectors of use, types of measures and size of the plants, with an approach aimed at limiting soil consumption and the impact on the landscape and environment, including requirements on air quality. With regard to the electricity sector, and with an additional view to the electrification of consumption, the intention is to make widespread use of built-up areas or areas already in use in some other way, by raising the profile of the different forms of self-consumption, including through distributed generation and storage. A further aim is to promote the creation of systems, starting with a few small islands disconnected from the national networks, in which an accelerated decarbonisation process and electrification of consumption with renewable sources can be trialed. In the heating sector, it will be particularly important to ensure coordination with the instruments for energy efficiency, in particular for buildings, and coherence of the instruments with air quality objectives.

Dimension energy efficiency

The intention is to use a mix of fiscal, economic, regulatory and policy instruments, primarily calibrated by sector of activity and type of target group.

However, attempts will be also be made to integrate the energy efficiency aspect into policies and measures whose main purpose is something other than efficiency, in order to optimise the cost-benefit ratio of the actions. In this respect, the significant potential for efficiency in the building sector may be better exploited through measures aimed at, for example, the energy renovation of buildings and neighbourhoods, together with the structural renovation, earthquake-proofing, systems upgrading and refurbishment thereof, in line with the strategy for energy renovation of the building stock by 2050. It will thus be possible to give due consideration to the potential contribution to decarbonisation of existing building stock, and of stock not undergoing significant refurbishment, which makes up most of the total built environment. In this context, solar heating, electric and gas heat pumps, and micro and mini high-efficiency cogeneration (HEC) technologies should be carefully considered, especially if fueled by renewable gas.

With regard to transport, priority is given to policies for reducing demand for mobility and increasing collective mobility, in particular rail transport, which includes shifting freight transport from road to rail. ‘Improve’ measures (regarding vehicle efficiency and emissions) must be supplemented with instruments to reduce mobility needs (‘avoid’ measures) and with efficiency in travel (‘shift’ measures).

As for the remaining demand for private mobility and the mobility of goods, the aim is to promote the use of alternative fuels and, in particular, electricity. This will be done by increasing the share of renewables through economic and regulatory instruments, in coordination with local government bodies.

Along with the ordinary instruments, it will also be possible to use resources from the EU's development and cohesion programming cycle for 2021-27. In this regard, in the discussions with partners, which involve the Regions, among others, a specific national energy programme has been proposed. Taking the INECP as reference, this is intended to support initiatives to modernise and improve the efficiency of buildings and build new infrastructure, including infrastructure for sustainable mobility. The national programme, when approved, will be coordinated with regionally managed programmes.

Dimension energy security

In terms of security of supply, the aim is, on the one hand, to become less dependent on imports by increasing renewable sources and energy efficiency and, on the other hand, to diversify sources of supply (for example through the use of natural gas, including liquefied natural gas (LNG), with infrastructure consistent with the scenario of deep decarbonisation by 2050).

With regard to the security and flexibility of the electricity system, and notwithstanding the need to promote the extensive involvement of all available resources – including storage, renewables and demand – account must be taken of the transformation of the system resulting from the growing importance of renewables and distributed generation. New operational methods and structures must be tested, including with the active participation of the transmission system operator (TSO). Similarly, the vital need for storage systems must be considered, to prevent overgeneration by electricity plants fueled by renewables. As evidence of this need, estimates of the power needed from wind and photovoltaic alone to meet the 2030 renewables goals are of the same order of magnitude as the annual peak power demand on the network.

In addition, to achieve the security and flexibility objectives, the intention is to explore the potential offered by growing integration of the electricity and gas network infrastructure. In this context, it will be important to explore the costs and benefits of power-to-gas technological solutions which, especially over the long term, make it possible to absorb any imbalances between renewable electricity production and energy demand, especially with high levels of photovoltaic penetration. Hydrogen could contribute to this, including for non-electricity consumption.

Particular attention will be paid to the resilience of the systems, in particular of transmission and distribution networks, through preventive measures proportionate to the expected increase in extreme events and periods of heavy load, and operational rules that enable the systems to be quickly restored to normal functioning levels.

In addition, with the Plan for the Sustainable Energy Transition of Suitable Areas (PSETSA) has been possible to establish a framework of reference of those areas in Italy in which hydrocarbon exploration, research and production activities would be planned, with the aim of improving their environmental, social and economic sustainability. In this respect, the outcomes of the PSETSA analyses could change the national production scenario.

Consumption and sources of supply will be monitored in order to ensure compliance with Security Regulation No 2017/1938 concerning preventive action plans and emergency plans.

Dimension internal market

A greater degree of market integration is considered to be advantageous to the entire Union, and therefore the electricity interconnections and market coupling with other Member States will be enhanced; however, given Italy's geographical position, the interconnections with third countries will also be studied and developed, in order to facilitate efficient trade.

In terms of transmission infrastructure, the references are Terna S.p.A.'s development plans, which will be revised with a view to introducing additional measures, such as centralised storage systems, needed to ensure safe integration of renewable sources, and reducing over-generation, to be implemented in compliance with the provisions of the latest EU guidelines.

In any event, in the long term the electricity market must evolve towards different forms of trading because the cost of renewable sources, on which the focus must necessarily be placed in order to increase their contribution, is predominantly one of investment. Consequently, they make it possible for the producers concerned to present their offering following a different dynamic from gas-fuelled plants, which also have to deal with variable fuel costs. This entails a need to supplement and then adjust market regulation to create a context in which the offerings can be fairly compared and prevent negative effects on system adequacy, which would also have repercussions for the gas market.

The need for flexibility may also prove beneficial to system integration (between electricity, hydro and gas systems in particular), which should be implemented on a trial basis, including with a view to researching the most efficient long-term storage methods for renewable energy. Appropriate changes to the market and to the regulatory system could be analysed to foster the electricity-gas integration of technologies that convert electricity into a gas that can be injected to the network, in line with the provisions for energy storage systems in the recently approved Electricity Market Directive and Regulation. This would be done taking developments in storage systems, including those enabled by technologies that convert one form of energy to another, and the need to develop seasonal and long-term storage into special consideration.

The expected reduction in the cost of electrolysis technology will make it possible to obtain renewable hydrogen for the decarbonisation of energy-intensive industrial sectors and long-haul commercial transport.

With regard to energy poverty, to supplement the measures described below, studies are under way to introduce efficiency measures and measures for the installation of renewable energy plants with self-consumption.

Dimension research, innovation and competitiveness

There are three fundamental criteria behind research and innovation activities in the energy sector:

a) the finalisation of resources and activities geared towards the development of processes, products and knowledge that have an outlet into markets opened up as a result of support measures for the use of renewables, energy efficiency and network technology;

b) synergistic integration between systems and technologies;

c) viewing 2030 as a milestone in the process towards full decarbonisation, on which Italy is engaged in line with the long-term strategy to 2050, in which ambitious scenarios are proposed that envisage the reduction of emissions eventually to climate neutrality, in line with the EU approach.

Similarly, the support measures for innovation in sectors other than the energy sector will follow an approach, in the light of the Green New Deal, that fosters the modernisation of the production system in line with the medium and long-term energy and environment scenario.

With regard to competitiveness, the strategy outlined in the previous sections must be combined not just with the integration of the single market, but also with careful regulation of the energy markets, so that consumers and businesses can benefit from the positive effects of transparent competition, and prudent use of support mechanisms that may burden the community, as well as integration into the single market.

5.1.1.6 Montenegro

At the moment, the NECP for Montenegro is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the NECP[70]. As per obligation towards the Energy Community, the draft NECP should be submitted by 30/06/2023. Preparation of the NECP is incorporated into Montenegrin legislation, through the Energy Law[71]. In accordance with the Energy Law, monitoring of NECP implementation is performed by the line Ministry[72,] which prepares biennial progress reports.

Prior to the NECP, Montenegro has prepared the following strategic documents in the field of RES:

- Energy Sector Development Strategy of Montenegro until the year 2030[73] (issued in 2014), and
- National Renewable Energy Action Plan until 2020[74] (also delivered in 2014).

[70] Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

[71] Official Gazette of Montenegro (OG ME) 5/2016, 51/2017 and 82/2020.

[72] Ministry of Capital Investments – Energy Directorate.

[73] https://wapi.gov.me/download/eac811f8-4b13-46ce-97c4-412b8d1ebb8a?version=1.0

[74] https://wapi.gov.me/download/6d8db09e-a2b1-4e4a-bf98-42c39a0b3299?version=1.0.

The Energy Sector Development Strategy of Montenegro until the year 2030 envisages the following FEC:

Final energy consumption, in ktoe (Energy Sector Development Strategy of Montenegro until 2030), in ktoe

FEC / Year	2015	2020	2025	2030
Total FEC	**768.7**	**874.9**	**1,005.7**	**1,107.8**

Source: Energy community

The national RES target (RES share in total gross FEC) of 33% (in the year 2020) has been determined for Montenegro in accordance with the Decision 2012/04/MC-EnC of the Energy Community Ministerial Council (18/10/2012). The Decision obliged Montenegro to transpose the RED into Montenegrin legislation.

5.1.1.7 North Macedonia

Following up on the national Energy Strategy adopted in December 2019 and in response to the Recommendation of the Ministerial Council of the Energy Community (2018/1/MC-EnC) on preparing for the development of integrated national energy and climate plans by the Contracting Parties of the Energy Community and the relevant Policy Guidance by the Energy Community Secretariat (PG 03/2018), North Macedonia prepared National Energy and Climate Plan (NECP), which covers the period from 2021 to 2030 prescribing the pathway to achieve the 2030 targets. The economy wide GHG emission reduction target for North Macedonia is 82% in 2030 compared to 1990, or 78% compared to BAU scenario (defined in the Energy Strategy). The NECP was adopted in May 2022, by the Government of Republic of North Macedonia.

As the Energy strategy does, the NECP also takes a holistic approach and address the five main dimensions of the Energy Union in an integrated way recognizing the interactions between the different dimensions.

The strategic policy under the **decarbonisation dimension** envisages the realization of all identified climate change mitigation actions that will further reduce GHG emissions, and at the same time will increase the share of renewable energy sources in the gross final energy consumption in a sustainable manner. Around 70% of the total GHG emissions in the country originate from fossil fuel combustion activities in the energy sector, particularly in the energy transformation, industry, and transport sub-sectors. Therefore, promoting the transition of the energy sector towards low-carbon technologies as a key objective includes a strong plan for gradual decommissioning of the coal power plants and accelerating the utilization of renewable sources in the electricity generation mix in conjunction with energy efficiency measures in all sectors. The introduction of a CO2 tax will speed up the phasing-out of conventional fuels, and at the same time stimulate the investments in RES and implementation of energy efficiency measures. In the area of renewable energy, the country will continue its current support mechanisms for RES electricity generation via feed-in tariffs and feed-in premiums with auctions (granted in a tendering procedure). The country will promote further utilization of RES in the electricity sector (without incentives), but also in the other sectors through the introduction of the "prosumer" concept and by electrification of the heating and cooling sector using highly efficient heat pumps and district heating fueled by CHP biomass, as well as by increasing the biofuels consumption in the transport sector.

The decarbonisation dimension also foresees policies and measures for GHG emissions reduction in the non-energy sectors. The measures related to agriculture, forestry and land use include improvement of feeding and manure management practices in livestock breeding farms, land conversions that will reduce the soil erosion, and increase the soil organic matter and carbon sinks, as well as management of forest fires and afforestation of forestland that will contribute to additional absorption of GHG. The NECP also envisages the potential for GHG emission reduction from the waste sector, by improving waste management and treatment practices.

Concerning the **energy efficiency dimension**, North Macedonia will strive to maximise the savings in primary and final energy consumption. The projection with the current policies shows that the consumption of both, primary and final energy will increase by 38% and 55%, respectively, in 2040 relative to 2017, due to continuing economic growth. Having in mind that the country has the limited potential of lignite and biomass, as the most dominant domestic resources that are currently used, the goal is to pay special attention to energy efficiency. Therefore, North Macedonia is planning to implement a number of policies and measures over the period 2020 – 2040, in order to reduce the energy consumption in buildings (households, commercial and public), industry sector, transport sector, and to reduce the losses the energy transformation, transmission, and distribution network. Considering that the secondary legislation that should deliver the targets and roadmaps for energy efficiency (as required by the new Energy Efficiency Law) is still not developed, the NECP provides some indicative savings that can be achieved in the future, when all the requirements from legislative acts will enter into force.

The policies and measures relevant for building sector will focus on improving the energy performance of buildings by refurbishing of the existing and construction of new buildings (including passive buildings), as well as through promotion and introduction of more advanced end-use technologies (if possible, in combination with RES), utilization central heating systems, green procurements, etc. Regarding the industry sector, a priority is given to the improvement of the processes by using more efficient and advanced technologies, in combination with the energy management of the processes. Concerning transport, priority is given to policies for replacement of the road vehicle fleet (including the promotion of electric vehicles), promotion of advanced mobility (biking, walking, etc.) and using collective modes of transport, as well as a modal shift in freight transport from road to rail. The implementation of these measures in combination with the measures envisaged in the decarbonisation dimension will keep the primary energy consumption at the current level. This indicates notable energy savings relative to the BAU scenario (presented in the Energy Strategy), which is used to evaluate the indicative EE targets. In addition, all these policies and measures will have a direct effect on emission reductions, decrease import dependence, and stimulate the domestic economy with local job opportunities.

In terms of **energy security**, the country aims to become less dependent on energy imports by increasing the utilization of renewable sources and energy efficiency but, at the same time, plans to diversify its sources of supply through the use of natural gas (mainly in the industry sector). Analysing the current situation, the identified potential risks for the security of supply include limited use of domestic resources in energy production (mainly based on lignite, biomass and hydro), depleting coal resources, single interconnection point for natural gas supply, and high dependence on energy import (with nearly 60% of the total primary energy consumption). The policies and measures relevant to the security of energy supply are already addressed in the other dimensions. Thus, the measures for increasing the RES share envisaged in the decarbonisation dimension are highly pertinent for the diversification of domestic resources, but also for the reduction of energy import dependence when combined with the measures under the energy efficiency dimension. The flexibility of the system is expected to be increased by combining the utilization of RES with the electrification of the transport. The NECP also envisages diversification of the supply routes, through developing the gas transmission network, considering the significance of using the natural gas in the industry sector as a less carbon-intensive fuel that will reduce the GHG emission and improve the air quality resulting from this sector.

Regarding the **internal energy market dimension**, the NECP aims to establish an organized day-ahead market in North Macedonia, to enable coupling with the Bulgarian day-ahead market and to participate in initiatives for the establishment of regional market. In terms of the electricity interconnectivity, the country plans to improve the currently high level of connection, by finishing the new interconnection with Albania (as a project on the PECI List), thus enhancing the interconnectivity of the region. The country also plans to diversify the supply routes by realizing the planned natural gas interconnection with Greece (as a project on the Projects of Mutual Interest (PMI) list) and interconnections with Kosovo* and Serbia (as projects on the preliminary Projects of Energy Community Interest (PECI) list), that will ensure the security of the supply in the region. Also, the NECP includes continuous investments in the electricity transmission and distribution network, as well as the development of the gas transmission and distribution network in the country. Other plans for the development of the internal energy market that will increase the flexibility of the system for higher RES integration include improvement of the demand response level and introduction of real-time price signals that will encourage the consumers to have a pro-active role in balance services, thus increasing the capacity of energy storage. The NECP also envisages developing of an annual program for vulnerable consumers that will ensure their protection from the price shocks.

Concerning **research, innovation, and competitiveness dimension**, Macedonia will strive to include the energy transition technologies and measures in its research and innovation (R&I) priorities. In 2018, the country launched the process for developing a Strategy for Smart Specialization, which identified the energy sector as one of the priority areas that need innovation strategies, based on the objectives of the Energy Strategy for utilization of renewable energy sources and enhancement of energy efficiency. The NECP also identifies the need for frequent revision of the energy-related curricula at all educational levels to follow the innovative trends in science and technology, especially the energy transition trends.

In terms of funding the research and innovation activities related to energy and climate, the country plans to continue the national support via the mechanisms of the Fund for Innovation and Technology Development (like grants, loans, etc.) for support of innovation activities in micro, small and medium-sized enterprises (MSMEs). The FITD's programs, also include possibilities for new mechanisms targeted also to the public sector and large enterprises. These support mechanisms will enable knowledge and technology transfer between the scientific institutions and the industry, thus enhance the competitiveness of the business sector and at the same time support the industry-driven science. Also, the access to international support from the EU research and innovation programs (like Horizon Europe) and other donor funds should be further enhanced by establishing effective project management units in the responsible ministries (comprised of multidisciplinary officers involved in the planning, evaluation and monitoring procedures) and by increasing the competences of the institutions to effectively absorb such funds.

In terms of competitiveness, the NECP identifies that the SMEs should be encouraged and supported to diversify their portfolio of services and products in RES and EE, by providing suitable financial and technical mechanisms. The mechanisms included in the FITD programs (like co-financing grants, business accelerators, technology transfer offices, Science Technology Park, etc.) could be a good starting point towards improving the business environment and ensuring the competitiveness of companies.

The following are the main objectives of the 2030 NECP on renewables, energy efficiency and greenhouse gas emissions:

Decarbonization (GHG emissions and removals):

- 82% GHG net emissions reduction relative to 1990 level
- 66% emissions reduction in Energy sector (mainly through decommissioning of coal fired TPP Oslomej in 2021 and TPP Bitola up to 2027)
- 45% emissions increase in IPPU sector
- 29% emissions reduction in Agriculture sector
- 95% removals increase in FOLU sector
- 21% emissions reduction in Waste sector

Decarbonization (renewable energy):

- 38% share in gross final energy consumption
- 66% share in gross electricity production
- 45% share in gross final energy consumption for heating and cooling
- 10% in final energy consumption in transport

Energy efficiency:

- 20,8% savings of final energy consumption relative to BAU scenario

- 34,5% savings of primary energy consumption relative to BAU scenario
- Establishment of Monitoring and Verification Platform by 2021
- Development of Building Renovation Strategy
- 19% savings of final energy consumption in the transport sector relative to BAU

Energy security:

Energy import dependency of 59%, mainly thought:

- Fulfilling the RES and EE targets
- Continuous creation of a positive investment climate in RES
- Continuous maintenance and improvement of the transmission and distribution networks
- Increasing the number of prosumers
- Creating a system of guarantees of origin that will increase the value of projects in RES

Increase the diversification of energy sources and supply from third countries thought:

- Fulfilling the RES target
- Construction of additional interconnection pipelines with Greece, Kosovo*15 and Serbia

Increase the flexibility of the national energy system thought:

- Implementation of balancing market
- Construction of hydro-power plants (including pump storage) or gas fired power plants (including CHP)
- Construction of biomass and biogas power plants
- Implementation of viable demand response options, including vehicle-to-grid, power-to-heat and battery storage.

Internal energy market:

Maintain the high interconnectivity level

Maintain and upgrade the energy transmission infrastructure through:

- finishing the already started project for electricity interconnector Bitola-Elbasan up to 2023
- implementation of the projects for construction of the natural gas pipelines to Greece, Kosovo* and Serbia
- increasing the access to the natural gas transmission network, especially of the industrial consumers

Increase market integration through:

- establishing a day-ahead market as soon as possible
- coupling with IBEX (Bulgarian day-ahead market) and participation in the initiative for establishing a regional electricity market

- increasing the level of demand response
- increasing the number of consumers that can provide balance services and aggregators
- increasing the capacity of energy storage

Decrease energy poverty level through:

- ensuring the implementation of the provisions for protection of consumers (vulnerable consumers) by the suppliers
- stimulating the installations of solar thermal collectors for hot water, especially for the vulnerable customers
- carrying out annual programs for vulnerable consumers, with an appropriate increase in the intensity of the measures, based on annual needs
- introduction of energy poverty as a term in the relevant laws

R&D and competitiveness:

Increase funding for research and innovation, promote clean energy technologies and improve the competitiveness through:

- channelling more of the national funds into science
- research and innovation (R&I) activities related to energy and climate
- increasing the access to the EU funding programs for research and innovation (like Horizon Europe, the successor of Horizon 2020) and other international donors
- adjusting the energy-related curricula at all educational levels to be responsive to energy transition trends
- promote RES technologies and EE in the energy transformation and industry sector, in parallel with the electrification of heating and cooling sectors and transport
- development and adoption of Strategy for Smart Specialization
- encouraging and support of SMEs to diversify their portfolio of services and products in RES and EE by providing suitable financial and technical mechanisms

5.1.1.8 Serbia

The National Energy and Climate Plan for the period 2021-2030 with the vision until 2050 (NECP) for Serbia is currently being prepared, hence the targets have not been made public. However, preliminary analyses were done in the course of preparing the NECP, and the results of these analyses are presented in Chapter 5.2.1.8.

In April 2021, a set of laws in the energy sector has been adopted, including

- The Law on RES Utilization,
- The Law on Energy Efficiency and Rational Utilization of Energy, and
- Amendments to the Energy Law,

which have prescribed the obligation of preparing the NECP, as well as monitoring and reporting on its implementation, in accordance with the Energy Community regulations[75].

Prior to NECP, the following strategic documents in the energy sector had been adopted:

- The National Renewable Energy Action Plan until 2020 (NREAP), adopted in June 2013[76], which determined the goals/targets of using RES until 2020 as well as of the means of reaching these targets. The NREAP set the share of RES in final energy consumption in Serbia to increase (from 21.2% in the year 2009) to 27% in the year 2020. At the same time, the final energy consumption has been projected to increase from 9.1497 Mtoe (in the year 2009) to 10.3306 Mtoe in the year 2020 (an increase of 12.9%), without additional EE measures, i.e. to 9.495 Mtoe in the year 2020 with applied EE measures. Apart from RES target in the overall FEC, Serbia undertook the obligation to ensure the share of energy from RES in all forms of transport (RES-T) in 2020 to be at least 10 % of the FEC in transport on state/country level.
- The Energy Sector Development Strategy of the Republic of Serbia for the Period until 2025 with Projections by 2030[77] (the Strategy) has been developed in 2015. This document has provided projections of FEC in Serbia, which will be presented in this chapter. The Strategy is followed by the Program for Implementation of the Strategy.
- National Energy Efficiency Action Plans (NEEAP):
    - First NEEAP for the period 2010-2012[78],
    - Second NEEAP for the period 2013-2015[79],
    - Third NEEAP for the period until 2018[80], and
    - Fourth NEEAP for the period until 31/12/2021[81].

The validity of NREAP and NEEAP has expired, while the Program for the implementation of the Energy Strategy is valid until 2023. The NECP which is being prepared should replace the strategic documents which have expired.

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[75] https://www.energy-community.org/implementation/package/NECP.html.

[76] Conclusion of the Government of the Republic of Serbia of 04/06/2013 - OG RS 53/13; https://www.mre.gov.rs/dokumenta/sektor-za-zelenu-energiju/izvestaji/akcioni-plan-za-obnovljive-izvore-energije

[77] Official Gazette of the Republic of Serbia (OG RS) 101/2015, https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/skupstina/ostalo/2015/101/1/r.

[78] Adopted in June 2010.

[79] Adopted in October 2013 - OG RS 98/13.

[80]Adopted in December 2016 - OG RS 1/17),

https://arhiva.mre.gov.rs/doc/efikasnost-izvori/efikasnost/Treci_akcioni_plan_za_energetsku_efikasnost_Republike_Srbije_za_period_do_2018_godine.pdf

[81]https://www.mre.gov.rs/dokumenta/sektor-za-energetsku-efikasnost-i-toplane/ostalo/cetvrti-akcioni-plan-za-energetsku-efikasnost-republike-srbije-za-period-do-31-decembra-2021-godine

5.1.1.9 Slovenia

Slovenia submitted its NECP for the period from 2021 to 2030 in February 2020 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The key objectives and contributions of NEPN across the five dimensions of the Energy Union are set out below.

Dimension decarbonisation

Reduce GHG emissions in sectors not covered by the trading scheme by 2030 as laid down by the Effort Sharing Regulation for Slovenia, i.e. by at least 20% compared to 2005, achieving the following sectoral targets:

- transport: +12%
- general consumption: -76%
- agriculture -1%
- waste management: -65%
- industry (part of the sector not covered by the ETS): -43%
- energy (part of the sector not covered by the ETS): -34%

Ensure that LULUCF (Land Use Land Use Change and Forestry) sectors will not produce net emissions by 2030 (after applying accounting rules), i.e. emissions in the LULUCF sector will not exceed sinks.

In the area of adaptation, reduce Slovenia's exposure, sensitivity and vulnerability to climate change, and increase society's resilience and adaptive capabilities.

To reduce the use of fossil energy sources and dependence on importing them by:

- phasing out consumption of coal: by at least 30% by 2030, and the decision to phase out coal consumption in Slovenia in line with the principles of just transition by 2021,
- a ban on the sale and installation of new fuel-oil boilers by 2023,
- support for the implementation of pilot projects for the production of synthetic methane and hydrogen (the indicative target is a 10% share of renewable methane or hydrogen in the transmission and distribution network by 2030).

Reach at least a 27% share of renewables in energy end-use by 2030, i.e. (indicative):

- at least 2/3 of energy consumption in buildings to come from RES by 2030 (the share of RES in end-use of energy products excluding electricity and district heating),
- at least a 30% share of RES19 in industry,
- 43% share in the electricity sector,
- 41% share in the heating and cooling sector,

- 21% share in transport (with a share of biofuels of at least 11%).

Dimension energy efficiency

Improving energy and material efficiency in all sectors (and therefore reducing energy and other natural resources) as first key measure in the transition to a climate-neutral society.

By 2030 improve energy efficiency by at least 35% compared to the 2007 baseline (in line with the Energy Efficiency Directive).

Ensure systematic implementation of the policies and measures adopted so that the energy end-use does not exceed 54.9 TWh (4 717 ktoe). When converted to primary energy level, 2030 usage will not exceed 73.9 TWh (6 356 ktoe).

Reduce final energy consumption in buildings by 20% by 2030 compared to 2005 and ensure the reduction of GHG emissions in buildings by at least 70% by 2030 compared to 2005.

Dimensions energy security and internal energy market

Provide additional financial, human and technical resources to expedite the integrated development and management of the electricity distribution network to increase capacity, reinforce resistance to disruption and future development potential, boosting connectivity and adaptability, making it possible to exploit flexible sources and loads and expedite the incorporation of heat pumps, the roll-out of e-mobility and the integration of renewable electricity production and storage facilities.

Slovenia's other energy security and internal energy market targets for 2030 are:

- to ensure a reliable and competitive energy supply,
- to maintain a high level of electricity interconnection with neighbouring countries,
- at least 75% of electricity supply from sources in Slovenia by 2030 and by 2040, and ensuring an adequate level of security of electricity supply,
- to continue to exploit nuclear energy and maintain excellence in the operation of nuclear facilities in Slovenia,
- to reduce fossil fuel import dependency,
- to increase electricity distribution network resilience to disruption - increase the share of the underground medium-voltage network from the current 35% to at least 50%,
- further development of system services and the active role of clients,
- development of energy storage technologies, infrastructure and services,
- to establish a development-oriented regulatory framework to determine the amount of the network charge for the transition to a climate-neutral society,
- to support the development of an efficient and competitive market for full use of the flexibility of the energy system and new technologies

- support for cross-sectoral integration and implementation of new cross-sectoral system services,
- to encourage development and research cooperation between companies in and outside the sector,
- to ensure the further development of the pipeline system in accordance with the gas flows and system performance, including new sources of renewable gas and waste,
- to prepare a regulatory and support environment for renewable gas alternatives in the natural gas network, while analysing and determining the maximum possible share of hydrogen in the natural gas network,
- to support the implementation of pilot projects for the production of synthetic methane and hydrogen (with an indicative target 10% share of renewable methane or hydrogen in the transmission and distribution network by 2030),
- to provide appropriate conditions to maximise the share of renewable energy stored and used, when and where necessary, and to maximise the capacity of RES generating facilities,
- to enable the mitigation and reduction of energy poverty by accelerating the implementation of social policy measures, general housing policy measures and existing targeted measures.

Dimension research, innovation and competitiveness

Slovenia’s 2030 targets in the research, innovation and competitiveness dimension are:

- to increase investment in R&D - at least 3% of GDP by 2030 (of which 1% of GDP is public funding),
- to increase investment in human resources and new knowledge needed to move to a climate-neutral society,
- to support businesses for an efficient and competitive transition to a climate-neutral and circular economy,
- to stimulate targeted research projects and multidisciplinary R&D programmes and demonstration projects with the goal of achieving a climate-neutral society, in line with the direct interest of the economy or public sector, and meeting the country's development goals, in particular in the areas of energy efficiency, the circular economy and green energy technologies,
- to incentivise businesses to finance and become involved in R&D programmes and demonstration projects by means of an active tax policy,
- to promote new and bolster existing R&D programmes in line with the objectives of the NEPN and the Long-Term Climate Strategy,
- to promote the use of digitisation for climate action and increase cyber security across all strategic systems,
- to promote public and private sector R&D cooperation,
- to create competitive conditions for innovative research work in public companies.

5.1.2 Nationally Determined Contributions (NDCs) under the Paris Agreement

5.1.2.1 Albania

Albania has submitted its First NDC (2nd version) in October 2021.

Considering all sectors (including FOLU), emissions for the NDC scenario (with mitigation measures) increase from 10.139 kt CO_2e in 2016 to 11.978 kt CO_2e in 2030, which represents an increase of +18.1%. The difference, in 2030, with the BAU scenario, is -3.170 kt CO_2e, which represents a mitigation impact of -20.9%.

Overall, the mitigation actions accounted in the NDC scenario could help avoid, in total during the period 2021-2030, 16.828 kt CO_2e compared to the BAU scenario. This is the cumulative effect of the emissions reduction between NDC scenario and BAU scenario.

Regarding the energy sector, the NDC scenario takes into account the introduction of natural gas in almost all sectors (including energy industry, manufacturing industry, transport, commercial, residential and agriculture). It also considers the implementation of the different National Energy Efficiencies Actions Plans (NEEAP) to increase energy efficiencies in both supply and demand reaching a 15% gain in 2030. It also takes into account the National Renewable Energy Action Plan (NREAP) with objectives of a share of 38% of renewables in the final energy consumption in 2020 (already almost reached in 2019) and 42% in 2030.

5.1.2.2 Bosnia and Herzegovina

Bosnia and Herzegovina has submitted its First NDC (2nd version) in April 2021.

According to this version of NDC, the unconditional GHG emissions reduction target for 2030 is 12,8% compared to 2014 or 33,2% compared to 1990. The conditional target (with more intensive international assistance for the decarbonisation of mining areas) for 2030 is 17,5% compared to 2014 or 36,8% compared to 1990. GHG emissions reduction target for 2050 is 50,0% (unconditional) and 55,0% (conditional) compared to 2014, that is, 61,7% (unconditional) and 65,6% (conditional) compared to modelling 1990.

In the case of conditional target, more intensive international assistance is expected for faster decarbonisation of the power sector with an emphasis on fair transition of mining areas. Not all of these targets include GHG sinks. In the forestry sector, measures are planned to increase the sinks by 93 $GgCO_2eq$ until 2030.

Meeting the defined targets includes the following:

- Significant decarbonisation of the economy, especially power sector, with investments of approx. BAM 17 billion in the period until 2030, which is over 5% of GDP;
- Cessation of the long-standing emission growth trend in the short term;
- Ambitious reduction of GHG emissions in a relatively short period (2014 – 2030);

- Halving of emissions by 2050 compared to 2014;
- The targets imply reduction in GHG emissions by just over a third by 2030, and almost two-thirds by 2050 compared to 1990.

5.1.2.3 European Union

The European Union and its Member States submitted their intended nationally determined contribution (INDC) in March 2015 and it has been updated in December 2020.

The EU's INDC became its NDC when the EU ratified the Paris Agreement in October 2016.

The EU and its Member States, acting jointly, are committed to a binding target of a net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990.

The respective emissions reductions in force at time of this submission are as follows.

- Under Directive (EU) 2018/410 the EU Emissions Trading System: EU will reduce its emissions from the sectors covered by this legislation by 43% from 2005 levels by 2030;
- Under Regulation (EU) 2018/842, each EU Member State will reduce its emissions from sectors outside the EU ETS from 2005 levels by 2030 in accordance with the following percentage: Belgium 35%, Bulgaria 0%, Czech Republic 14%, Denmark 39%, Germany 38%, Estonia 13%, Ireland 30%, Greece 16%, Spain 26%, France 37%, Croatia 7%, Italy 33%, Cyprus 24%, Latvia 6%, Lithuania 9%, Luxembourg 40%, Hungary 7%, Malta 19%, Netherlands 36%, Austria 36%, Poland 7%, Portugal 17%, Romania 2%, Slovenia 15%, Slovakia 12%, Finland 39%, Sweden 40%.
- Under Regulation (EU) 2018/841 on the inclusion and accounting of greenhouse gas emissions and removals from land use, land use change and forestry in the EU framework, for the periods from 2021 to 2025 and from 2026 to 2030, each Member State shall ensure that emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all of the land accounting categories combined, as accounted in accordance with this Regulation.

5.1.2.4 Montenegro

Montenegro has submitted its First NDC (2nd version) in June 2021.

The updated NDC for Montenegro has set a target of at least a 35% reduction in total national GHG emissions (excl. LULUCF) by 2030 compared to 1990 (base year).

The mitigation benefits in the energy sector are related to renewable energies, and accordingly to a decrease in fossil fuel consumption. Also improvements to insulation will reduce the consumption of electricity and wood for heating and decrease cooling needs.

5.1.2.5 North Macedonia

The Republic of North Macedonia has submitted its First NDC (2nd version) in April 2021.

The enhanced nationally determined contribution to the global efforts for GHG emissions reduction by 2030 are following:

- 51% reduction in greenhouse gas emissions compared to 1990 levels.

  Disaggregated by sector (2030 vs.1990):
  - Energy: 66% reduction (mainly through decommissioning of coal-fired power plants Oslomej in 2021 and Bitola up to 2027);
  - IPPU: 45% increase;
  - Agriculture: 29% reduction;
  - LULUCF: 95% removals increase;
  - Waste: 21% reduction.
- expressed in net emissions, 82% reduction compared to 1990 levels.

The enhanced NDC is focused on mitigation area, with a vision to include adaptation component in the subsequent submissions, once the relevant national strategic and planning documents are prepared and adopted.

The enhanced NDC is coherent with the following sectoral non-GHG targets in 2030 stipulated in the draft National Energy and Climate Plan (NECP):

- Renewable Energy Sources (**RES**)
  - 38% share in gross final energy consumption
  - 66% share in gross electricity production
  - 45% share in gross final energy consumption for heating and cooling
  - 10% in final energy consumption in transport
- Energy Efficiency (**EE**)
  - 20.8% savings of final energy consumption relative to BAU scenario
  - 34.5% savings of primary energy consumption relative to BAU scenario

The enhanced NDC echoes the Green scenario from the National Strategy for Energy Development up to 2040 and is fully aligned with the draft National Energy and Climate Plan (NECP). It is consistent with the following long term (2040) goals:

- % reduction of GHG emissions vs. 2005: 61.5
- % of RES in gross final energy consumption: 45
- % reduction of primary and final energy consumption vs. BAU: 51.8 primary, 27.5 final

5.1.2.6 Serbia

The Republic of Serbia has been Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 2001 and to the Paris Agreement since 2017. In 2015, the Government of the Republic of Serbia submitted its Intended National Determined Contributions (INDCs), defining a 9,8% greenhouse gas emissions reduction by 2030 compared to base year emissions (1990). The first NDC also refers to losses and damages associated with extreme weather events and indicates the need to adapt to climate change. The Integrated National Energy and Climate Plan (INECP) for the period 2021-2030 is being drafted.

The Republic of Serbia communicated its updated Nationally Determined Contribution (NDC) for the period 2021-2030 in August 2022, increasing its ambition to the GHG emission reduction by 13,2% compared to 2010 level (i.e. 33,3% compared to 1990) by 2030.

5.1.3 Projects of Energy Community Interest (PECI), measures by the Western Balkan 6 Initiative, EUSAIR-labelled projects for electricity networks

Most of the planned projects compete with each other. Some are designated as Projects of Common EU Interest (PCI) by the EC that can benefit from accelerated permitting procedures and funding, some are designated as Projects of Energy Community Interest (PECI), Projects of Mutual Interest (PMI) by the Energy Community and some are included in the Ten-Year Network Development Plan (TYNDP) by ENTSO-E.

Following are the infrastructure electricity projects listed by promoting countries:

1. Trans-Balkan Electricity Corridor (Lead countries: Bosnia and Herzegovina, BA – Montenegro, ME – Serbia, RS)

The Trans-Balkan electricity corridor represents a project which goal is strengthening of the important regional and pan-European energy paths in directions from the northeast to the southwest and from east to west. Realization of Trans-Balkan corridor is fully in line with three basic goals of EU energy policy: increasing of security of supply, integration of renewable generation and establishing internal electric energy market across Europe, and is accordingly recognised in ENTSO/E pan European TYNDP as well as in the appropriate Regional Investment Plan of ENTSO/E and supported by EC.

The first investment item, 400 kV OHL Pancevo – Resica was marked by EC as a PCI (Project of common interest) and its realization was monitored by EC.

Energy Community marked all Sections of Trans-Balkan corridor as projects of the highest regional interest within the process of building the PECI list (PECI Projects of Energy Community Interest).

Trans-Balkan Corridor, consists of the following infrastructure investment items:

Serbia

1.1. New 400 kV OHL SS Kragujevac 2 (RS) – SS Kraljevo 3 (RS) with Voltage Level Upgrade of SS Kraljevo 3 (RS) to 400 kV

Project ID in TYNDP 227 Trans-Balkan Corridor

Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

Project code in PECI: EL_01a

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022

New 400 kV OHL between Kragujevac - Kraljevo with the upgrade of Kraljevo substation to 400 kV voltage level is a part of a wider project to further transition to 400 kV voltage in central and western Serbia. The length of this OHL is 60 km.

It accounts for one of the four first phase Trans-Balkan corridor infrastructure investment items and it was completed in 2022.

Pre-feasibility study completed in 2014. Feasibility study and Preliminary design finished in 2015. ESIA finished in 2016. Detailed design finished in 2017. Building permit for the works in S/s Kraljevo 3 and S/s Kragujevac 2 were obtained in 2016. Building permit for the transmission line was obtained in February 2018. The project was enlisted in EMS' investment plan 2018-2020 which was approved by Serbian regulator (AERS).

Construction has started in May 2020. Contracts for OHL construction was signed in March 2020, but contracts for SS was signed in September 2020.

The project is a part of the Trans-Balkan Electricity Corridor which will improve the energy trade across the whole region and with Italy to assist in the integration of European electricity markets thereby allowing for increased cross border trade and competition among suppliers. The purpose of the Project is to:

i. increase the transmission capacities,
ii. improve the efficiency and reliability of the power transmission system,
iii. improve the security and quality of power supply,
iv. contribute to the promotion of investments in Renewable Energies in Serbia and neighbouring countries.

Promoting country (organization): Serbia (EMS-TSO)

Construction: 2020 – 2022.

Commissioning: June 2022.

1.2. New Double Circuit 400 kV OHL SS Obrenovac (RS) – SS Bajina Basta (RS) with Voltage Level Upgrade of SS Bajina Basta (RS) to 400 kV

Project ID in TYNDP 227 Trans-Balkan Corridor
Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks
Project code in PECI: EL_01b
TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022

Upgrade of the transmission network in western Serbia to 400 kV between S/s Obrenovac and S/s Bajina Basta, which implies a new 2x400 kV transmission line S/s Obrenovac – S/s Bajina Basta, reconstruction of existing S/s Obrenovac and upgrade of SS Bajina Basta to 400 kV level accounts for one of the four first phases of Trans-Balkan corridor infrastructure investment items, due to be completed by 2027. The length of this OHL is 109 km.

Project pre-feasibility assessment completed in March 2010. Feasibility Study, Preliminary Design and Environmental Impact Assessment Study, funded by WBIF, were completed in 2011. However, due to incoherencies with the national legislation, KfW grant in amount of 250,000 EUR was received for adapting the studies to the national legislation, which was done in December 2017. Adoption to the national legislative finished in December 2017. Missing technical documentation (Design for Building Permit and Project execution plan). started to be prepared in May 2019. In 2021, Design for construction permit for SS and OHL was completed and Construction permit for both SS has been obtained.

In October 2022, the contract for consulting services for the construction of the SS's and OHL was signed with period of execution October 2022 – August 2027 under KfW Development Bank financing rules.

Promoting country (organization): Serbia (EMS-TSO)
Construction: August 2023 – August 2027.
Commissioning: August 2027[82].

[82] Updated based on the information for conclusion of the consulting contract.

Bosnia and Herzegovina, Montenegro and Serbia

1.3. New 400 kV interconnection between SS Bajina Basta (RS) - Visegrad (BA) - Pljevlja (ME) (part of Trans-Balkan corridor)

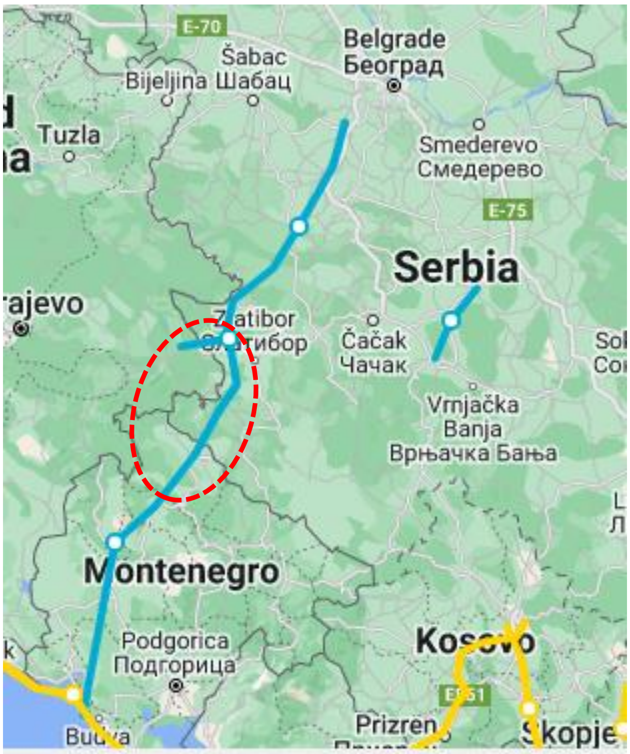
Project ID in TYNDP 227 Trans-Balkan Corridor

Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

Project code in PECI: EL_01c

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022

New 400 kV interconnection between Serbia, Bosnia and Herzegovina and Montenegro, which implies construction of a new double 400 kV OHL between SS Bajina Basta (Serbia), SS Visegrad (BA), SS Bistrica and SS Pljevlja (Montenegro) accounts for one of the four first phase Trans-Balkan corridor infrastructure investment items, due to be completed by 2025.



This project will encompass the following activities:

a) equipping of both systems of wires from SS Bajina Basta to Vardiste (BA),
b) equipping of one system of wires from Vardiste to border of Bosnia and Herzegovina and
c) equipping of one system of wires from Vardiste to border of Montenegro.

The length of this OHL is:

- 84 from Serbia to Bosnia and Herzegovina and Montenegro;
- 17,18 km from Bosnia and Herzegovina to Serbia and Montenegro;
- 15,7 km from Montenegro to Bosnia and Herzegovina and Serbia.

Currently the project status is in Permitting phase. **Documents:** Feasibility study is done and ToR for the technical documentation was developed as follows: Project Pre-feasibility Assessment (2013-2015); Feasibility Assessment, ESIA/EIA and Design Studies: RS (2013-2015), BA and ME (2013-2020); FEED/Main Design (2019-2021). In Serbia currently, Design for construction permit is in progress. In BIH: the Main design is in progress, Route survey was done in 2020, Tower spotting activities geological survey are in progress. In ME: As pointed out the preparation of the Preliminary Design by the IPF 7 Consultant is underway and the commencement of compiling the Main Design cannot be anticipated until the Preliminary Design is completed, tendering launched and the Contractor selected.

Permitting phase: RS: Permitting process started with the Design for construction permit. Application for construction permit is expected in Q3 2021 if financial construction is closed by this time. (Start Q2 2020 End: Q4 2021). BA: TSO is in progress with provision of Location Conditions according to national legislation. (Start October 2019, End February 2024)

Promoting country (organization): Bosnia and Herzegovina, Montenegro and Serbia (NOSBA, Elektroprenos BA (BA), EMS (RS), CGES (ME))
Construction: Expected to start in year 2024, provided that the investment grant is approved by WBIF in 2021.
Commissioning: Foreseen in 2027, provided that the investment grant is approved by WBIF in 2021.
Phase I: Visegrad-Bajina Basta 2023/2024.
Phase II: Visegrad-Pljevlja 2027.

Montenegro

1.4. Trans-Balkan Electricity Corridor – Grid Section in Montenegro – Part I

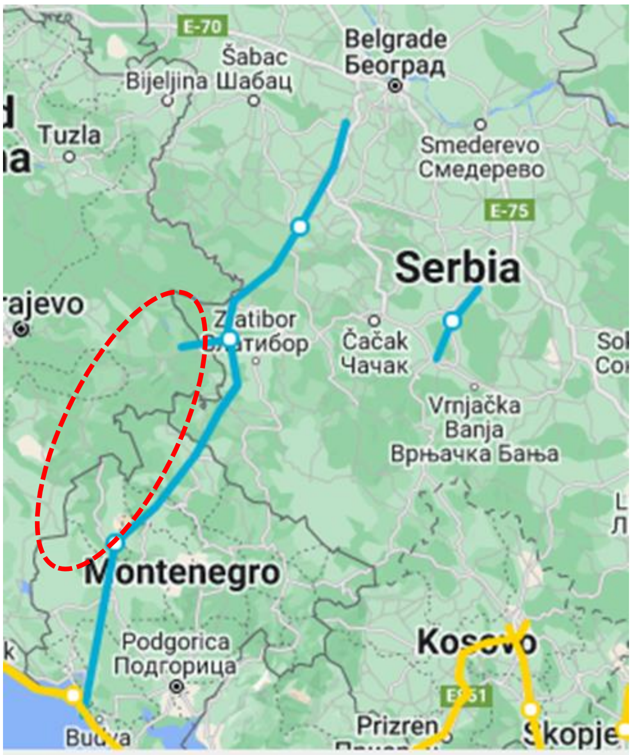
Project ID in TYNDP 227 Trans-Balkan Corridor
Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks
Project code in PECI: EL_01d

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022

The Trans-Balkan Electricity Corridor – Grid Section in Montenegro – Part I is consisted of 3 Lots:

Lot 1: Construction of SS 400/110/35 kV Lastva and extension of existing SS 400/220/110 kV Pljevlja;
Lot 2: Construction of OHL 400 kV Lastva-Cevo: construction of the double circuit line 2x400 kV Lastva-

Trebinje and Lastva-Pljevlja (section Lastva-Cevo) and the single circuit line 400 kV Lastva-Podgorica (section Lastva-Cevo); Lot 3: Construction of OHL Cevo-Pljevlja: construction of the 400 kV Lastva-



Pljevlja line (section Cevo-Pljevlja) which is partly double circuit and construction of OHL 2x400 kV Pljevlja-Border with Serbia. The project also includes replacement of high voltage equipment in substations; reconstruction of protection system in transmission network and construction of SS 110/35 kV Brezna.

Expected benefits are as follows:

- development of regional electricity market;
- increase of safety and reliability of operation of electricity transmission system facilities through its upgrade and reconstruction and elimination of bottlenecks for integration of renewable energy sources.

Total amount of the project is 155 mEUR. The project is financed by the loan (EBRD-60 mEUR, KfW - 25 mEUR), WBIF grant (25 mEUR) and CGES own funds. The main problems on the project are complex and long-lasting expropriation procedure. Current realization of the project:

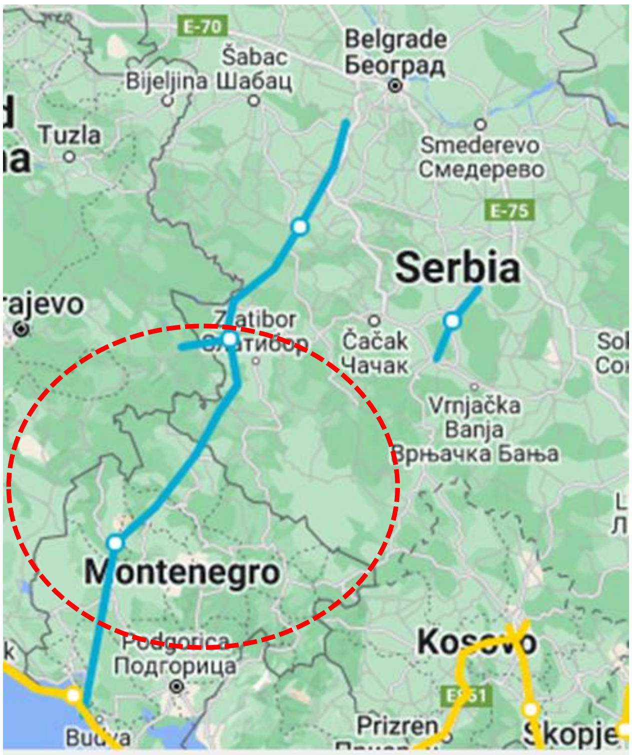
- Lot 1: The works are completed;
- Lot 2: Realised more than 98% of the works;
- Lot 3: Around 85% of the planned works realised.

Promoting country (organization): Montenegro (CGES-TSO)
Construction: 2008 – ongoing (ETA 2023).
Commissioning: ETA 2023.

1.5. Trans-Balkan Electricity Corridor – Grid Section in Montenegro – Part II

The project is included on the List of EUSAIR-labelled Projects and Measures on Energy Networks.
Project is the second part of a larger project with the full title “Trans-Balkan Electricity Corridor (I) – Grid Section in Montenegro” that aims to increase the cross-border transmission of electrical energy between Montenegro and Serbia, domestic transmission of electrical energy, efficiency of the transmission system in Montenegro by reduction of technical loses on transmission level and the security of the electric power supply in Montenegro by reduction of annual average outage

hours of electricity supply in transmission system substations in all parts of Montenegro. Part II of the project is divided into four components:



- Component 1: Replacement of high voltage equipment and other equipment in several high voltage substations.
- Component 2: Reconstruction of control and protection systems and the integration of several existing substations into SCADA communication
- Component 3: Replacement existing 220kV OHL with new 400kV OHL from Pljevlja 2 to Montenegrin border and extension of 400kV switchyard in substation Pljevlja 2.
- Component 4: Integration of SS 110/35 kV Brezna and associated transmission line into the public transmission grid.

The current status is in its final stages and official taking over for Component 1&2 (rehabilitation of 15 HV Substations) is expected in January 2023. The contract for Component 1&2 was awarded in July 2019 (Contract for Procurement of Works and Goods – LOT 1 (Reconstruction of transmission substations)) and in February 2020 works commenced on replacement of equipment in the substations on LOT 1. In September 2019: CGES signed the Agreement on purchase of infrastructure to connect WPP Krnovo to Montenegro's transmission grid.

Promoting country (organization): Montenegro (Ministry of Economy on behalf of Montenegro as Beneficiary and CGES as Project Executing Agency)
Construction: October 2017 – ongoing (ETA 2024/2025).
Commissioning: Component 1&2 - January 2023/ Component 4 – September 2019 / Component 3 – on hold (ETA 2024/2025).

2. Interconnection project North Macedonia and Albania

2.1. 400 kV OHL Bitola (MK) - Elbasan (AL)

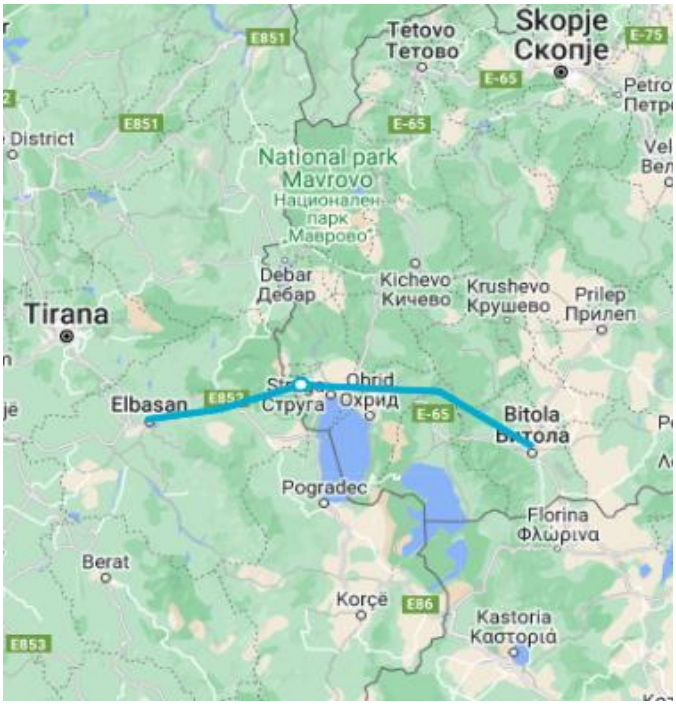
Project ID in TYNDP: Project cluster 147 (South Balkan CSE9, investment 239)

Project code in PECI: EL_02

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020

This project is a part of an initiative to establish a major East – West electricity transmission corridor between Bulgaria, North Macedonia, Albania and potentially Italy (via a planned submarine cable).

This section (Bitola to Albanian border, with substation at Ohrid) is part of North Macedonia / Albania section of that corridor. The section between Bulgaria and North Macedonia has been completed, and the submarine cable is now planned between Italy and Montenegro. Whilst the 400kV connection between Albania and Montenegro is operational, the Albania and Kosovo*83 connection is at tendering stage.



This project is part of the parent project, Elbasan – Bitola 400kV interconnection. Listed as Project of Energy Community Interest in 2013, Elbasan – Bitola 400kV interconnection is also featured in the Regional Investment Plan for CSE, 10 Years Network Development Plan of ENTSOE, and the national development plans of the two TSOs.

Promoting country (organization): Albania and North Macedonia (MEPSO-MK TSO and OST-AL TSO)
Construction: 2018 – ongoing (ETA December 2023).
Commissioning: December 2023.

3. Interconnection projects Bosnia and Herzegovina and Croatia

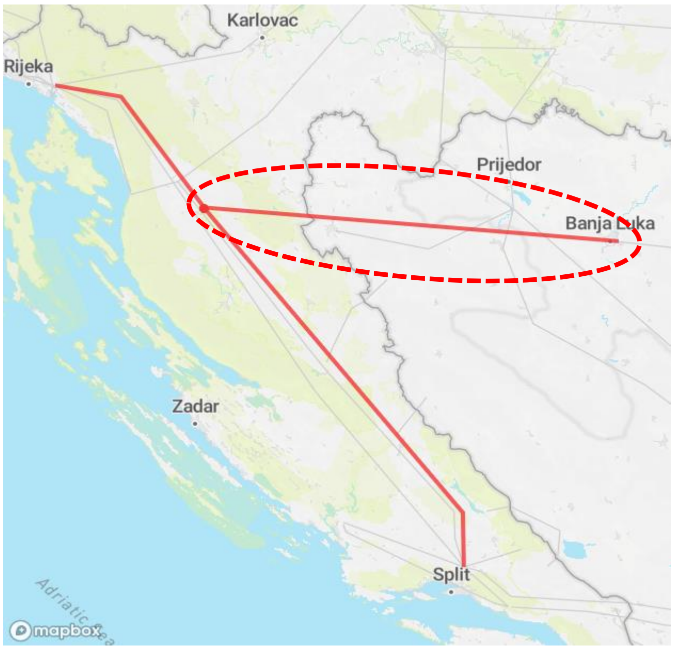
3.1. 400kV OHL Banja Luka (BA) - Lika (HR)

Project ID in TYNDP: 343
CSE1 New
Project code in PECI: EL_03
Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022
The project will contribute in strengthen Croatian transmission grid along its main north-south axis (in parallel with eastern Adriatic coast) allowing for additional long-distance power transfers (including cross border) from existing and new planned power plants (RES/wind/ and conventional/hydro and thermal/) in Croatia (coastal parts) and BA to major consumption areas in Italy (through Slovenia) and north Croatia. The increased transfer capacity will support market integration (particularly between

[83] Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

Croatia and Bosnia-Herzegovina) by improving security of supply (also for emergency situations), achieving higher diversity of supply & generation sources and routes, increasing resilience and flexibility of the transmission network.



Construction of new transmission infrastructure:

- an interconnector between Bosnia and Herzegovina and Croatia; Banja Luka – Lika (EL_03_1), and
- two internal Croatian lines;
  - Lika – Konjsko (EL_03_2) and
  - Lika – Melina (EL_03_3).

The Project implies increasing of transfer capacity between HR and BA by construction of new SS 400/110 kV Lika and its connection to an existing SS 400/220/110 kV Melina and SS 400/220/110 kV Konjsko in HR, and to an existing SS 400/110 kV Banja Luka in BA.

Status: In planning but not permitting. **Documents:** Feasibility study in progress.

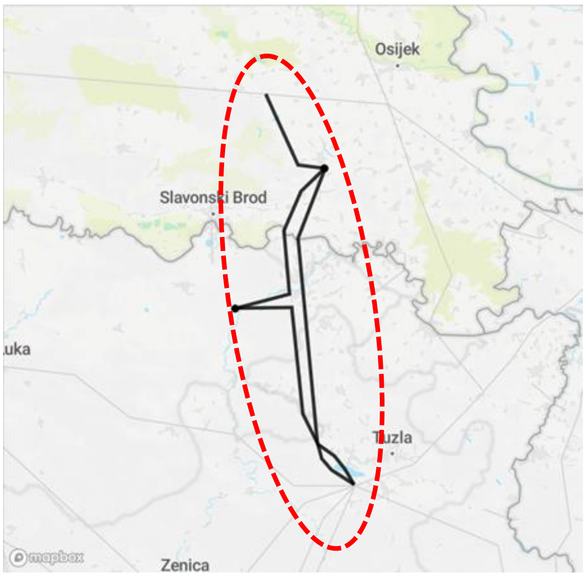
Promoting country (organization): Bosnia and Herzegovina and Croatia (NOSBA, Elektroprenos BA (BA), HOPS (HR))
Commissioning: 2033

3.2. Upgrading of Existing 220 kV Lines between HR and BA to 400 kV Lines

Project ID in TYNDP: 241
Project code in PECI: EL_04, EL_05
Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

TYNDP history: TYNDP 2020, TYNDP 2022

Upgrading of existing 220 kV lines between SS Dakovo (HR) and SS Tuzla/Gradacac (BA) to 400 kV lines.



The project 241, has been proposed assessed in the TYNDP 2016, based on the results of common planning studies performed in the CSE Region during preparation of regional investment plan 2015. The project assumes upgrade of existing 220 kV lines between SS Dakovo (HR) and SS Tuzla (BA) and SS Gradacac (BA) to 400 kV, with additional internal new double 400 kV line connecting SS Dakovo to existing 400 kV line Žerjavinec - Ernestinovo. This project is under consideration and there is a need for pre-feasibility study.

Status: Consideration phase

Promoting country (organization): Bosnia and Herzegovina and Croatia (NOSBA, Elektroprenos BA (BA), HOPS (HR))

Commissioning: 2032

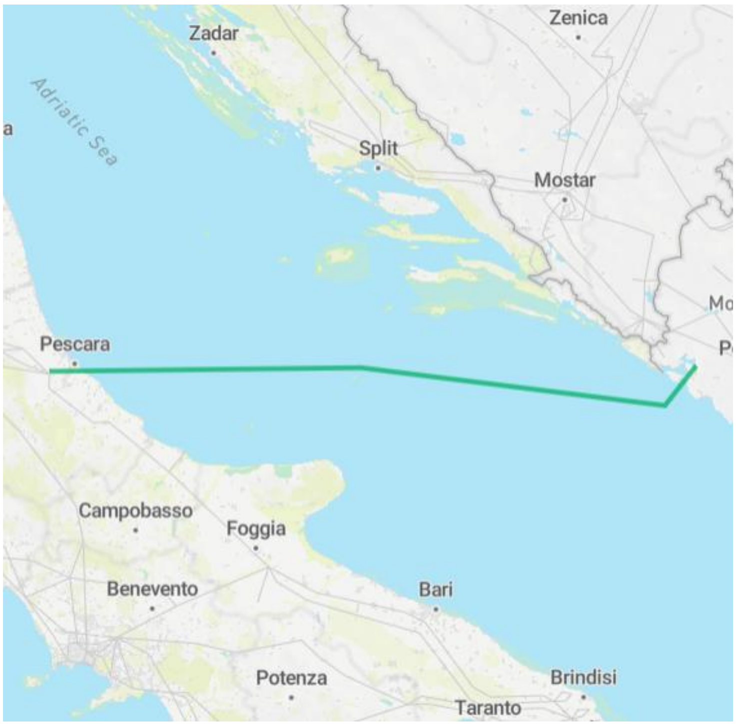
4. Doubling of Trans-Adriatic Power Interconnectors (Lead country: Italy, IT)

4.1. MONITA 2 – Doubling of Existing HVDC Power Link between Italy and Montenegro

Project ID in TYNDP: 227 Trans-Balkan Corridor and 144 Mid Continental East Corridor
Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

TYNDP history: TYNDP 2012, TYNDP 2014, TYNDP 2016, TYNDP 2018, TYNDP 2020, TYNDP 2022

The 600MW HVDC link between the Adriatic part of the Italian peninsula and Montenegro, between the 380 kV Villanova station in Italy and the Lastva station on the Montenegro's primary grid.



Of the 600 MW associated with the first module (went into commercial operation on 28.12.2019), a portion of 200 MW is available free of charge to private funders, in accordance with the mechanism provided for in Law 99/2009.

The MON.ITA project is an EU project of common interest. The interconnection consists of 2 cables (P1 and P2) extending for a length of approximately 16 km from the power station in Cepagatti to the landing point on the Pescara coast. TERNA Group financing for the public part. For the part of the project falling within the interconnector perimeter, the financing was made available by Interconnector Energy Italia s.c.p.a. - a consortium that groups together the so-called energy-intensive private companies (industrial consumers mainly in the steel, paper and chemical sectors) as assignee of the transport capacity for the Italy-Montenegro interconnector.

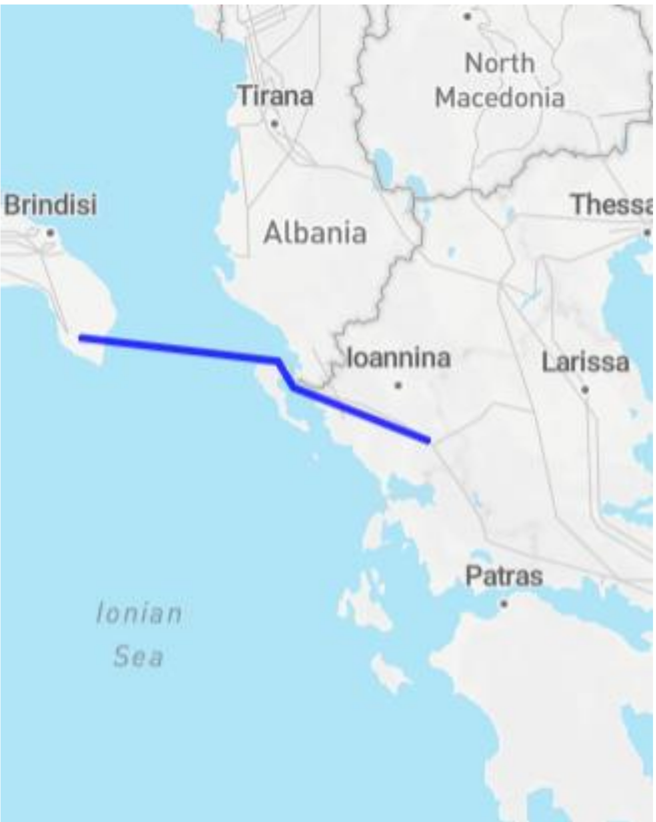
The second HVDC module (600 MW) of the Italy-Montenegro interconnection project is strictly correlated with the Trans-Balkan (project 227) and the Mid Continental East (project 144) corridors, and therefore contributes significantly to enable the usage of an increased transmission capacity between Italy and South-Eastern European Countries (especially Romania and Bulgaria)

Status: Under Construction.
Promoting country (organization): Italy and Montenegro (Terna - IT, CGES-MNE)
Commissioning: December 2026

4.2. GRITA 2 – New HVDC Power Link between Italy and Greece

Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks

The project concerns the development of a new HVDC link between Italy and Greece of 1000 MW capacity, in order to address future challenges and EU targets set. The new HVDC link between Italy and Greece along with the existing one called "Grita" with a capacity of 500 MW, will contribute to the safe management of the entire southern zone, thanks to the possibility of evacuating excess power form and towards Eastern Europe (Export) or providing adequate load coverage and reserve margins for the southern zone. The concerned TSOs, IPTO and Terna, work towards an agreement on the development of the project.



In April 2021, Terna and the Greek TSO IPTO signed the Agreement of Terms of Reference for a feasibility study of "New electricity interconnection project between Greece and Italy" aimed at carrying out joint studies for the implementation of the project. The technical and economical assessment between alternative configurations for the new HVDC link has been completed based on which the possibility to develop a new HVDC link with an additional transmission capacity up to 1000 MW has been identified. The project has been included in the current NDPs of IPTO and TERNA (update of the project as included in Terna's Development Plan 2021.

Status: Under Consideration.
Promoting country (organization): Italy and Greece (Terna - IT, IPTO-GR)
Commissioning: December 2031

4.3. Adriatic Power Link: New Underwater Power Line that through Abruzzo and Marche Regions

Included on the List of EUSAIR-labelled Projects and Measures on Energy Networks.

The project envisages the construction of an electrical connection in HVDC cable between Abruzzo and Marche, called "Adriatic Link". The "Adriatic Link" will be realized with a bipolar scheme with "bidirectional" electrodes. The operating voltage will be ±500 kV and the nominal power will be 1000 MW in bipolar configuration (i.e. 500 MW for each pole). The new interconnection, which will have a total length of approximately 276 km and will be completely 'invisible', will consist of a submarine cable, two underground cables - thus with no impact on the environment - and two conversion stations located near the existing power stations of Cepagatti (Abruzzo) and Fano (Marche).

The project is currently in the consultation and design phase. Public consultation is underway, which began on 6 September 2021 and will end by 2021, pursuant to current regulations (for the project, as it falls under the provisions of the 2021-2030 Integrated National Energy and Climate Plan (PNIEC), the provisions of Article 9, paragraph 4 of European Regulation 347/2013 and of Decree Law 76/20 apply). This will be followed by the planning for authorization and the start of the relevant authorization process expected in 2022, start of construction activities by 2024 and completion by 2028.

Status: Planned but Not Yet Permitting.
Promoting country (organization): Italy (Terna - TSO)
Commissioning: December 2028.

5.1.4 Other projects, relevant initiatives and measures either in the national programmes or supported by international and European financing institutions

In the present chapter, the Consultant summarized the data about other projects, relevant initiatives and measures different than those already included in the electricity infrastructure project categories from the PECI, PCI and PMI lists, as well as from those from the List of EUSAIR-labelled Projects and Measures.

The below data are not based on the information provided by the project promoters in their data submissions, but on the publicly know data and Consultants own elaboration. The below list is not exhaustive as mentions some of the most prominent ones:

1. Coal Regions in Transition

The Coal Regions in Transition Project for Western Balkans and Ukraine is a joint effort of the principals (European Commission, Energy Community, World Bank, EBRD, College of Europe, Government of Poland) who are working to deliver knowledge to coal regions and governments for planning and preparing for transition. In addition, the project will bring financial resources to assist selected regions in identifying and implementing pilot projects.

2. Clean Air Regions Initiative (CARI)

The Clean Air Regions Initiative (CARI) intends to incentivize regions and communities at a subnational level to mobilize in the field of air quality on a voluntary basis and to achieve improvements via the introduction of measures capable of reducing pollution (originating from burning fossil fuels, plastic and biomass in urban and rural areas) into the air. Recognizing the pressing need to tackle air pollution, the mayors of the municipalities signing the Declaration of the Clean Air Regions. The Initiative started in 2021.

3. Regional Energy Efficiency Programme for the Western Balkans (REEP)

Introduced in 2012, Regional Energy Efficiency Programme (REEP) was developed by EBRD in cooperation with the Energy Community Secretariat, and KfW, as a comprehensive package of bank financing, EU incentives, other donor funds for technical assistance (TA) and policy dialogue.

The programme helped to mobilized more than EUR 500 million for project financing, over EUR 80 million EU grants and over EUR 25 million other donors' grants. This programme is ongoing and financing is still available. REEP is structured around several "windows" of activities:

- Western Balkans Sustainable Energy Financing Facility (WebSEFF)
- Green Economy Financing Facility (GEFF)
- Direct EBRD financing facility (WebSDEFF)
- KfW credit facility of EUR 50 million for SMEs and public sector on-lending introduced in 2018.
- EBRD direct public sector finance of EUR 20 million of financing and EUR 2 million of investment grants targeting energy efficiency in public buildings.

4. Green Energy Financing Facility (GEFF)

EBRD has created a lending facility Green Economy Financing Facility (GEFF), for businesses and homeowners wishing to invest in energy efficient and green technologies in all EBRD COO. This benefits from the financial support of the European Union, Republic of Austria and the Western Balkan Investment Framework. Projects that have been successfully implemented and the energy and emission savings have been verified are eligible to receive an investment incentive of max 20% of the eligible investment costs incurred by a household, or up to 35% of eligible costs for a multi-apartment building.

5. Green for Growth Fund (GGF)

Initiated by EIB and KfW in December 2009, the Green for Growth Fund has supported energy efficiency and renewable energy loans worth hundreds of million in the Western Balkans and Eastern Europe. GGF's investments seek to achieve a 20% reduction in energy consumption and/or a 20% reduction in CO2 emissions. GGF is a public-private partnership involving donor agencies, international financial institutions and private institutional investors. The fund is supported by EIB, KfW, IFC, the German Federal Ministry of Economic Cooperation and Development, EBRD, Netherlands

Development Finance Company (FMO), Oesterreichische Entwicklungsbank AG (OeEB), several private institutional investors, and the European Commission.

6. Western Balkans Enterprise Development & Innovation Facility (WB EDIF)

Set up under the EU umbrella of Western Balkans Investment Facility, WB EDIF, was launched in December 2012 by the European Commission, the European Investment Fund, the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB), acting as co-lead international financial institutions. Although this is not directly addressing support to energy efficiency or small renewable investments, it aims at increasing the financial resources made available to SMEs based in the Western Balkans, in order to support socio-economic development and EU accession across the Region.

7. Renewable District Energy in the Western Balkans (ReDEWeB) Programme

The Renewable District Energy in the Western Balkans Programme (the ReDEWeB Programme) is devlooped by EBRD and will contribute to enabling investment in the Renewable District Energy (ReDE) Sector of the Western Balkans (WeB). District Energy (DE) Systems produce and store hot water or chilled water, which is then piped underground to individual residential and commercial buildings for space heating, domestic hot water, and cooling. The beneficiaries of ReDEWeB are: Albania; Bosnia and Herzegovina; N. Macedonia; Kosovo*84; Montenegro; and Serbia. In view of the challenges and opportunities for ReDE, the aim of ReDEWeB Programme is to facilitate the development of up to 10 ReDE projects, and to provide the policy and technical support needed for investment origination and support.

8. USAID Investments in Developing Energy Assets (IDEA) Programme

The purpose of the USAID Investments in Developing Energy Assets (IDEA) is to improve regional energy supply security, reliability and efficiency through supporting investments in all segments of the energy sector, including heat and power generation facilities, transmission and distribution networks, renewable sources, demand side improvements, and water supply and sanitation infrastructures. Activities under this mechanism will be focused primarily on developing energy sector infrastructure projects requiring substantial capital investment. Investment projects requiring smaller investment will also be considered as long as they improve reliability, safety, and efficiency of the energy assets, thus materializing a significant reduction of energy resources needs, and improving energy security.

9. World Bank

In 2022 World Bank conducted a project named: Western Balkan Clean Energy Transition: Least Cost Generation Planning and Variable Renewable Energy Grid Integration Analysis. Through the project, a document was produced that provides an overview of the key assumptions and scenarios for the technical analysis performed under the project. The focus of the text is on the (initial) scenario framework and assumptions for conducting the least-cost generation expansion plan (LCGEP). The

[84] Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

scenario framework is aligned with the assumptions of the 2020 edition of the Ten-Year-Network-Development-Plan (TYNDP) of ENTSO-E, and focuses on the WB6 region.

5.2 Power generation and demand forecasts to the year 2030 for each EUSAIR Member State and the Adriatic-Ionian Region

5.2.1 Estimated shares of power generation by primary energy sources (including RES) and the consumption of the electricity by final sector

5.2.1.1 Albania

Electricity production in Albania is almost exclusively based on hydropower and is therefore renewable. Aspects of energy security play an increasing role with changing climate conditions and diminishing rainfall. Dry years with low hydroelectric output can currently not be compensated by other production technologies.

Possible solutions are an increased electricity interconnection with neighboring countries, combined with the expansion of other renewable sources like solar power or wind energy that are subject to different temporal variations than hydropower.

Solar PV sees an increase in power generation with existing measures. Further, considerations are made to refurbish the Vlora thermal power plant to be fueled with natural gas. The Transadriatic Pipeline (TAP) entered into operation in late 2020 and brings gas from Azerbaijan. Gas has a very flexible character in energy generation but will increase the GHG emissions of the electricity production sector. Relying on imported gas does not necessarily improve the situation of energy security.

According to the NECP scenarios, also in the CPS scenario it is expected a natural gas supply for Vlora Thermal Power Plant from 2025. The plant has a capacity of 97 MW.

The share of renewable electricity (RES-E) in final energy consumption determined according to Directive 2009/28/EC is largely determined by hydropower, with increases projected for solar PV.

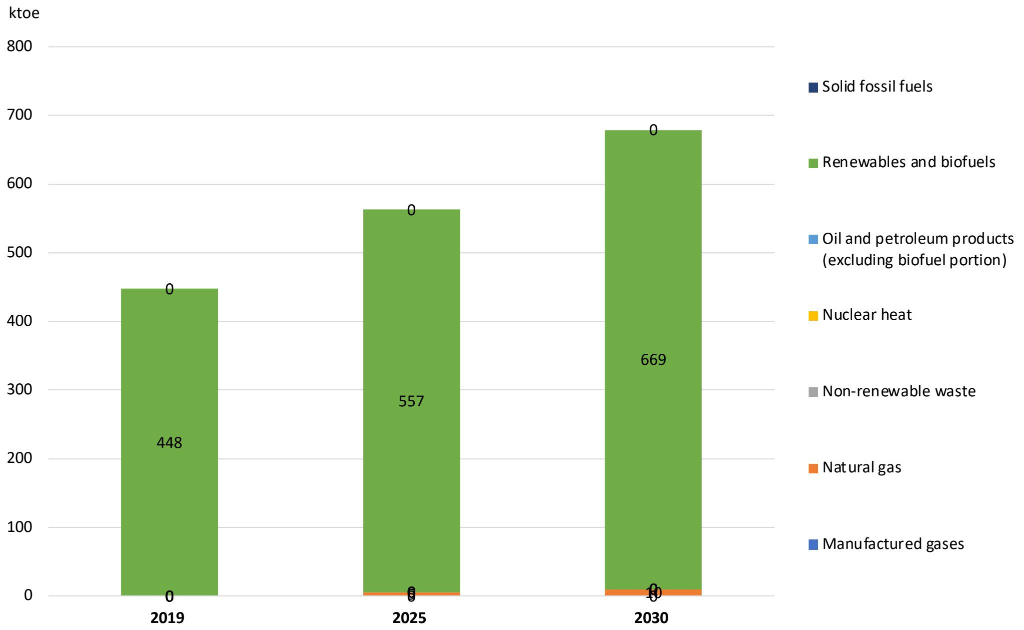


Figure 38 – Power generation in CPS in Albania

Source: Consultant's elaboration on NECP, Eurostat and IEA data

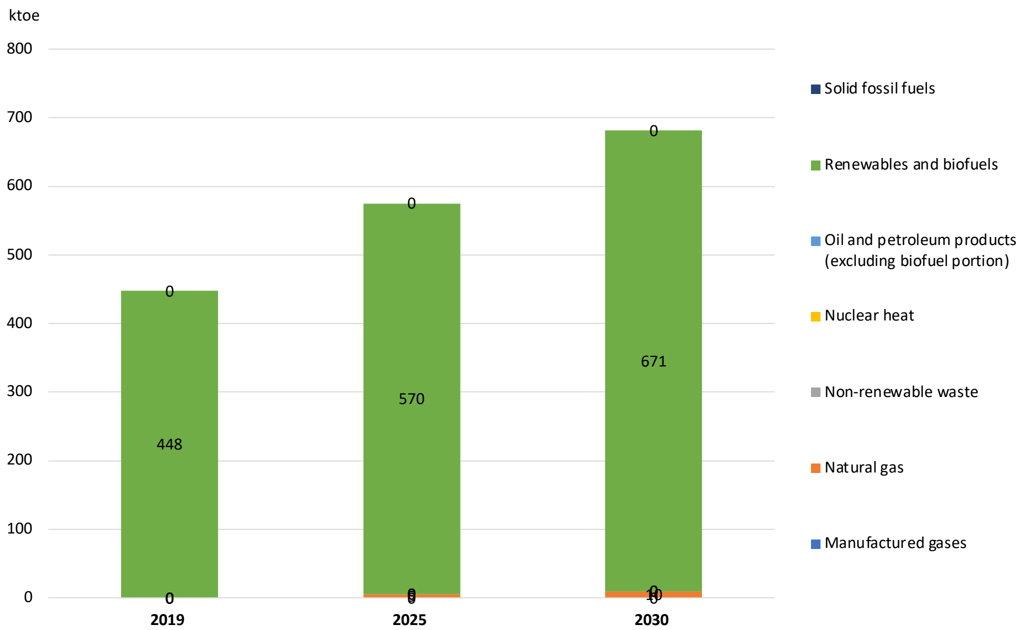


Figure 39 – Power generation in NPS in Albania

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Regarding final electricity consumption, in both scenarios this is expected to slightly increase in 2030, while a more sustained increase is expected in 2040.

In the CPS, however, electricity consumption is expected to be fairly stable in all sectors, while in the NPS the increase in electricity consumption in the industrial sector is offset by the decline in the residential sector.

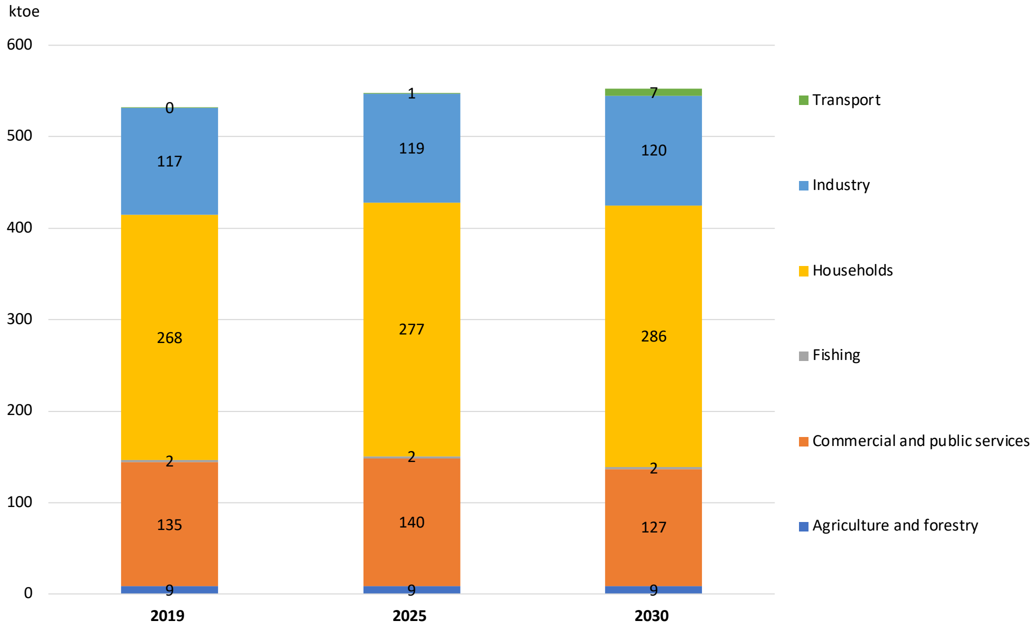


Figure 40 – Electricity consumption in CPS in Albania

Source: Consultant's elaboration on NECP, Eurostat and IEA data

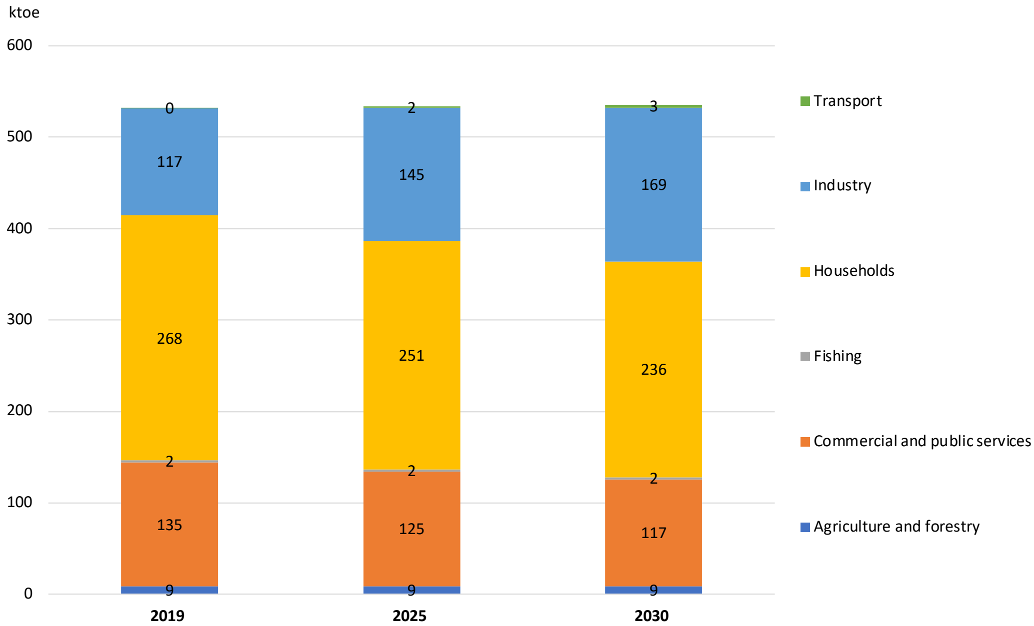


Figure 41 – Electricity consumption in NPS in Albania

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.2 Bosnia and Herzegovina

At the moment, the NECP for Bosnia and Herzegovina is under preparation, therefore the CPS and NPS scenarios were built starting from those of the IEA.

As regards electricity generation, the use of coal in Bosnia and Herzegovina is still important, and in both the CPS and NPS scenarios a complete phase-out of coal is not envisaged, which however in the NPS scenario becomes marginal.

In both scenarios, on the other hand, significant growth of renewables in electricity generation is expected while power generation from natural gas stands marginal.

Due to the country's exposure to coal, these scenarios, in particular the NPS one, could be critical for the security and stability of the electricity system, which would see a sharp reduction in domestic production by 2030 not replaced by other productions.

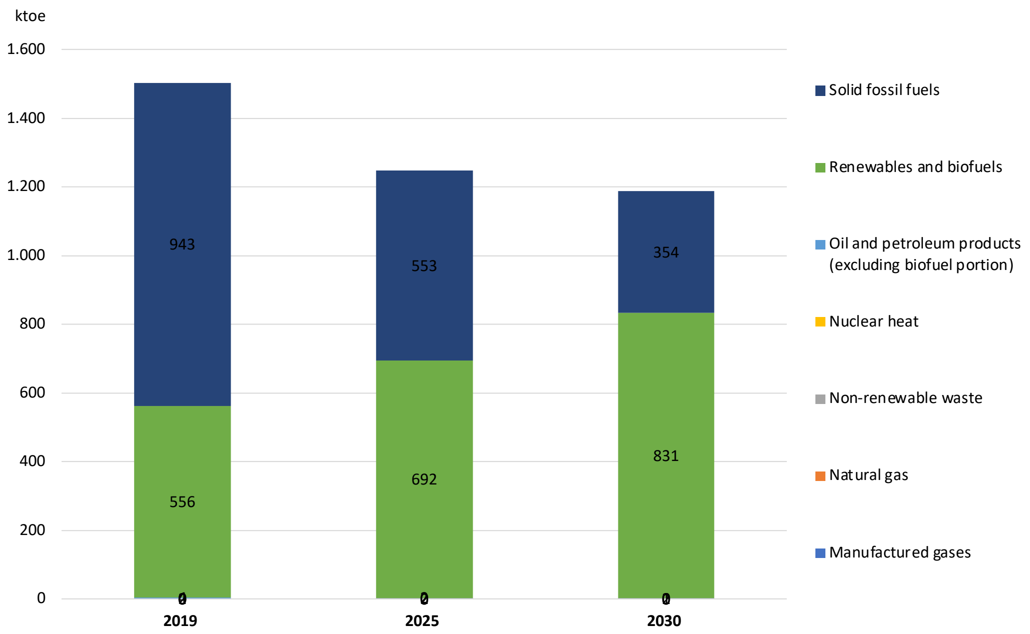


Figure 42 – Power generation in CPS in Bosnia and Herzegovina

Source: Consultant’s elaboration on Eurostat and IEA data

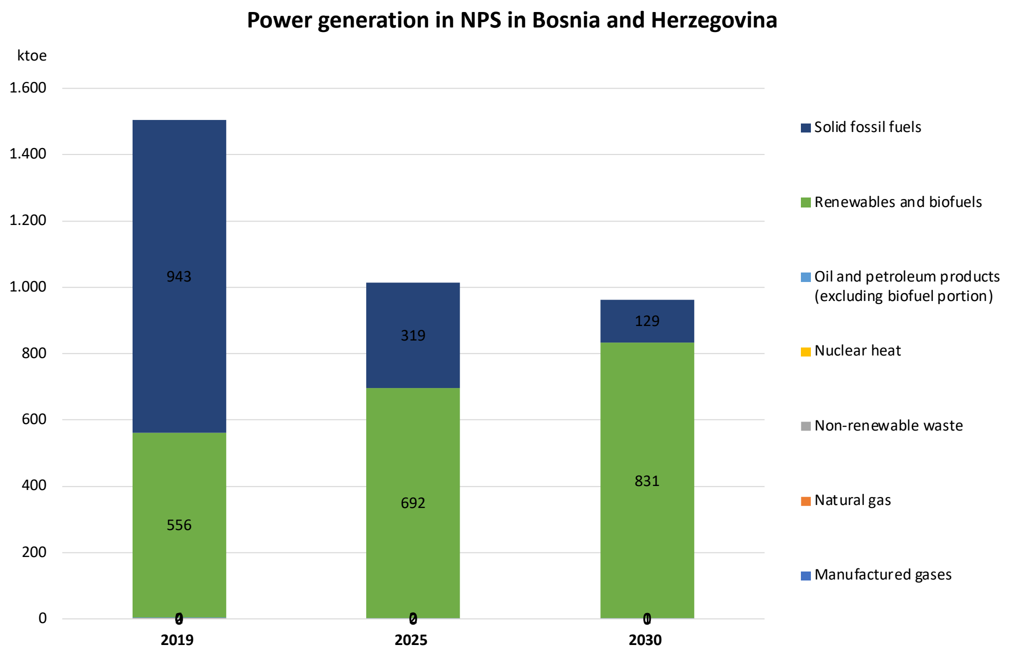


Figure 43 – Power generation in NPS in Bosnia and Herzegovina

Source: Consultant's elaboration on Eurostat and IEA data

As regards the evolution of electricity consumption, a slight increase is expected in both scenarios by 2030; however, in the NPS scenario the main driver of electricity consumption increase is related to the electrification in transport, while in other sectors a greater commitment to energy efficiency tends to partially offset this increase.

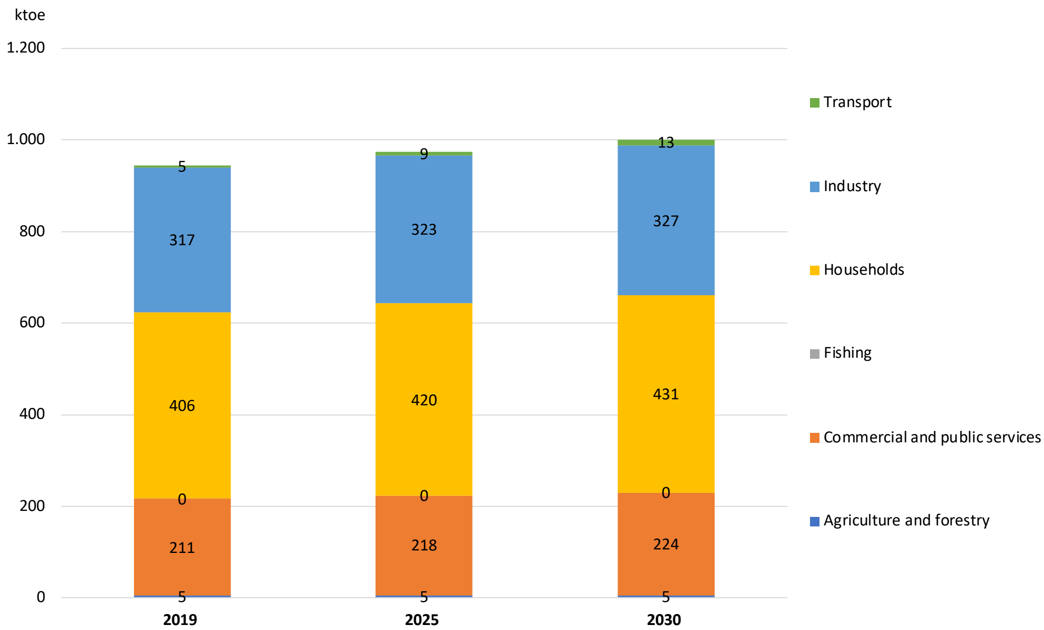


Figure 44 – Electricity consumption in CPS in Bosnia and Herzegovina

Source: Consultant's elaboration on Eurostat and IEA data

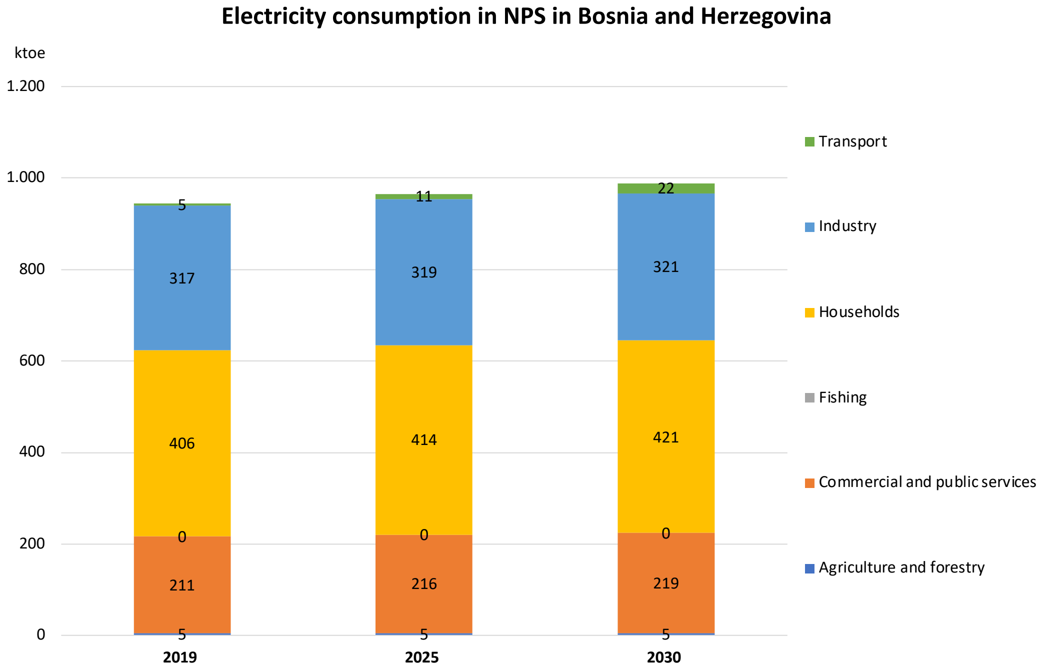


Figure 45 – Electricity consumption in NPS in Bosnia and Herzegovina

Source: Consultant's elaboration on Eurostat and IEA data

5.2.1.3 Croatia

The total installed capacity in power generation plant in Croatia is almost 5 GW, of which more than 2 GW in hydropower power plants (HPPs). Of these, 9 HPPs are accumulation power plants with a total capacity of more than 1,5 GW, 7 HPPs are run-of-the-river hydropower plants with a total capacity of 0,4 GW, 36 HPPs are small hydropower plants with a total capacity of 45 MW and one is a pumped-storage hydropower plant with a capacity of 276 MW in turbine operation and 240 MW in generator operation.

By 2030, the construction of two to three large hydropower plants, several small hydropower plants (on watercourses and water supply systems) and one pumped-storage hydropower plant is expected. Revitalization of existing plants is expected to extend their life cycle with a slight increase in the power of hydropower plants.

The main difference between the two scenarios for the power generation sector in Croatia up to 2030 are related to the RES installed capacity: in NPS, indeed, the capacity installed in hydropower plants, wind and solar photovoltaics is higher in 2030 respect the CPS estimations.

Biomass, coal plants, natural gas, fuel oil and nuclear remains the same in both scenarios, according to projections contained in NECP. For these sources, indeed, are expected stable capacities (e.g. for coal and nuclear), a small difference for gas plants (from 997 to 1.048 MW installed) and biomass (from 145 to 148 MW) and the phase out from fuel oil in 2025 both in CPS and in NPS.

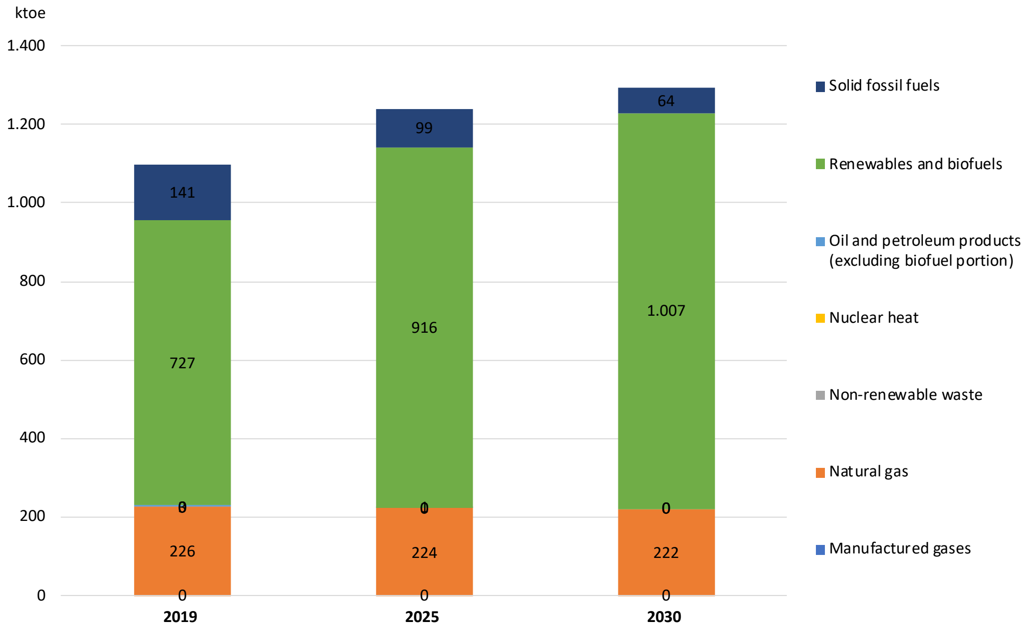


Figure 46 – Power generation in CPS in Croatia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

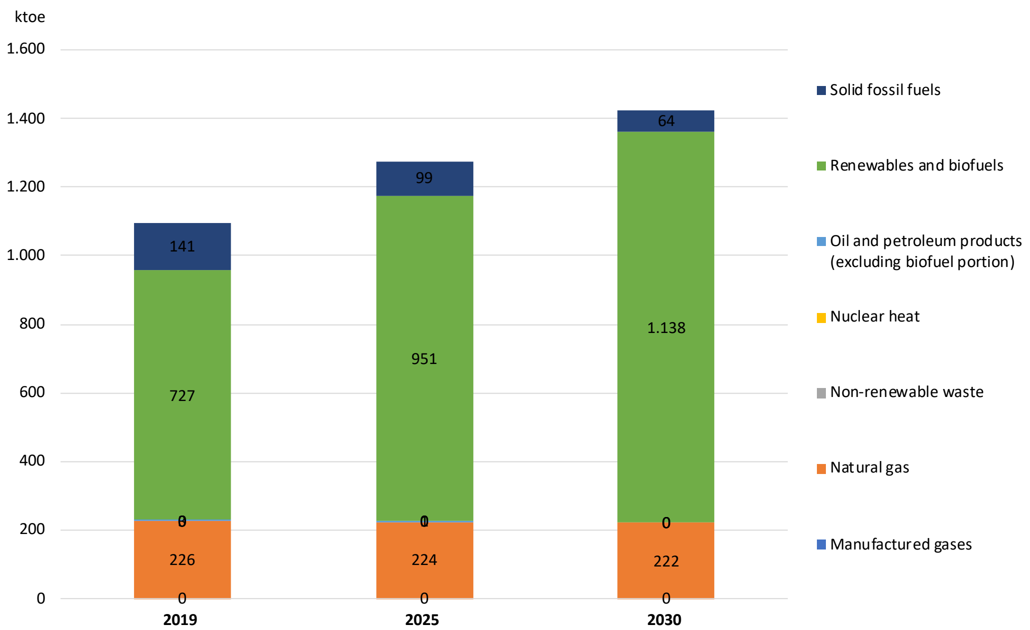


Figure 47 – Power generation in NPS in Croatia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Regarding final electricity consumption, in CPS is expected to slightly increase in 2030, while in NPS is expected a more sustained increase, guided from electrification of final uses in all sectors, primary buildings and transport.

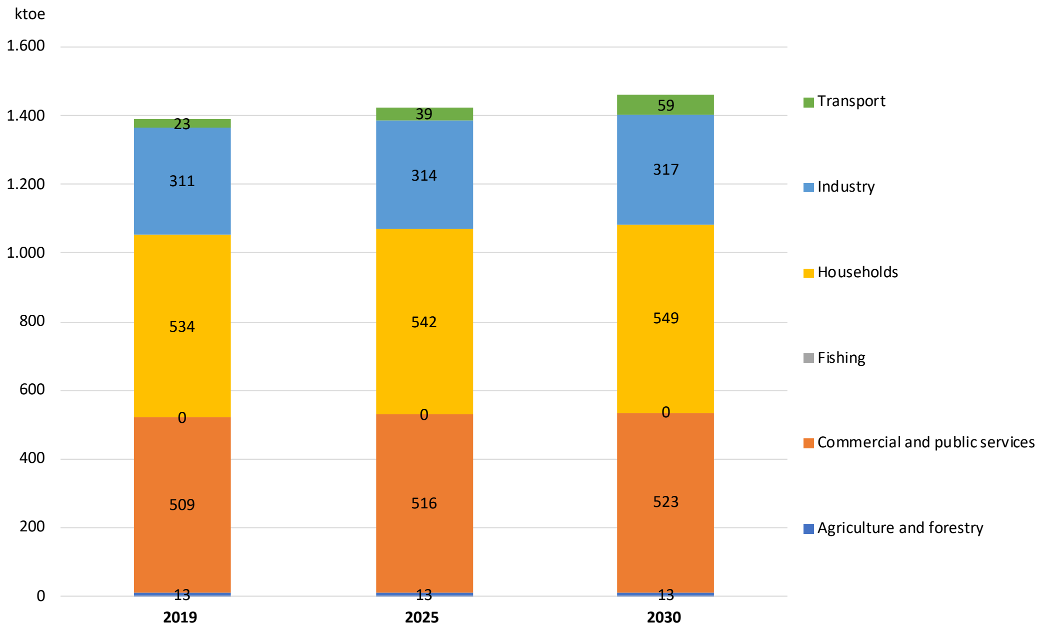


Figure 48 – Electricity consumption in CPS in Croatia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

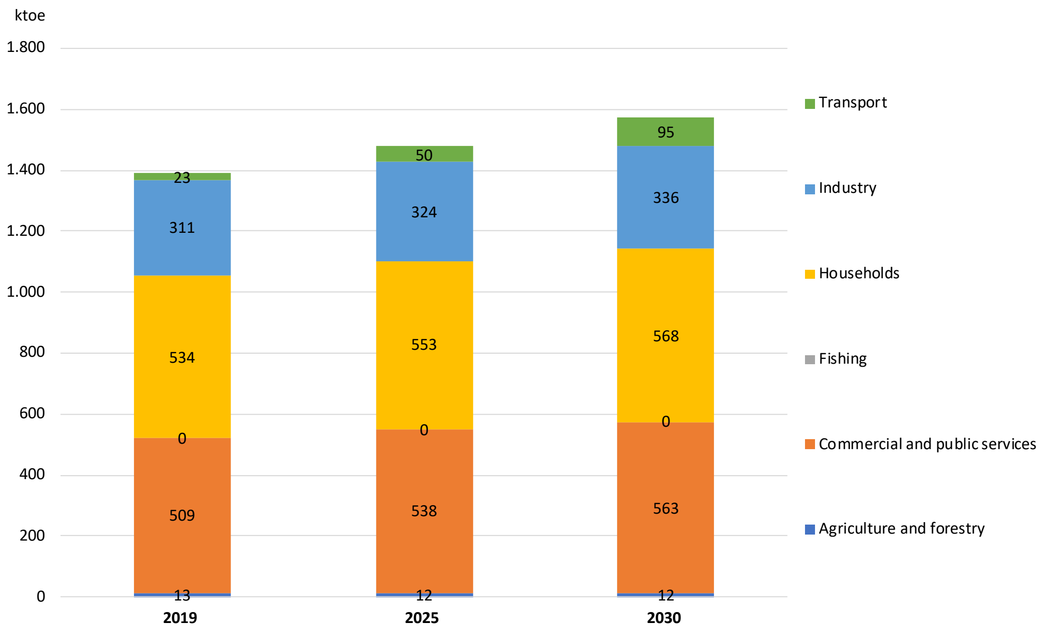


Figure 49 – Electricity consumption in NPS in Croatia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.4 Greece

According to the current NECP of Greece (Dec. 2019), the evolution of the Greek electricity generation system by 2030 is marked by a significant penetration of RES and the withdrawal of lignite plants by 2028, which is planned under the new national policy on lignite phase-out of the energy sector, and the reduction in installed capacity of the oil plants, which are expected to be decommissioned on the one hand due to the high emissions of gaseous pollutants and the age of these plants and on the other because of the impending power interconnections of the islands to the interconnected system during the period under consideration. The new NECP (to be finalized in 2023) is based on the REPowerEU plan, therefore a strong decline of natural gas consumption is foreseen.

It is noted that part of the petroleum plants on the islands which will be interconnected will continue to exist, mostly on cold standby. However, their operation will be considerably limited as, on the one hand, the electric charge of islands will be mainly covered by the interconnected system and, on the other hand, the implementation of the IED and MCPD Directives will be decisive in determining the maximum number of hours of operation.

RES penetration into the gross domestic product mix in 2030 is expected to reach a share of around 80%. due to the expected further reduction in the cost of RES technologies for electricity generation, especially photovoltaic and wind power plants. RES is planned to gradually replace lignite plants.

The retention of the relatively significant shares of natural gas in electricity generation by 2030 (> 30%) is due to its enhanced role as distributed generation technology following the total withdrawal of lignite-fired power plants.

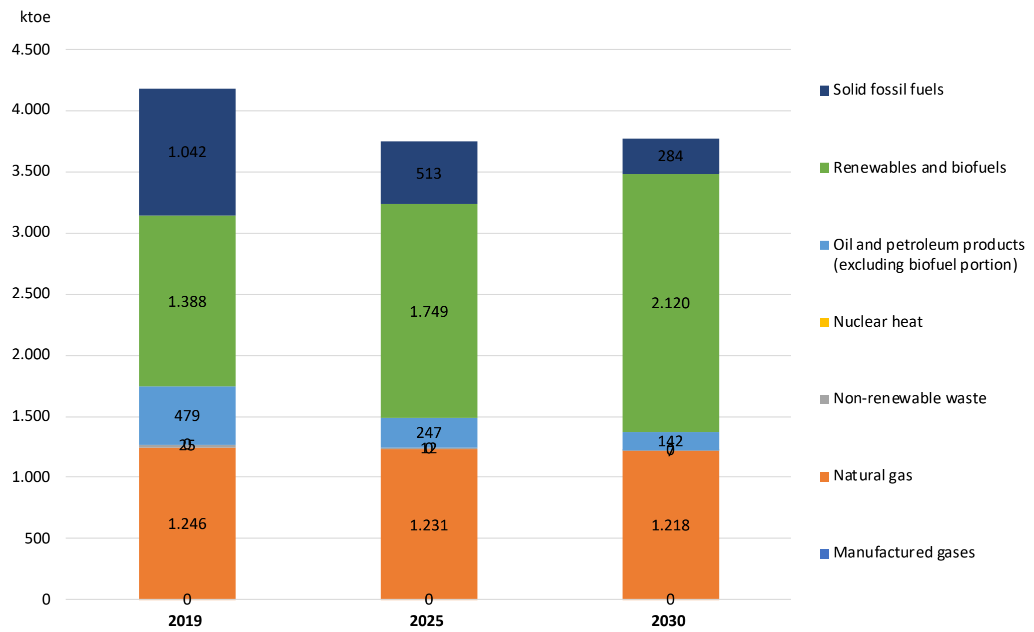


Figure 50 – Power generation in CPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

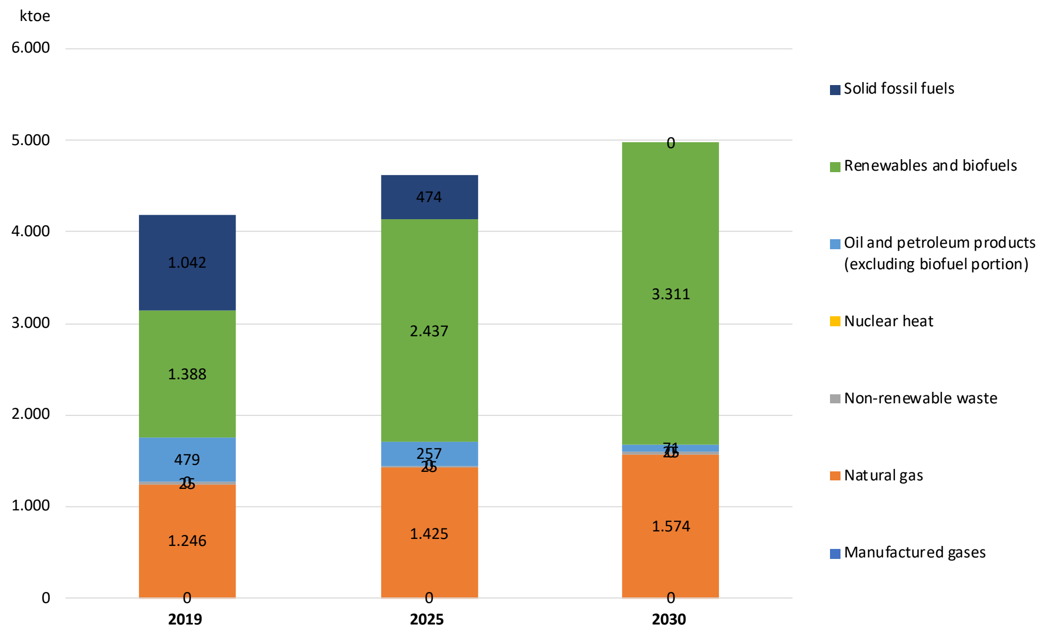


Figure 51 – Power generation in NPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

With regard to final electricity consumption, these are expected to increase in the NPS, while remaining rather stable in the CPS scenario.

In the NPS scenario, the increase in electricity consumption concerns all sectors, with the residential sector becoming the first sector for electricity consumption, overtaking the tertiary sector. The residential sector, together with transport, is in fact the one with the greatest growth in its electricity consumption.

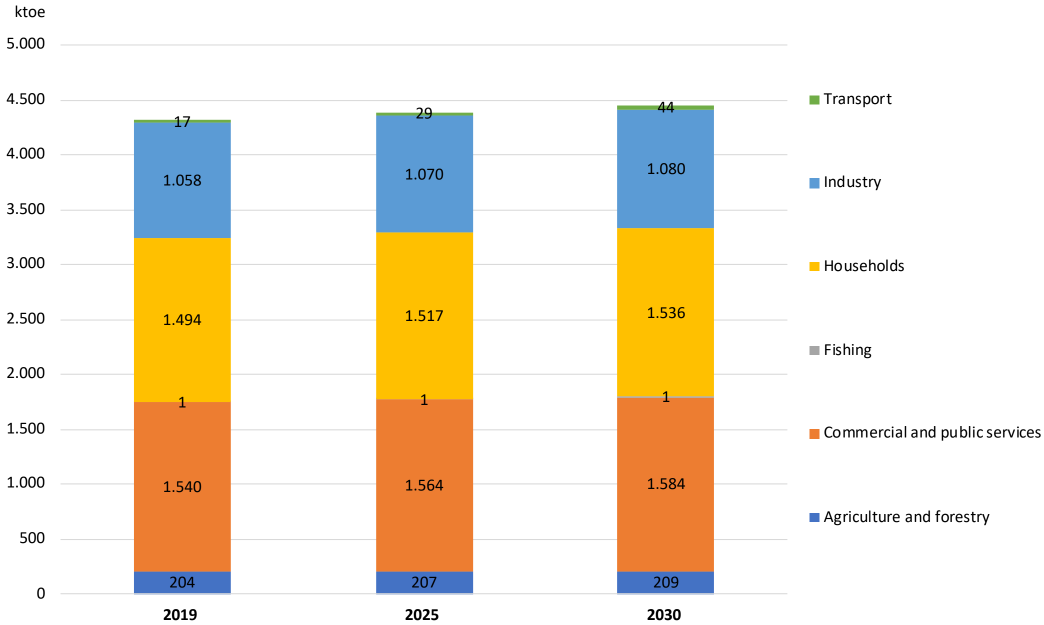


Figure 52 – Electricity consumption in CPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Figure 53 – Electricity consumption in NPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.5 Italy

According to the objectives of the Italian energy policy, electricity production facilities are undergoing a major transformation thanks to the target of phasing out coal-fired generation by as early as 2025 and the promotion of the widespread use of renewable energy sources.

Without prejudice to the need to accelerate growth of renewable energies, in the context of the overall measures (storage, networks, flexible generation, other network operations) to be implemented by 2030, some infrastructure changes are linked in particular to the phasing out of carbon and, in particular, are to be launched in the period 2020-2025: above all, is provided new gas capacity for around 3 GW, of which around 50% is substantially linked to the phase-out.

The new capacity for gas-fueled generation (with a resulting temporary increase in gas consumption, with no associated infrastructural development envisaged for the time being) will help cover the needs and maintain the adequacy of the system in the next few years. More specifically, taking into account the phase-out of coal-fired power stations, in view of their intrinsic characteristics (potential to respond quickly and for prolonged periods to wide ranges of electrical load), gas-fueled power stations will ensure the flexibility the system needs, compensating for the significant increase in non-plannable renewable production and ensuring that the system maintains its levels of safety, security, adequacy, resilience and quality of service.

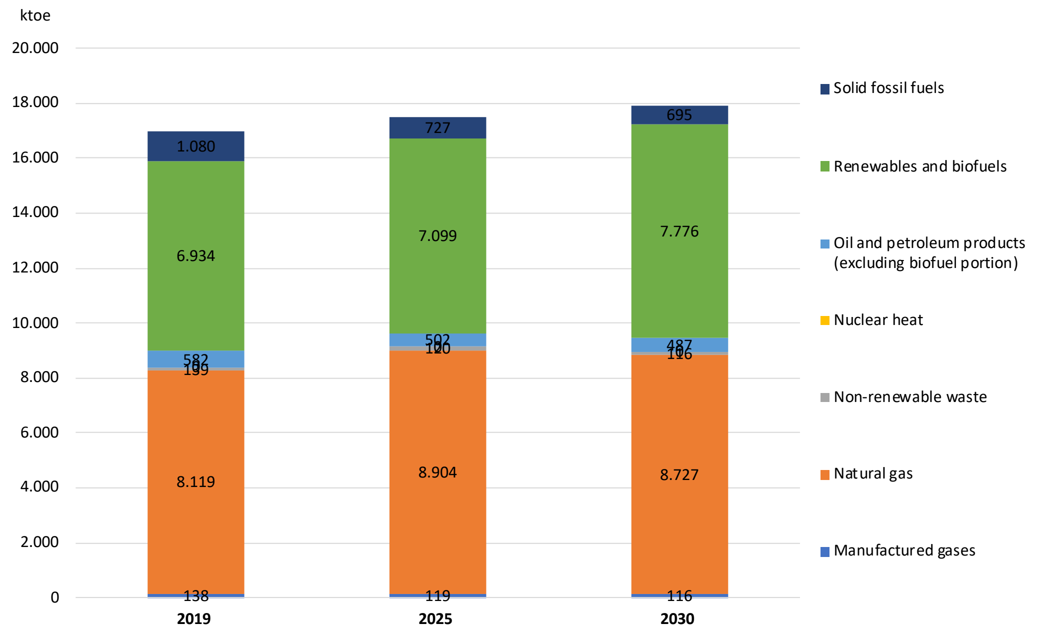


Figure 54 – Power generation in CPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

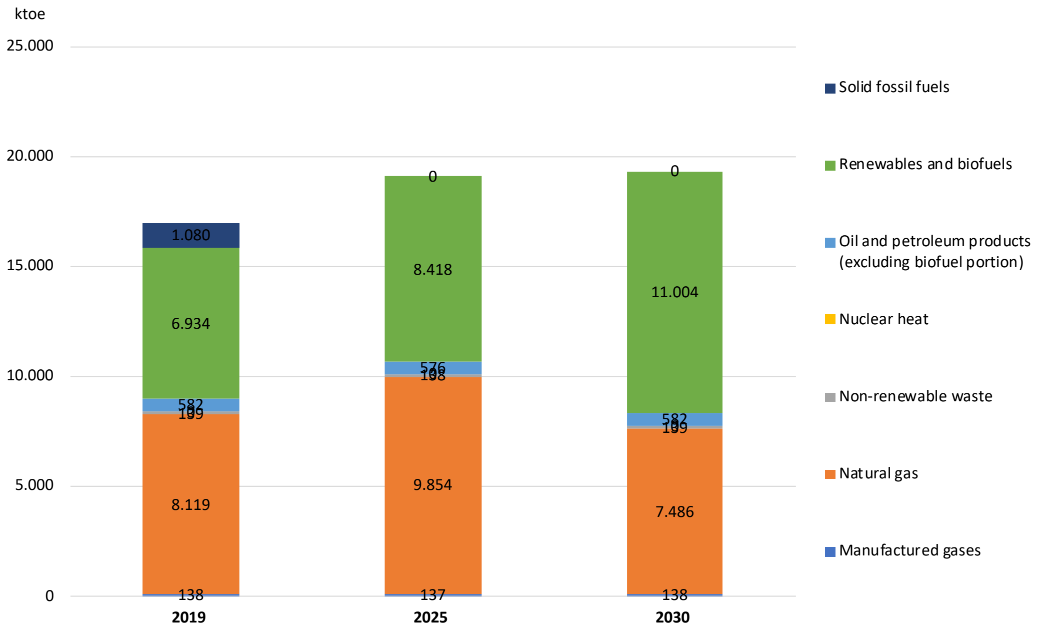


Figure 55 – Power generation in NPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Electrification plays a central role along with energy efficiency, above all in the long term, for decarbonisation in end-use consumption. While electricity demand is destined to rise, energy efficiency will impact upon the development of other energy carriers. The national policies will continue to encourage a significant improvement in energy efficiency in key end uses (buildings, lighting, cooling and heating, domestic appliances and industry), as well as replacing fossil fuels with electricity and renewables.

The need to electrify end-use sectors to accompany the transition to decarbonisation by 2050 with increasingly carbon-free electricity supports the development of renewable electricity sources.

Non-programmable renewable sources, mainly solar and wind, are expected to undergo significant growth; the expansion of these sources is set to continue even after 2030, and will also be managed through the use of significant quantities of storage systems, both on networks (electrochemical and pumping storage) and associated with the generation plants themselves (electrochemical storage). The strong presence of non-programmable renewable sources will lead to a high increase in overgeneration hours. This overproduction will not only be accumulated, but will have to be used in the production of alternative and zero-emission forms of energy such as hydrogen, biomethane, and e-fuels in general, which can be used to promote decarbonisation in sectors that are more difficult to electrify such as industry and transport.

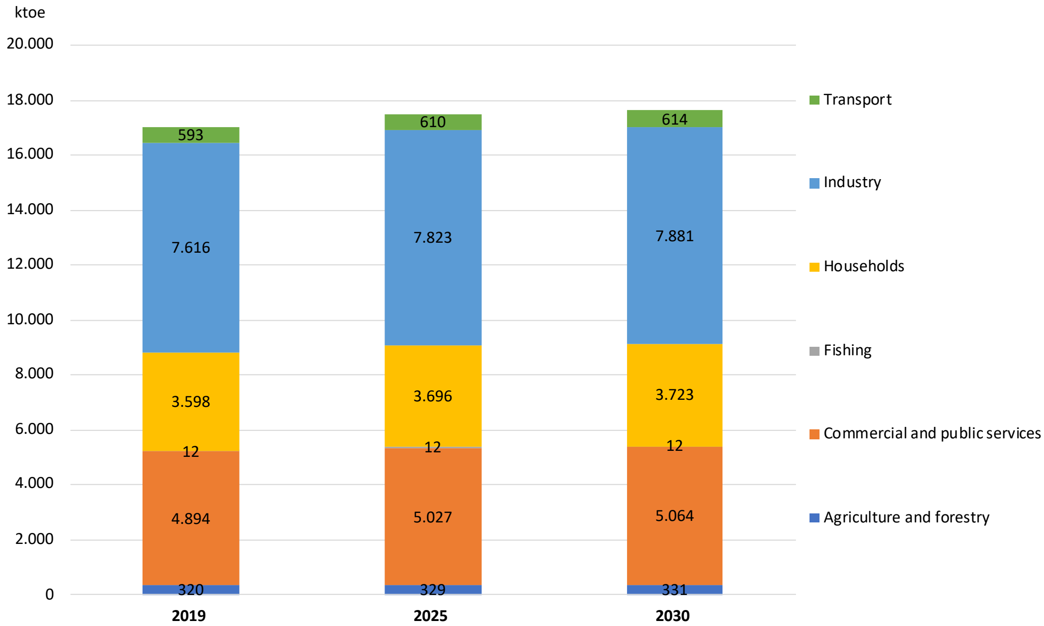


Figure 56 – Electricity consumption in CPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Figure 57 – Electricity consumption in NPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.6 Montenegro

At the moment, the NECP for Montenegro is not available, therefore the CPS and NPS scenarios were built starting from those of the IEA.

As regards electricity generation, the use of coal in Montenegro is still important, and in both the CPS and NPS scenarios a complete phase-out of coal is not envisaged, which however in the NPS scenario becomes marginal.

In both scenarios, on the other hand, significant growth of renewables in electricity generation is expected.

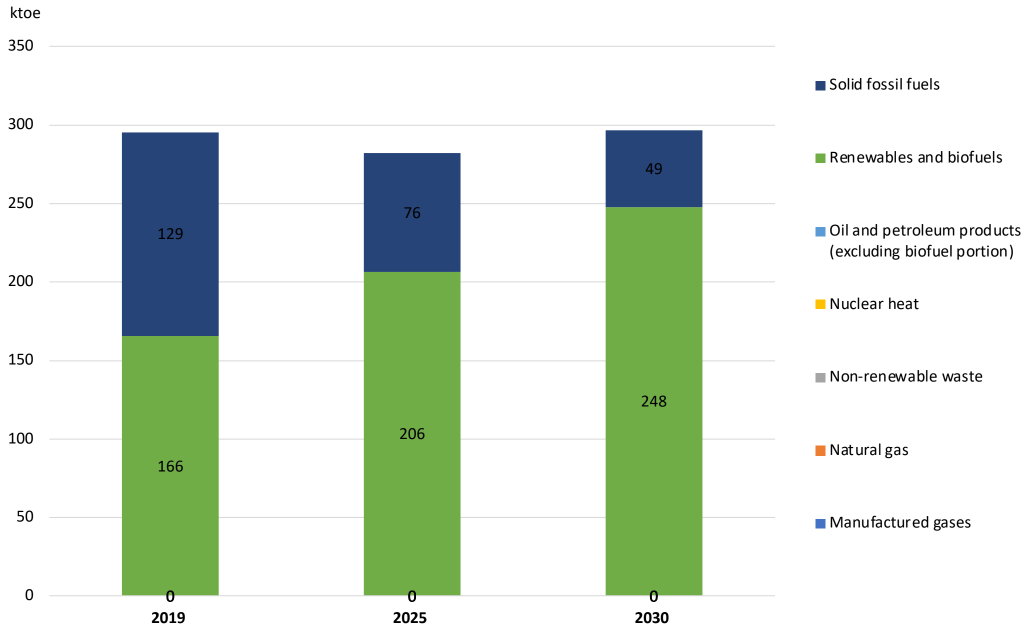


Figure 58 – Power generation in CPS in Montenegro

Source: Consultant's elaboration on Eurostat and IEA data

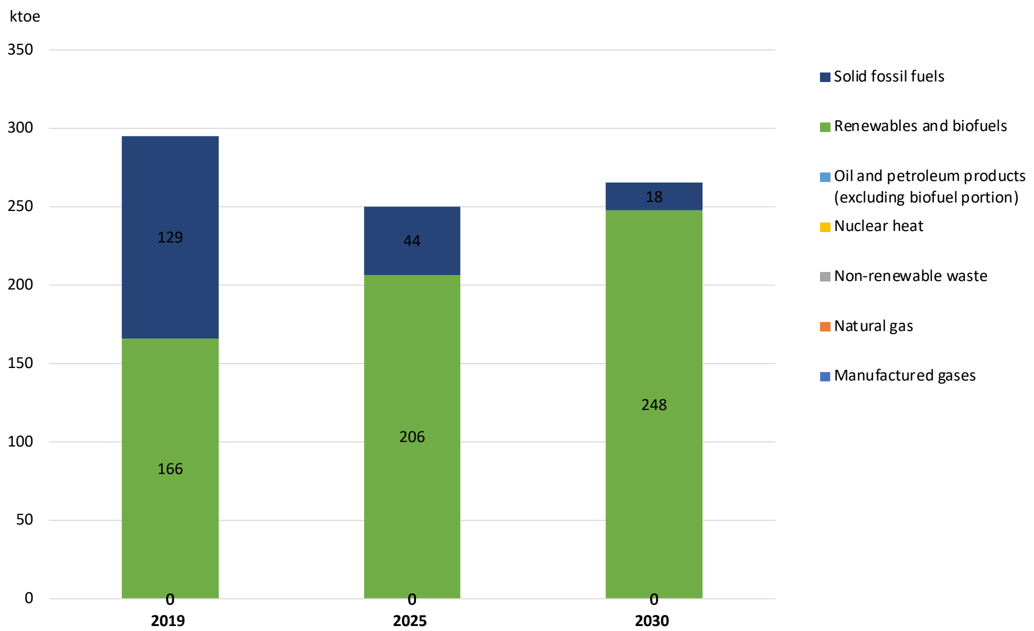


Figure 59 – Power generation in NPS in Montenegro

Source: Consultant's elaboration on Eurostat and IEA data

As regards the evolution of electricity consumption, a slight increase is expected in both scenarios by 2030; however, in the NPS scenario the main driver of electricity consumption increase is related to the electrification in transport, while in other sectors a greater commitment to energy efficiency tends to partially offset this increase.

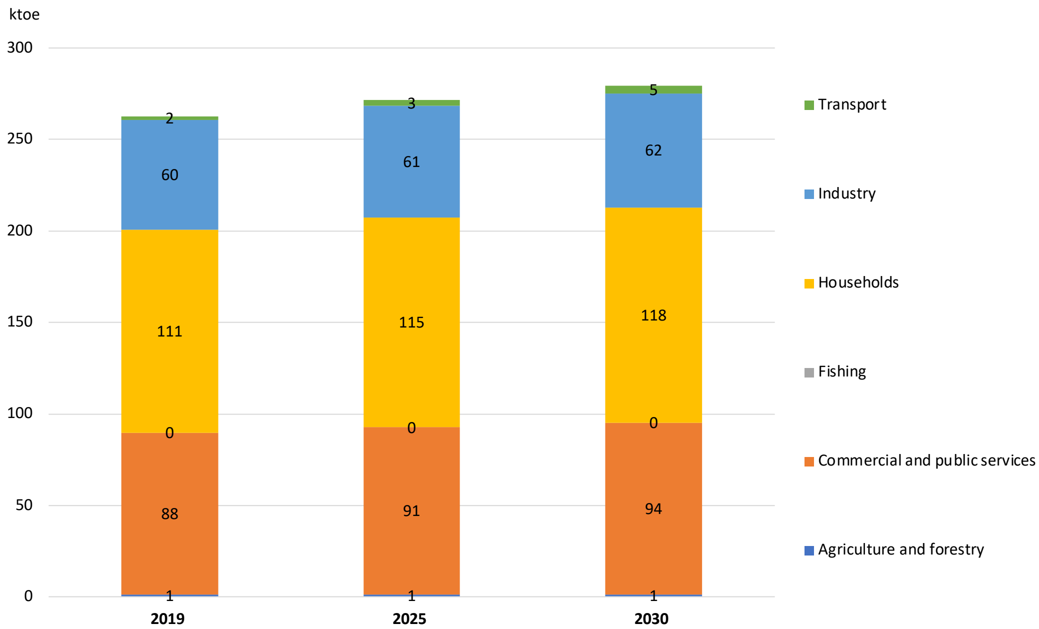


Figure 60 – Electricity consumption in CPS in Montenegro

Source: Consultant's elaboration on Eurostat and IEA data

Figure 61 – Electricity consumption in NPS in Montenegro

Source: Consultant's elaboration on Eurostat and IEA data

5.2.1.7 North Macedonia

The electricity mix from domestic resources in Macedonia is dominantly based on lignite, natural gas, and, depending from the hydrology, electricity production from hydro power plants. Thus, there is a need for diversification of domestic resources, because of the dominant role that lignite plays in the system, which can be a potential risk in the near future in the absence of lignite or the introduction of CO2 tax. Starting from 2012, the domestic production in 2021 is reduced by less than 10%, mainly as a result of reduction of the electricity production from lignite. The second biggest TPP - TPP Oslomej, has significantly decreased the production, due to having already exploited the overall deposits of coal in the mine, and now is operating based on imported coal. The overall production in the TPPs is decreasing also, because they are reaching the end of their working lifetime, having multiple defects and interruptions in the working process, and reduction of efficiency. On the other hand, the production of hydro energy is mainly dependent on the hydrology, which varies significantly, experiencing the lowest hydrology in 2017 and 2019.

On the other hand, with the liberalization of the electricity market, the import of electricity is increasing because most of the companies participate in the open market and are not obliged to buy electricity from domestic production. In the period from 2005-2015 the electricity import is increased for almost 60%, but in the later period it is reduced by 24% as a result of the higher electricity production from the gas CHP power plants, as well as the temporary lock-down of some industry facilities that should fulfill the environmental standards.

The overall import dependence is however quote high, and if this already high import dependence continues to increase it can be also considered as a risk for a country like North Macedonia, because that can have an influence on the financial market and the overall economy of the country.

These potential risks are taken into consideration during the process of preparation of the Macedonian Energy Strategy and therefore the domestic production has to increase in 2030. Additionally, it is diversified, mainly with introduction of more RES for electricity production which will increase their share in 2030. The aggressive investment in RES for electricity production will lead to stable net import of fuels in the period 2020-2030. Furthermore, energy efficiency measures, as well as, electrification of transport sector will contribute to reduction of import dependence.

Macedonia already started the energy transition process. Up to 2015, the most dominant fuel in Macedonia was coal (predominantly lignite). However, its share is constantly decreasing, as a result of the reduced electricity production from lignite, and in 2016, for the first time, the coal is not the dominant fuel in the primary energy consumption.

In the last period there is a significant increase of the natural gas consumption, as result of the electricity production from gas CHPs in Macedonia.

The current reduction of total primary energy consumption is mainly a result of replacing electricity production from lignite with: import of electricity, production from gas CHP which have higher efficiency, as well as electricity production from RES with feed-in tariffs. Additionally, the reduced energy consumption from the industry sector, because of the implementation of environmental standards, contribute to the overall reduction of the primary energy consumption.

It is projected that the primary energy consumption will increase in next decades, coal consumption will remain at almost the same level during the whole period in CPS. In order to fulfill the increased needs for primary energy, RES will increase their share for 14% and also natural gas, primarily used for electricity generation, will increase for 38% in 2030 compared to 2017. At the same time, the electricity generation from gas, as well as, from RES will decrease the import of electricity.

In order to achieve the target for GHG emissions reduction (NPS), Macedonian objectives for power sector are related mainly to the decommissioning of coal fired thermal power plants Oslomej in 2021 and Bitola up to 2027. The lignite production will be substituted mainly by RES.

* If by 2025 there is no conversion of TPP Bitola and/or TPP Negotino on natural gas or build a new power plant on natural gas, TPP Bitola needs to continue for some time so as not to disrupt the security of electricity supply, but this will be reflected in increasing GHG emissions and potentially failing to meet the targets set out in the National Climate Change Contributions. If it happens that there is no coal for TPP Bitola, and the gas power plant does not start operating, the need for electricity import will increase, which will directly affect the GDP and the security of electricity supply.

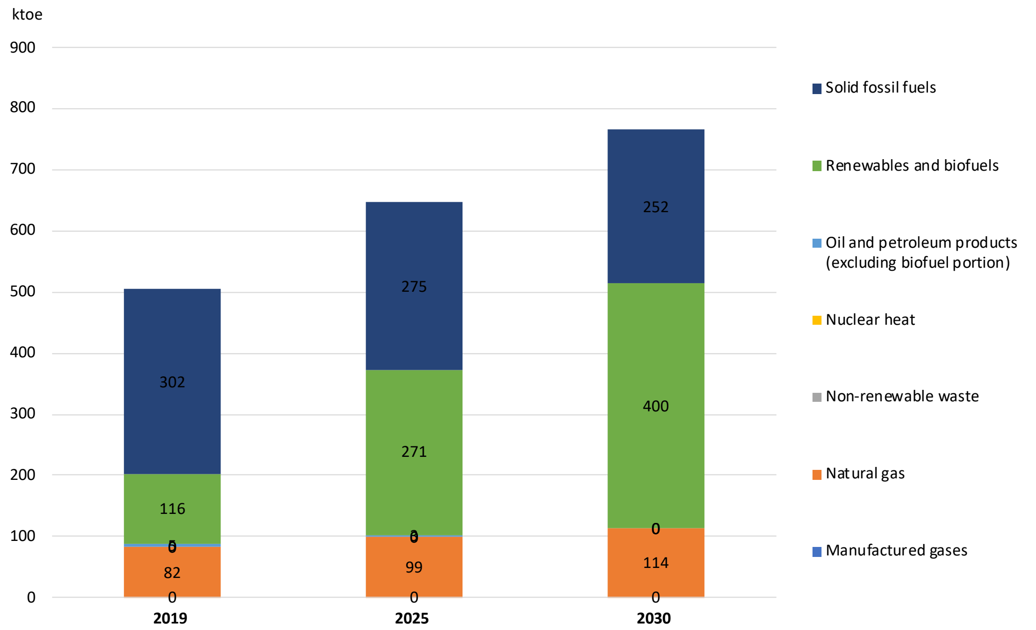


Figure 62 – Power generation in CPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

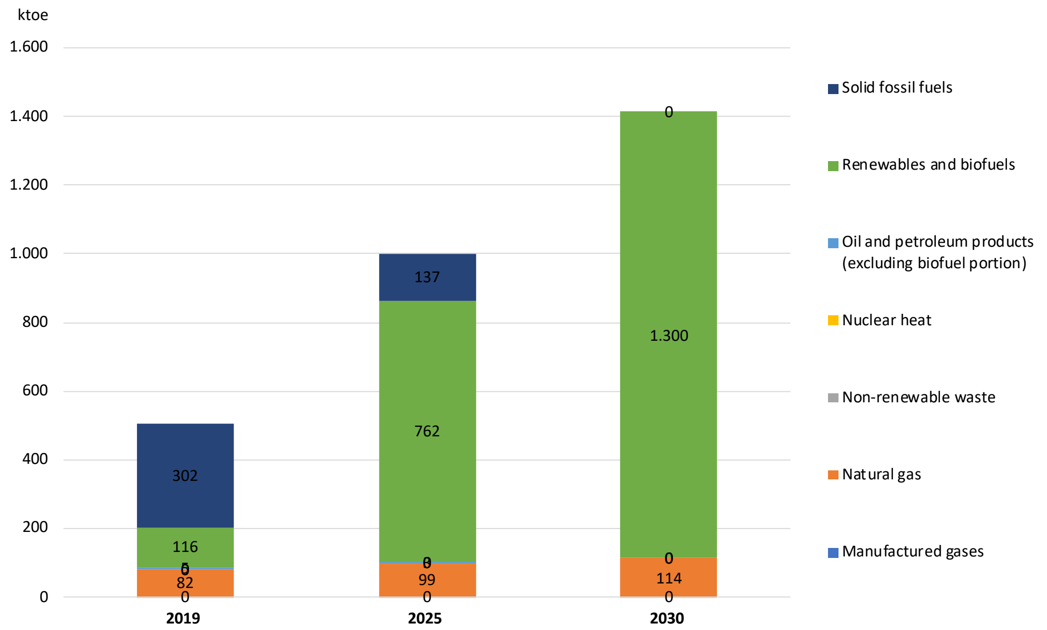


Figure 63 – Power generation in NPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

In CPS and NPS it is assumed that the industry will work with full capacity (this means that all the existing industry facilities will fulfill the highest environmental standards). In addition to this, the electrification of the heating and cooling sector, as well as transport sector will increase the electricity consumption in 2030. Especially in NPS, this electrification of the heating and cooling sector, as well as the improved building performances will not allow high increase of the final energy consumption in the household sector.

The final electricity consumption will increase in 2030 in both scenarios, as a result of the usage of more efficient technologies electricity-driven.

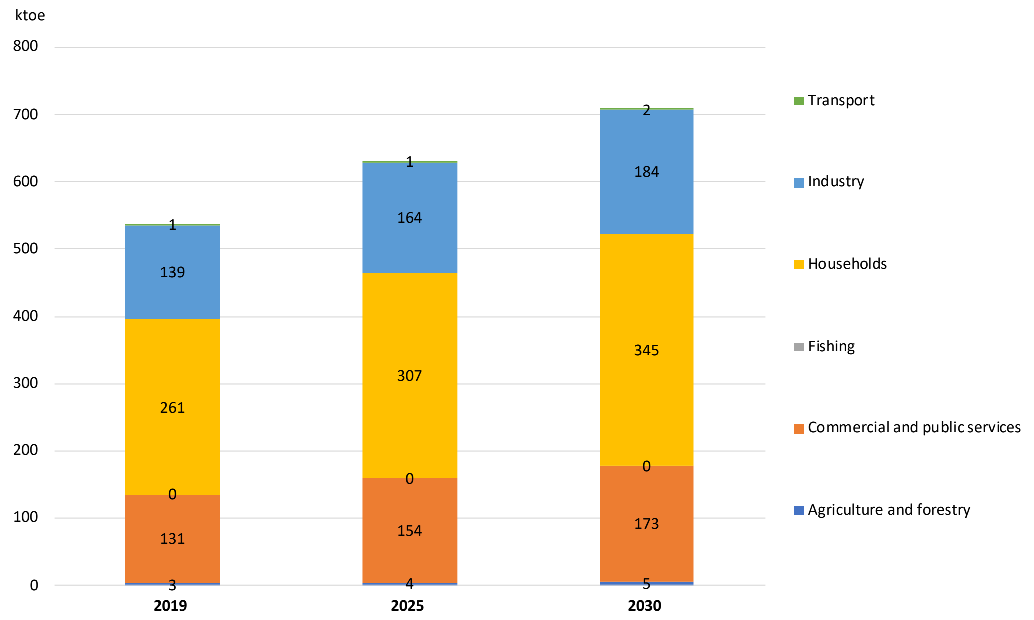


Figure 64 – Electricity consumption in CPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

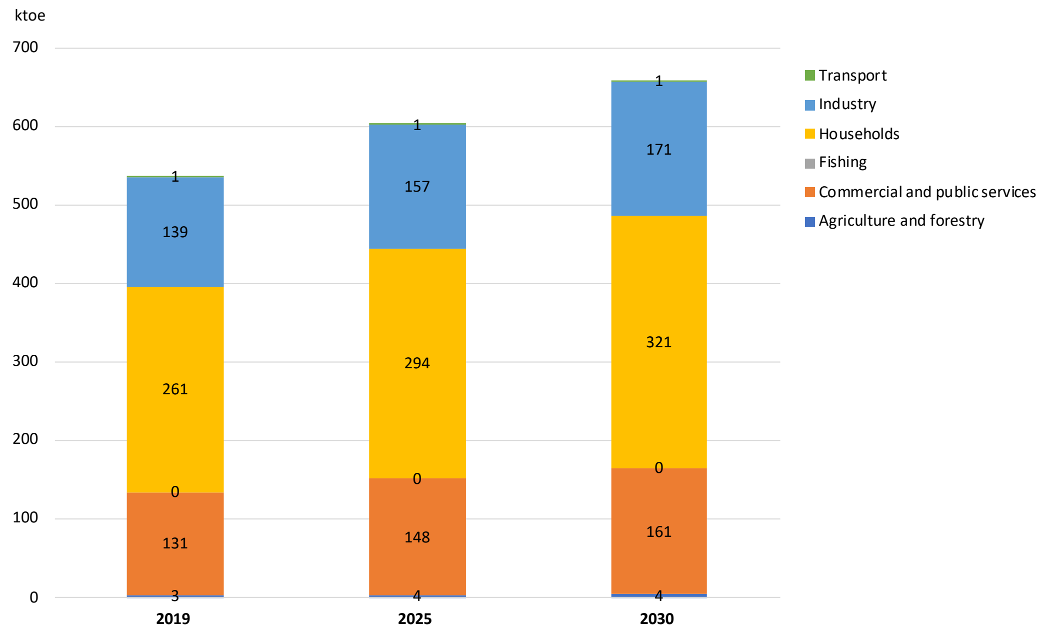


Figure 65 – Electricity consumption in NPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.8 Serbia

At the moment, the NECP for Serbia is under preparation, therefore the CPS and NPS scenarios were built starting from those of the IEA.

As regards electricity generation, the use of coal in Serbia is still important, and in both the CPS and NPS scenarios a complete phase-out of coal is not envisaged, which however in the NPS scenario becomes marginal.

In both scenarios, on the other hand, significant growth of renewables in electricity generation is expected while power generation from natural gas stands marginal.

Due to the country's exposure to coal, these scenarios, in particular the NPS one, could be critical for the security and stability of the electricity system, which would see a sharp reduction in domestic production by 2030 not replaced by other productions.

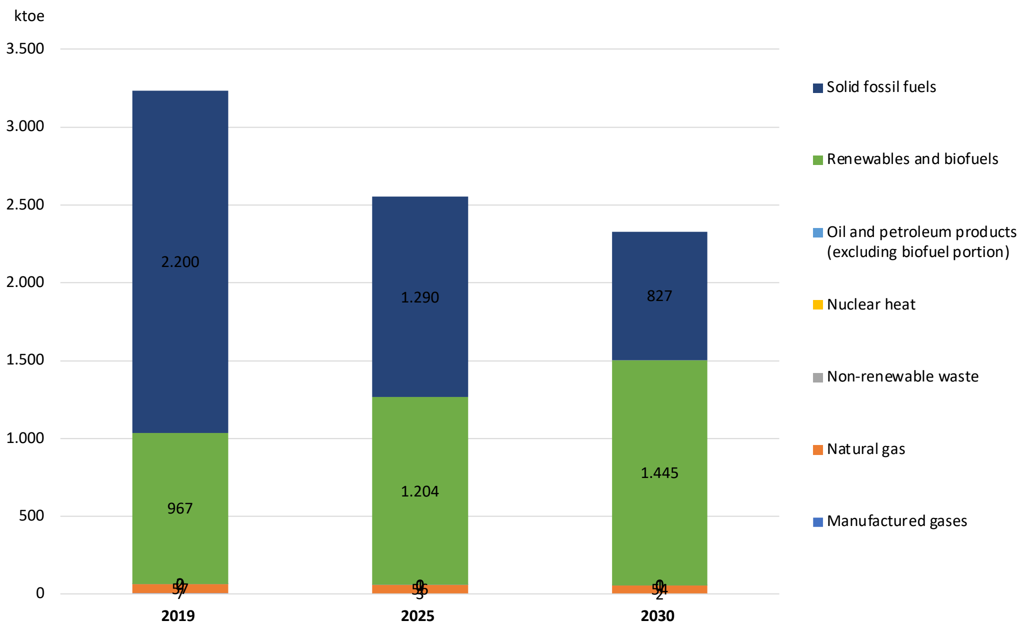


Figure 66 – Power generation in CPS in Serbia

Source: Consultant's elaboration on Eurostat and IEA data

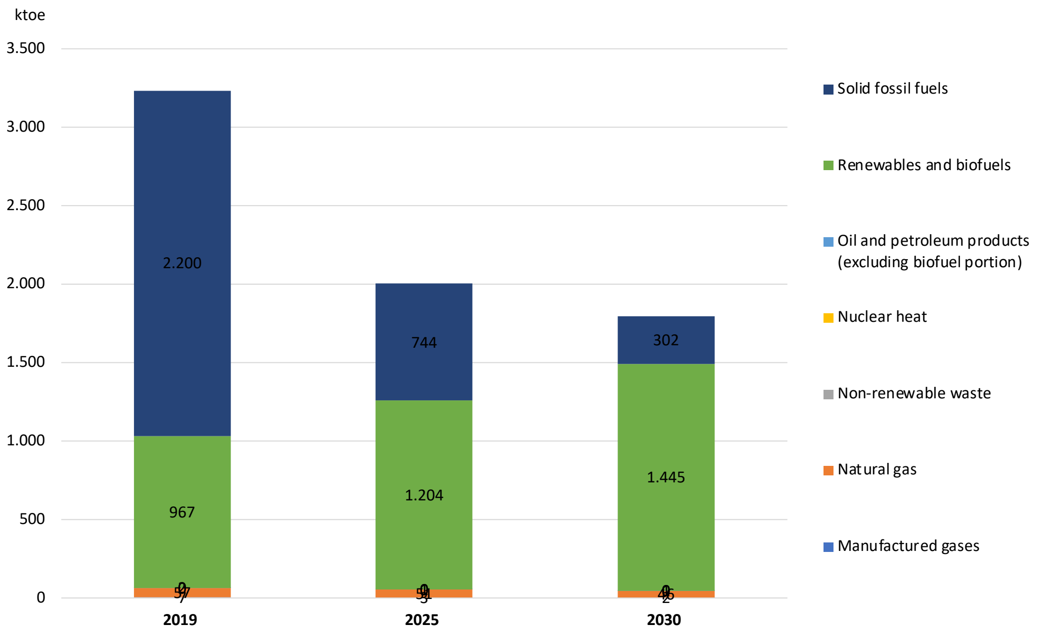


Figure 67 – Power generation in NPS in Serbia

Source: Consultant's elaboration on Eurostat and IEA data

As regards the evolution of electricity consumption, a slight increase is expected in both scenarios by 2030; however, in the NPS scenario the main driver of electricity consumption increase is related to the electrification in transport, while in other sectors a greater commitment to energy efficiency tends to partially offset this increase.

Figure 68 – Electricity consumption in CPS in Serbia

Source: Consultant's elaboration on Eurostat and IEA data

Figure 69 – Electricity consumption in NPS in Serbia

Source: Consultant’s elaboration on Eurostat and IEA data

5.2.1.9 Slovenia

The production of electricity in Slovenia for the most part uses domestic sources, which are the foundation of security of the energy or electricity supply. This involves use of the following:

- renewable energy sources, the share being ensured by large hydro power plants;
- domestic coal and lignite;
- nuclear energy.

Thus, in 2019, the three pillars of electricity security represented 114% of final customers' electricity consumption. Once Croatia’s 50% share in the Krško nuclear power plant is taken into account, domestic production covered 92% of electricity consumption in 2019. Using domestic sources ensures a reliable high-quality electricity supply.

In the past, Slovenia has almost always had a positive electricity balance, although it has fluctuated significantly over the years, mainly due to high dependence on hydrological conditions and, not least, the cost competitiveness of domestic production sources in conditions in which electricity prices on the market fall to levels that mean that production is not economically viable.

The share of electricity produced in hydro-electric and other renewable power plants varies annually depending on hydrological and other conditions and also on the volume of investments in the construction of renewable production units. This share amounted to approximately 30% of all electricity produced in Slovenia. Fossil-fuel power plants contributed about 30% to total production, down one percentage point from the previous year, and the nuclear power plant to 40% of all electricity produced.

In accordance with the targets set in the Paris Agreement, it was estimated that Slovenia would gradually phase out its use of domestic and imported coal for energy purposes and no price projection was therefore made. Domestic coal is used for energy purposes at the Šoštanj thermal power plant. Imported coal with low sulphur and ash content is used at the Ljubljana thermal power plant.

In future, based on projections in the existing measures scenario, due to the standstill in investments in renewable energy sources, the production of electricity from fossil-fuel products (gas) is expected to increase, while the NPS scenario with additional measures envisages an increased volume of investment in production facilities that use all renewable energy sources (solar, water and wind power), resulting in a significant increase in the share of electricity produced from RES and a decrease in the share of fossil fuels.

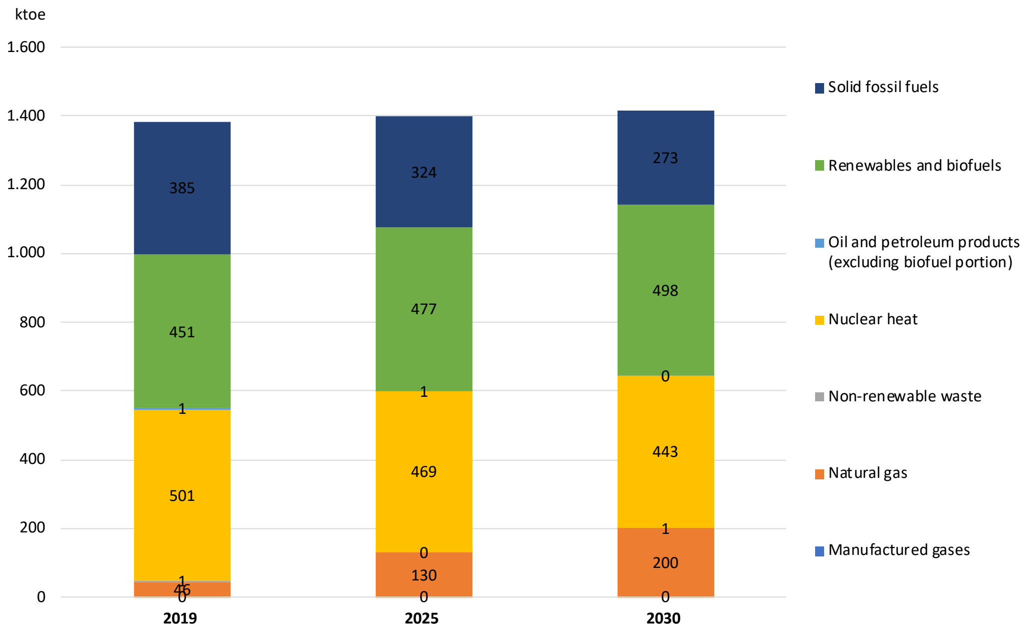


Figure 70 – Power generation in CPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

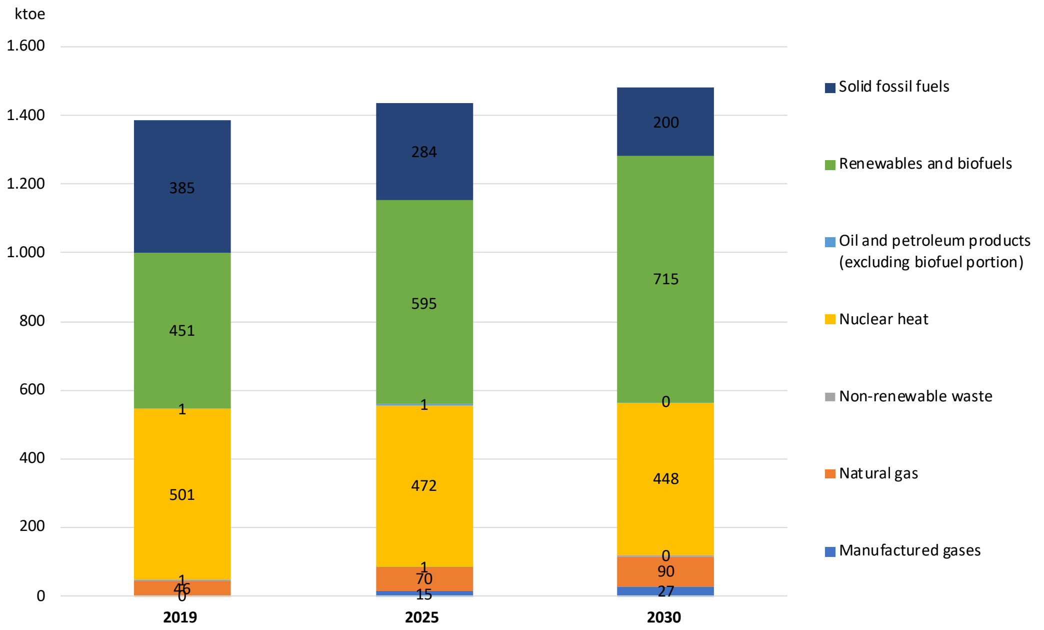


Figure 71 – Power generation in NPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

As regards final electricity consumption, an increase is expected in both scenarios, which is more contained in the NPS thanks to the greater efficiency achieved.

In both scenarios, however, the level of final electricity consumption in 2030 stands at around 1.3 Mtoe (compared to 1.1 Mtoe in 2019), albeit with a different sector composition thanks above all to greater electrification in transport in the NPS scenario.

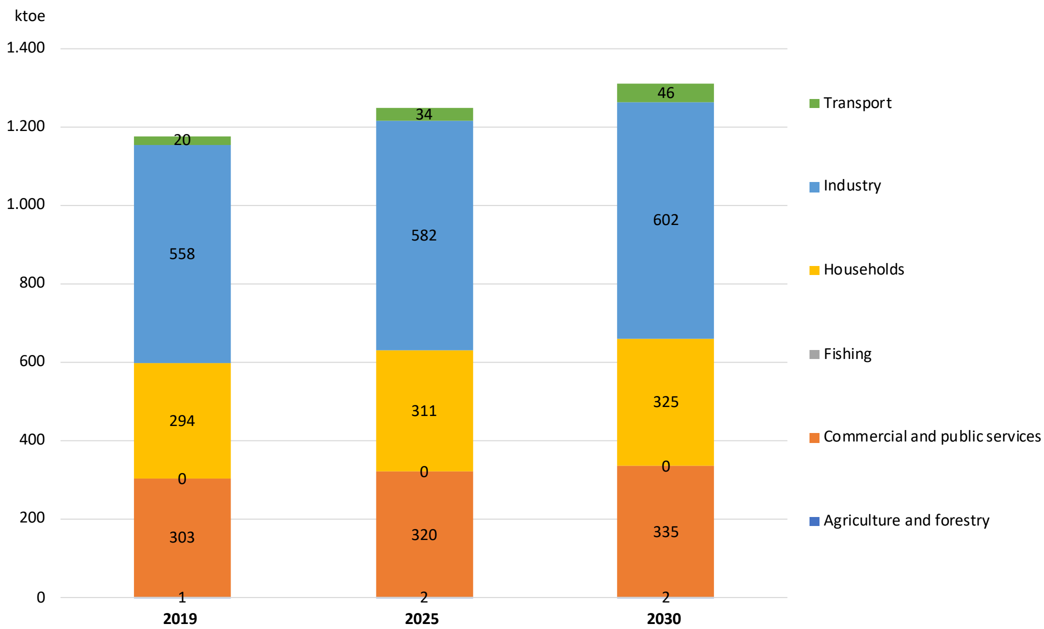


Figure 72 – Electricity consumption in CPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

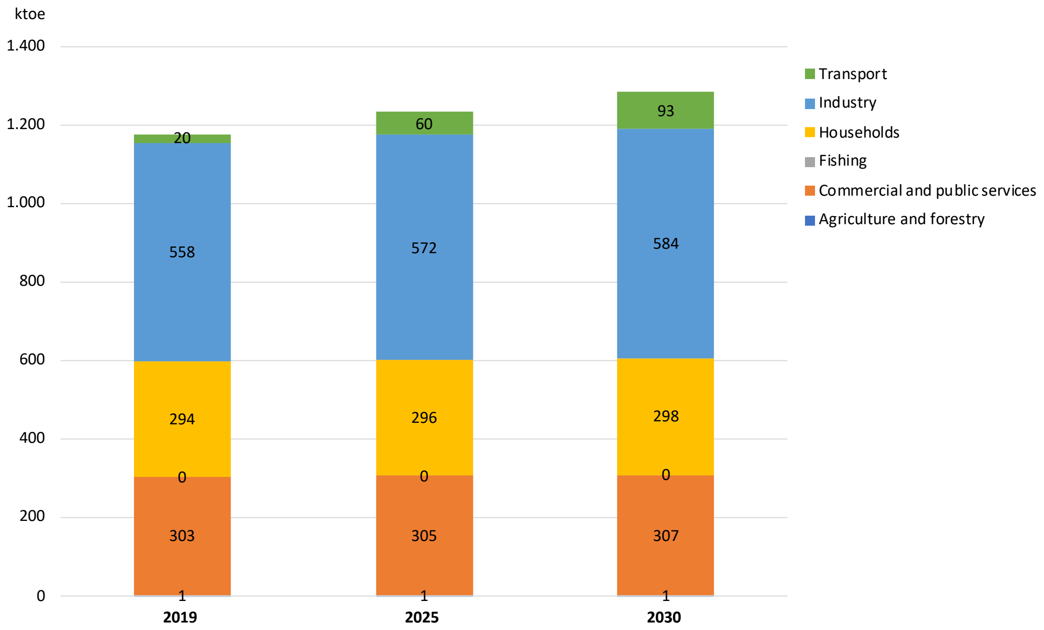


Figure 73 – Electricity consumption in NPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.1.10 EUSAIR area

Starting from the scenario results reported in the previous paragraphs at the individual country level, a summary at the EUSAIR area level is provided below.

As regards electricity consumption, on the basis of the CPS and NPS scenarios, a relatively limited increase in such consumption is expected in 2030, going from 28.6 Mtoe in 2019 to 30.0 Mtoe in 2030 in the CPS scenario or 30.3 Mtoe in the NPS scenario.

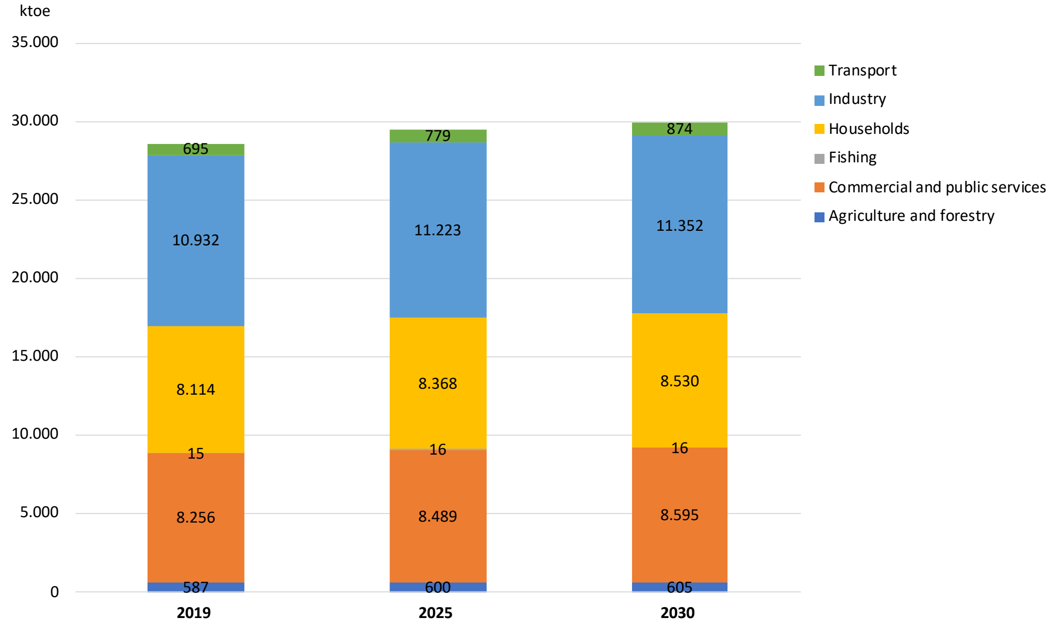


Figure 74 – Electricity consumption in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

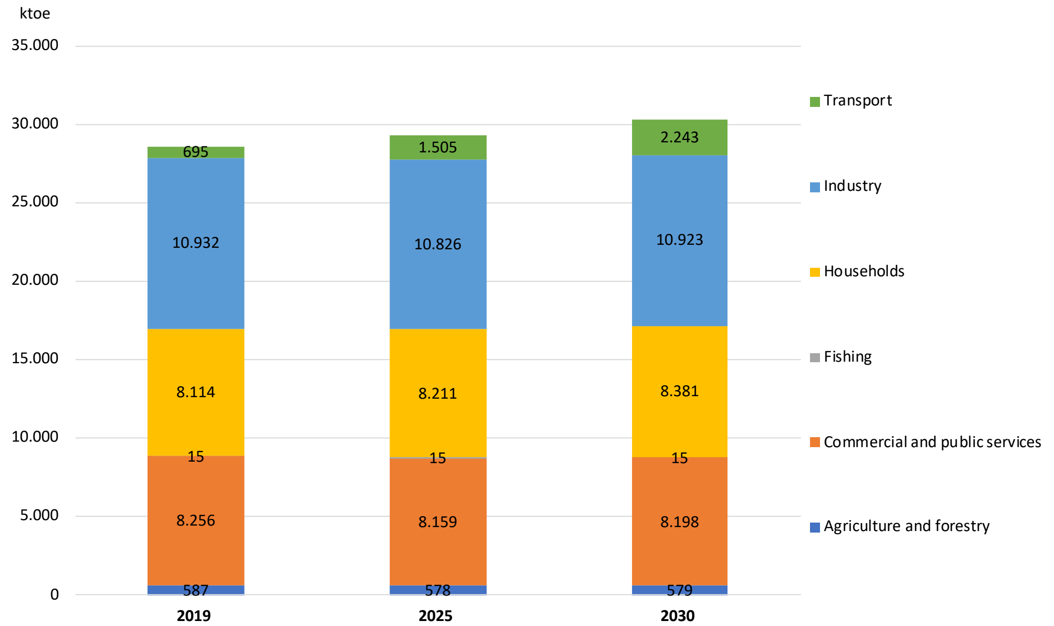


Figure 75 – Electricity consumption in NPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

This is therefore a modest increase, equal to around 6% of consumption in the base year (2019).

However, the situation is partially different if we look at the scenarios developed by the European Commission in 2020, the so-called "2020 EU Reference Scenario" and the "Fit for 55 Scenario" (MIX).

In both of these scenarios, in fact, a greater increase in electricity consumption is expected than expected in the EUSAIR scenarios, ultimately guided by the trajectories envisaged in the NECPs.

EUSAIR Country	2019	EUSAIR Scenarios in 2030		EU Scenarios in 2030	
		CPS	NPS	2020 EU Reference Scenario	Fit for 55 Scenario (MIX)
Albania	532	552	536	n.a.	n.a.
Bosnia and Herzegovina	945	1.001	988	n.a.	n.a.
Croatia	1.389	1.461	1.574	1.456	1.659
Greece	4.316	4.454	4.788	4.777	4.946
Italy (EUSAIR Region)	17.034	17.625	17.653	19.708	20.090
Montenegro	263	280	276	n.a.	n.a.
North Macedonia	537	709	659	n.a.	n.a.
Serbia	2.407	2.580	2.579	n.a.	n.a.
Slovenia	1.176	1.310	1.284	1.417	1.445
Total	**28.598**	**29.972**	**30.338**	n.a.	n.a.

Table 13 - Summary of electricity consumption scenarios in the EUSAIR area by 2030 (ktoe)

Source: Consultant’s elaboration on NECP, Eurostat, IEA and European Commission data

Even at the individual area level, there are no significant variations in consumption levels, as evident in the following figure.

Even though there is a slight increase, no strong increases in the use of electricity are in fact evident: this, in particular in the NPS scenario, is mainly due to the higher level of energy efficiency that is achieved, despite a greater penetration of electricity technologies.

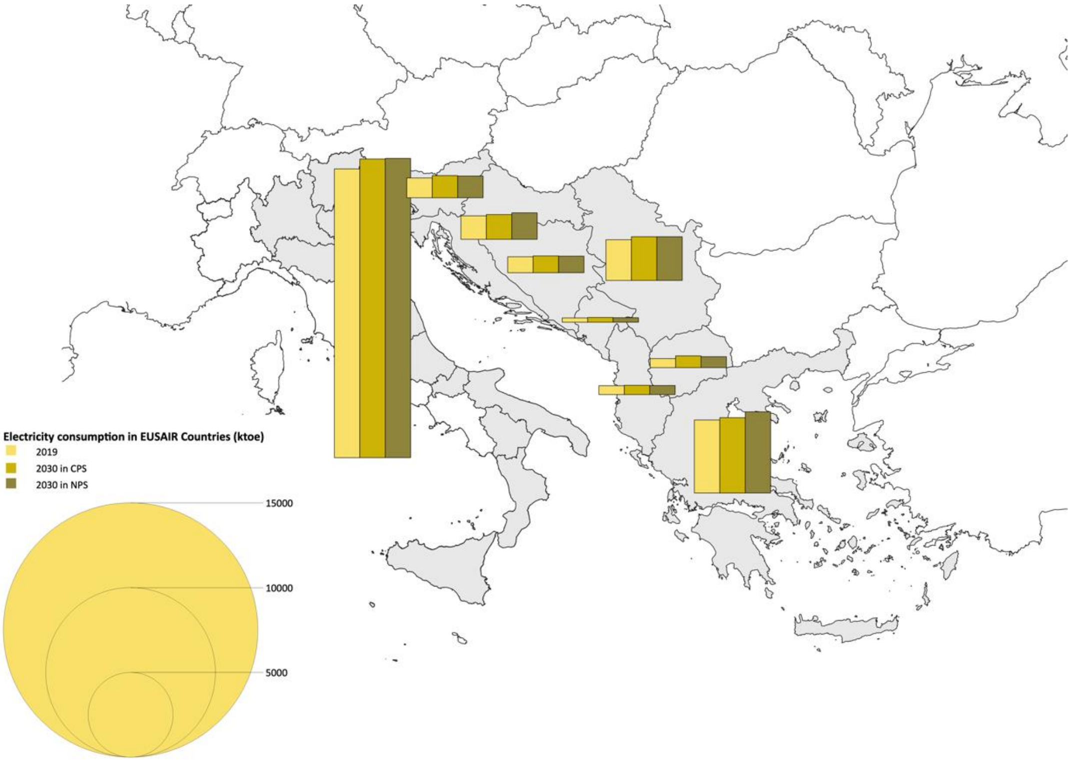


Figure 76 – Electricity consumption in CPS and NPS EUSAIR Scenarios by 2030

Source: Consultant's elaboration on NECP, Eurostat, IEA and European Commission data

In terms of electricity generation, a stable level is expected at the EUSAIR level in the CPS scenario (around 29.7 Mtoe), while a slight increase in the NPS scenario (32.4 Mtoe).

The role of natural gas remains important in both scenarios, with a peak in 2025 in the NPS scenario and then declining in 2030 to levels below those of the base year (2019); in the CPS scenario, on the other hand, natural gas remains rather stable even up to 2030.

Renewable sources assume a primary role in the NPS scenario as early as 2025, to then grow further in 2030 when is expected they could cover almost two-thirds of total electricity production.

At the same time, the role of coal tends to decrease in both scenarios, but while in the CPS scenario there is still production from coal even in 2030, in the NPS scenario an almost total exit from coal in favor of renewables is foreseen.

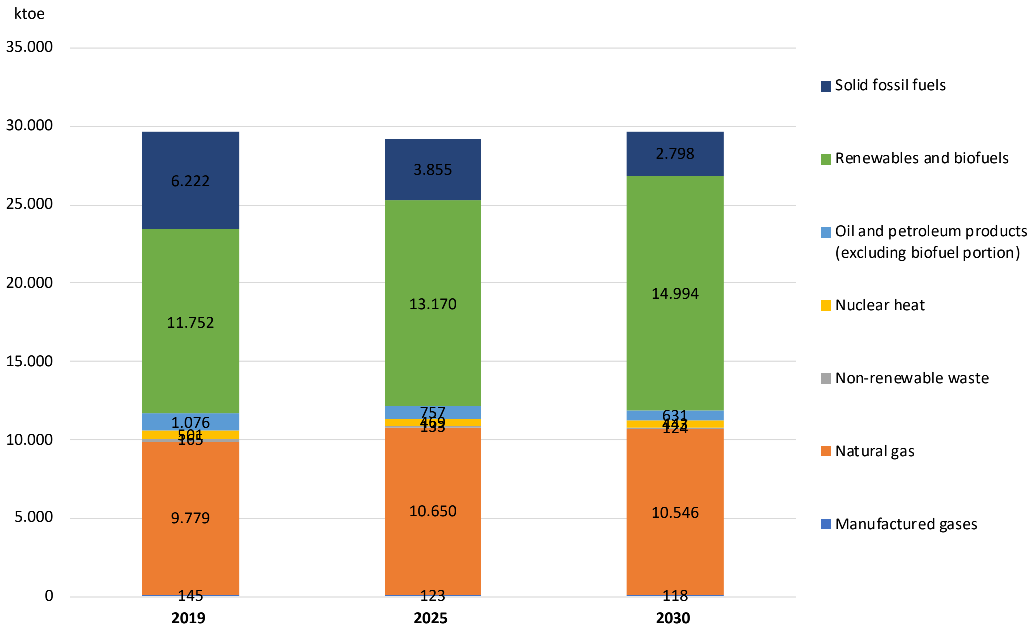


Figure 77 – Power generation in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

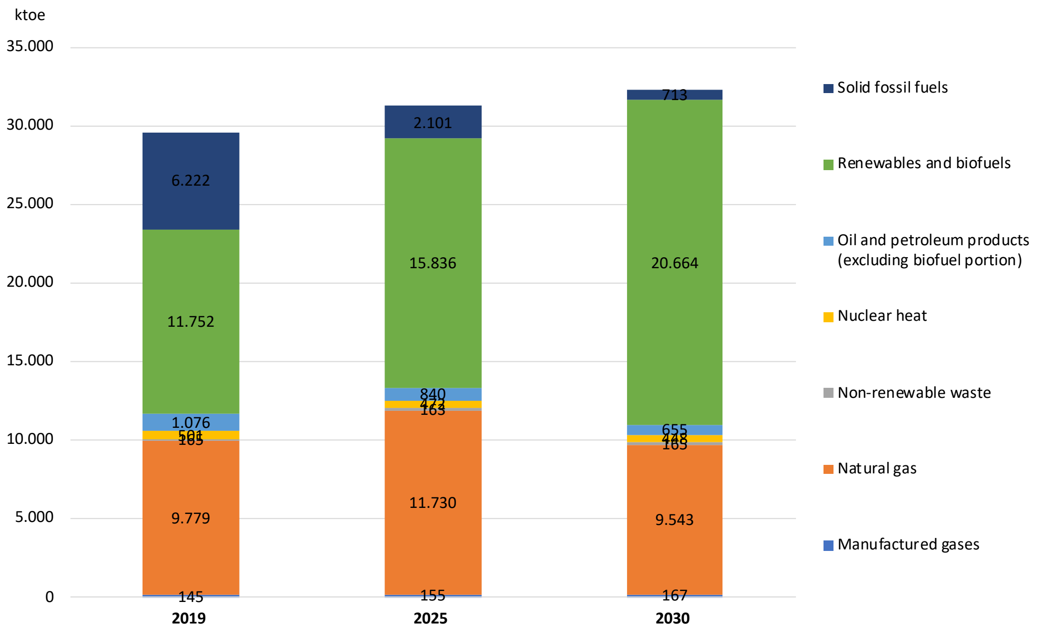


Figure 78 – Power generation in NPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

5.2.2 New powerlines, interconnections and their maps

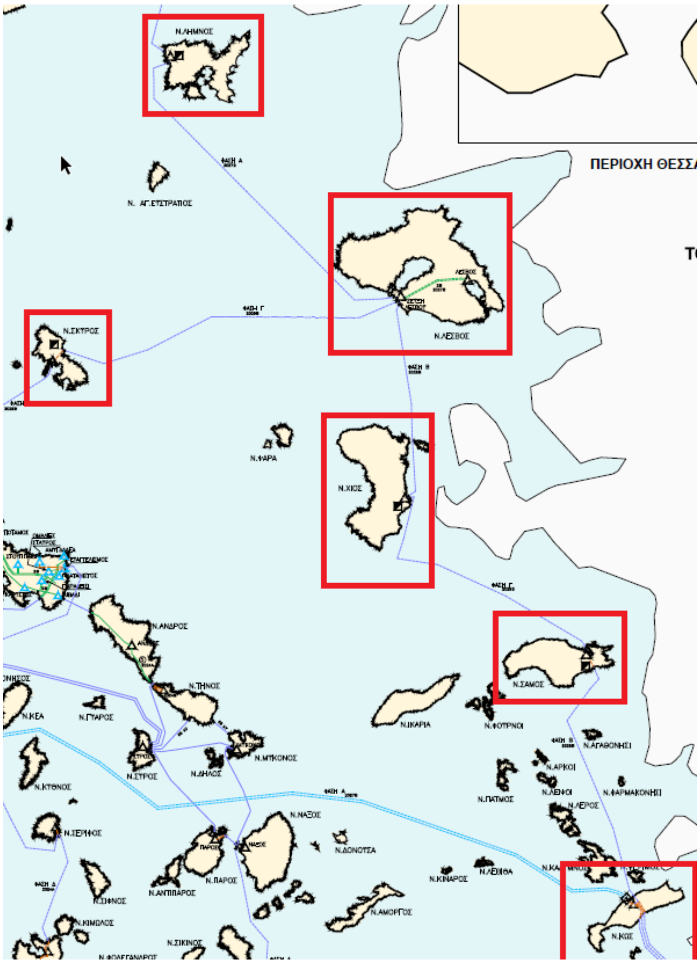
Construction of the new powerlines, interconnections, modernization and upgrading of the existing ones are all implied with the electricity system needs and each of them (particular project) addresses it depending on the necessary measures to be implemented. Most of the planned projects are included in the Ten-Year Network Development Plan (TYNDP) by ENTSO-E. The main results/contributions from implementation of respective infrastructure project, where each contributes to the efficiency of the pan-European power system in long-term horizons, are as follows:

1. Contribution/result 1 (C-R 1) - Reduce price differentials between EU and/or non-EU countries,
2. Contribution/result 2 (C-R 2) - Improve system adequacy, remove related deficiencies and risk of power infrastructure failures,
3. Contribution/result 3 (C-R 3) - Enable cost-efficient RES penetration to the grid and/or reduce RES curtailment, and
4. Contribution/result 4 (C-R 4) - Improve system flexibility and stability.
5. Contribution/result 5 (C-R 5) - Infrastructure to tackle a Need identified by one of the European ITEG indicators referring to the 15% interconnection target for 2030: 1. Reduce the price differential between EU countries to below 2EUR/MWh. 2. Contribute to pushing ratio between nominal transmission capacity and installed RES capacity past 30%. 3. Contribute to pushing ratio between nominal transmission capacity and peak load past 30%.
6. Contribution/result 6 (C-R 6) - Infrastructure and/or market design to provide balancing flexibility (e.g. international pooling / sharing of reserves, coordinated development of reserve capacity)
7. Contribution/result 7 (C-R 7) - Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.

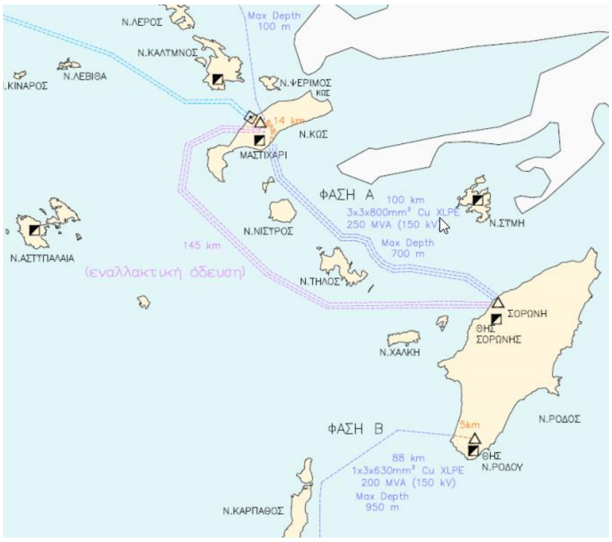
Following are the infrastructure electricity projects listed by promoting countries which contribute to the respective system needs:

5.2.2.1 Interconnection of islands of the Northeastern Aegean

		Project included in the approved NDP 2022-2031 of ADMIE
		Description: The interconnection of the islands of the Northeast Aegean includes the interconnections of the national transmission system with Lemnos via the High-Voltage Center of N. Santas and Skyros via the Aliveri substation, as well as the interconnections Limnos – Lesvos, Lesvos

		– Chios, Chios – Samos, Samos – Kos and Lesvos - Skyros. Furthermore, according to RAE Decision 785/2019, the overall project also includes the interconnections of the islands of the North-East Aegean (Ikaria and Agathonisi) in the Medium Voltage (MT). The planning and implementation of the project falls under the competence of DEDDIE S.A..
		Contribution: C-R 2, C-R 3, C-R 4
		Status: Under construction
		Promoting country (organization): Greece, admie
		Commissioning: Second half of 2029

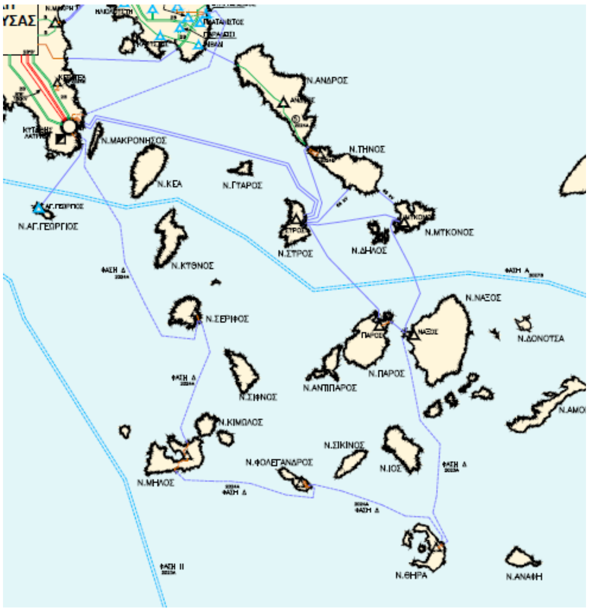
5.2.2.2 Interconnection of the Dodecanese islands



Project included in the approved NDP 2022-2031 of ADMIE
Description: The interconnection of the Dodecanese islands is a project with a budget around 1.4 billion euros with a completion date of 2028, envisages the interconnection of Kos with the Continental Transmission System through the new Ultra High Voltage Center in Corinth by means of two submarine DC cables of 380 km and a total transmission capacity of 900 MW (2x450MW). Afterwards, the interconnection of Kos-Rhodes and Rhodes-Karpathos will follow. The creation of another island "electrical corridor"which will enable the reliable electrification of the Dodecanese by the System and the utilization of the RES potential, with significant environmental and socio-economic benefits.
Contribution: C-R 2, C-R 3, C-R 4
Status: Under construction
Promoting country (organization): Greece, admie
Commissioning: Second half of 2028

5.2.2.3 Interconnection of the Cyclades islands

Project included in the approved NDP 2022-2031 of ADMIE
Description: The Cyclades interconnection project is a technically complex project, which is going to be completed in four phases, and will ensure the reliable, economical and sufficient supply of the islands of Syros, Paros, Tinos, Mykonos and Naxos (among other islands) with electricity. The first phase included the



connection of Syros with Lavrio as well as with the islands of Paros, Mykonos and Tinos with respective cables. The first phase was completed in the first half of 2018. Phase two included the connection of Paros with Naxos and Naxos with Mykonos and was completed in second half of 2020. The 3rd phase included the second interconnection of Lavrio with Syros and was completed in second half of 2020. The fourth phase of the Cyclades interconnection, which is currently under construction, includes the interconnection of the national transmission system with Serifos via Lavrio and the interconnections of Serifos - Milos, Milos - Folegandros, Folegandros - Thira and Thira - Naxos.

Contribution: C-R 2, C-R 3, C-R 4

Status: Under construction

Promoting country (organization): Greece, admie

Commissioning of the fourth phase: First half of 2024

5.2.2.4 Redipuglia (IT) - Vrtojba (SI) interconnection

Project ID in TYNDP: TR 324

Description: The Redipuglia (IT) - Vrtojba (SI) interconnection is a third-party cross-border electrical line. The project concerns an underground cable 110kV a.c. merchant line, 150 MW from Redipuglia (IT) substation to Vrtojba (SI) substation, including a 110/135 kV Phase Shifter Transformer.

Contribution: C-R 1, C-R 2, C-R 3, C-R 5

Status: In Permitting

Promoting country (organization): Slovenia and Italy (HSE d.o.o. (Holding Slovenske Elektrarne,

	d.o.o.) E3 d.o.o. (ENERGETIKA, EKOLOGIJA, EKONOMIJA, d.o.o) Adria Link Srl)
	Commissioning: 06-2024

5.2.2.5 Würmlach (AT) - Somplago (IT) interconnection

	**Project ID in TYNDP:** TR 210
	Description: Somplago - Würmlach is interconnection line promoted by Alpe Adria Energia Srl. The project concerns a 220kV a.c. merchant line, about 300 MW thermal capacity from Somplago substation to new Würmlach substation, including Phase Shifter Transformer located in Austria.
	Contribution: C-R 1, C-R 2, C-R 3, C-R 5
	Status: In Permitting
	Promoting country (organization): Austria and Italy (Alpe Adria Energia Srl)
	Commissioning: 01-2026

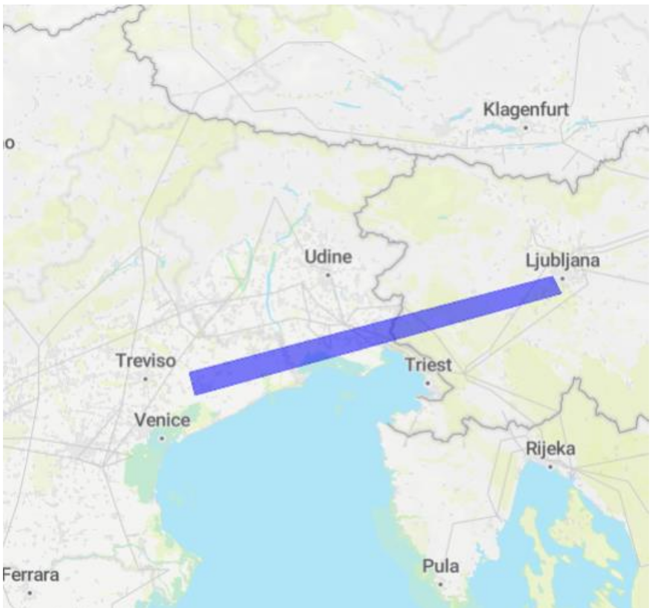
5.2.2.6 Dekani (SI) - Zaule (IT) interconnection

	Project ID in TYNDP: TR 323
	Description: The Zaule (IT) - Dekani (SI) interconnection is a third-party cross-border line promoted by Adria Link Srl, E3 (ENERGETIKA, EKOLOGIJA, EKONOMIJA d.o.o.) and Holding Slovenske Elektrarne d.o.o. The project concerns an underground cable 110kV a.c. merchant line, 150 MW from Zaule (IT) substation to Dekani (SI) substation, including a 110/135 kV Phase Shifter Transformer.
	Contribution: C-R 1, C-R 2, C-R 3, C-R 5
	Status: In Permitting

Promoting country (organization): Slovenia and Italy (HSE d.o.o. (Holding Slovenske Elektrarne, d.o.o.) E3 d.o.o. (ENERGETIKA, EKOLOGIJA, EKONOMIJA, d.o.o) Adria Link Srl)

Commissioning: 04-2025

5.2.2.7 Interconnection between Slovenia and Italy

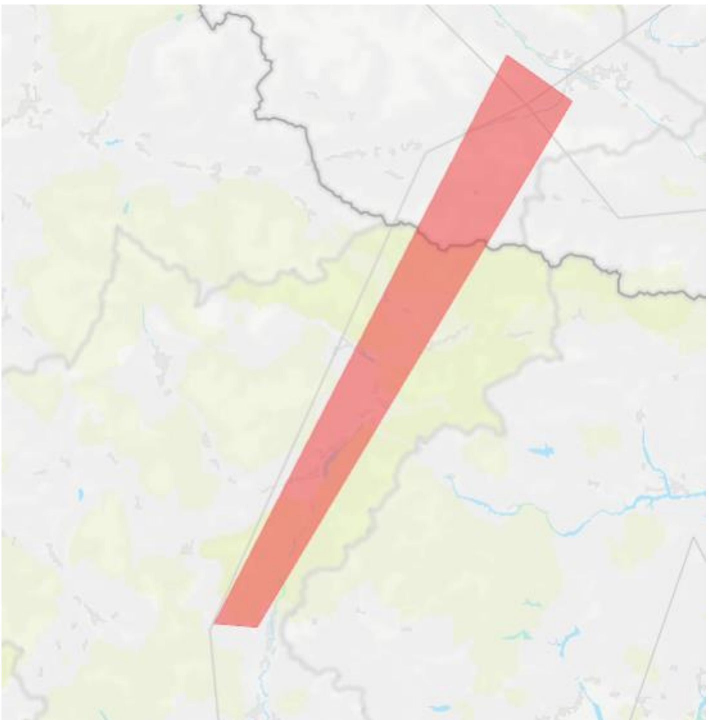


Project ID in TYNDP: TR 150

Description: The project is related to the new HVDC interconnection line between Salgareda (Italy) and Divaca/Bericevo (Slovenia) with the objective of strengthening the connection between the two EUSAIR countries. On Italian side the project is under authorization since 2012 and the permitting process is now closed. On Slovenian side the project is under consideration. ELES has performed a study based on TYNDP 2020 from the perspective of the Slovenian System, which determined that the project will bring the most of its benefits from 2040 onwards, and therefore the implementation should be planned accordingly.

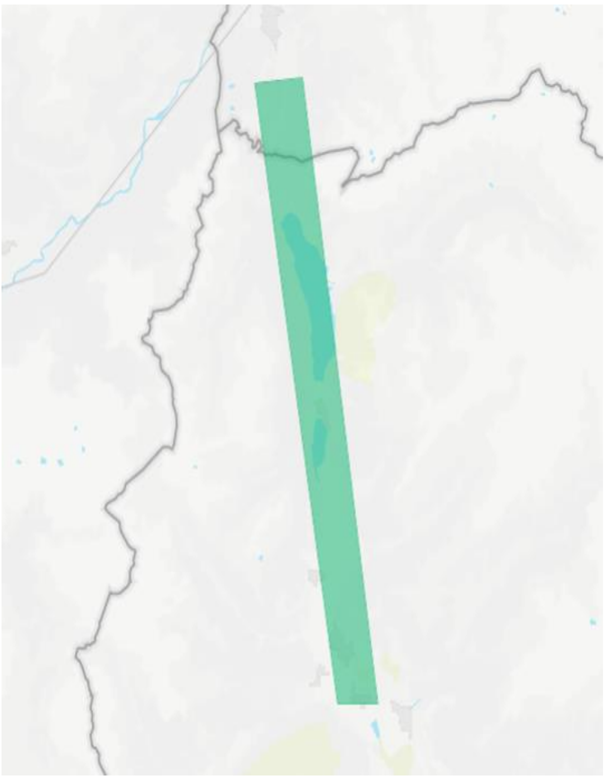
	Terna and ELES continue with evaluation of options for increasing NTC between Slovenia and Italy in the new TYNDP scenarios considering various solutions: • reinforcement of existing grid (PSTs, upgrade of existing lines) with 400 MW Delta NTC target • HVDC link with rated power up to 1000 MW
	Contribution: C-R 1, C-R 3, C-R 4
	Status: Under Consideration
	Promoting country (organization): Slovenia and Italy (Eles, Terna)
	Commissioning: 12-2040

5.2.2.8 Lienz (AT) - Veneto region (IT) 220 kV

	**Project ID in TYNDP:** TR 375
	Description: Reconstruction of the existing 220kV-interconnection line between Lienz and Veneto Region (IT) and adjustment of power regulation devices. Due to an update of the list of cross-border projects interconnecting Italy with other EU MS within 2020, the 2020 interconnection ratio of Italy has been updated accordingly (from previous value of 9% calculated by ENTSO-E in TYNDP 2018 to roughly 8%). The Interconnection level of 10% was not reached by 2020, Italy was requested to investigate options of further interconnections. The project is also considered important in that sense.

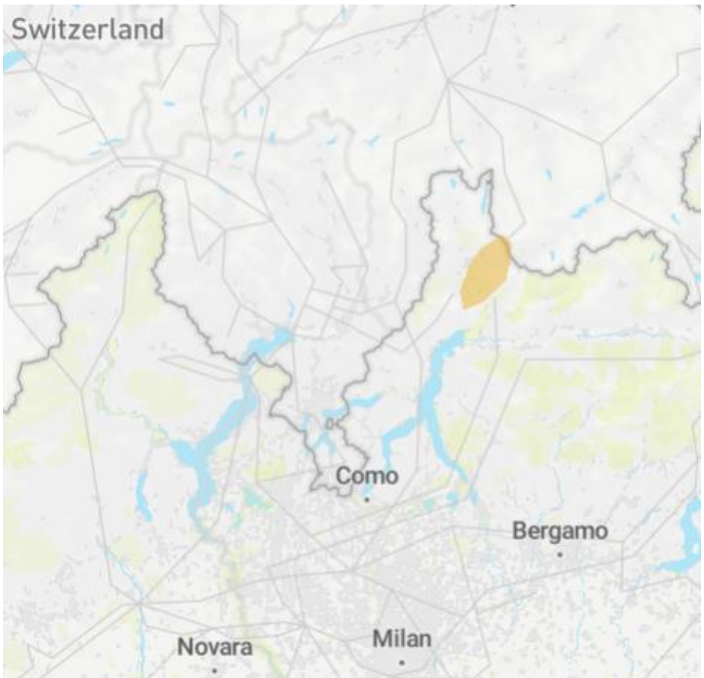
	Contribution: C-R 1, C-R 2, C-R 3, C-R 5
	Status: Planned but Not Yet Permitting
	Promoting country (organization): Austria and Italy (Austrian Power Grid, Terna)
	Commissioning: 12-2030

5.2.2.9 Reschenpass Interconnector Project

	**Project ID in TYNDP:** TR 26
	Description: New 220kV interconnector between the substations Nauders (AT) and Glorenza (IT). Due to an update of the list of cross-border projects interconnecting Italy with other EU MS within 2020, the 2020 interconnection ratio of Italy has been updated accordingly (from previous value of 9% calculated by ENTSO-E in TYNDP 2018 to roughly 8%). The Interconnection level of 10% was not reached by 2020, Italy was requested to investigate options of further interconnections. The project is also considered important in that sense.
	Contribution: C-R 1, C-R 2, C-R 3, C-R 5
	Status: Under Construction
	Promoting country (organization): Austria and Italy (TERNA; APG)
	Commissioning: 06-2023

5.2.2.10 Merchant line Castasegna (CH) - Mese (IT)

	Project ID in TYNDP: TR 250
	Description: The planned Transmission project is a merchant



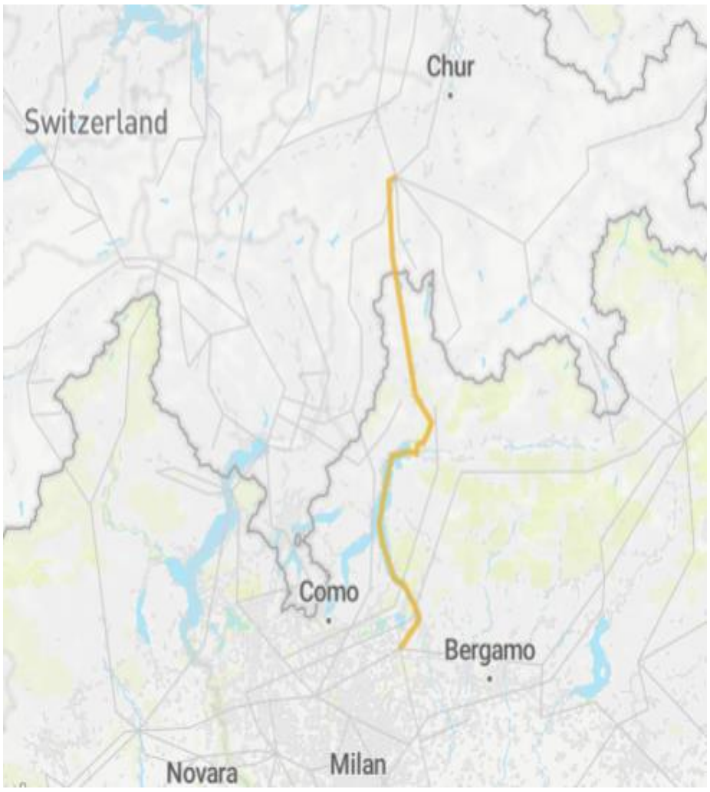
line on the Swiss-Italian border between Castasegna (CH) and Mese (IT). The planned cable interconnection of 220 kV AC is cca. 14 km, of which 13.5 is in Italy. In connection with the realization of the project a Rationalization of the 380 and 132 kV Grid in the region Mese (Provincia di Sondrio) is planned. The expected NTC increase is around 200-250 MW.

Status: In Permitting - Delayed

Promoting country (organization): Switzerland and Italy (Repower, MERA SRL)

Commissioning: 03-2025

5.2.2.11 Greenconnector



Project ID in TYNDP: TR 174

Description: Greenconnector is an HVDC underground cable interconnection project between Italy and Switzerland. The route/line length is about 165 km. The design power is 1000 MW (1200 MW in overload condition), while the DC voltage is +/- 400 kV DC. It is planned to install two cables in bipolar scheme. Great part of the cables route will exploit a section of an existing oil pipeline, no longer in service since January 1997. The cables will be pulled inside the pipeline itself, reducing the amount of civil works required before and after cable laying and therefore limiting even temporary environmental impact.

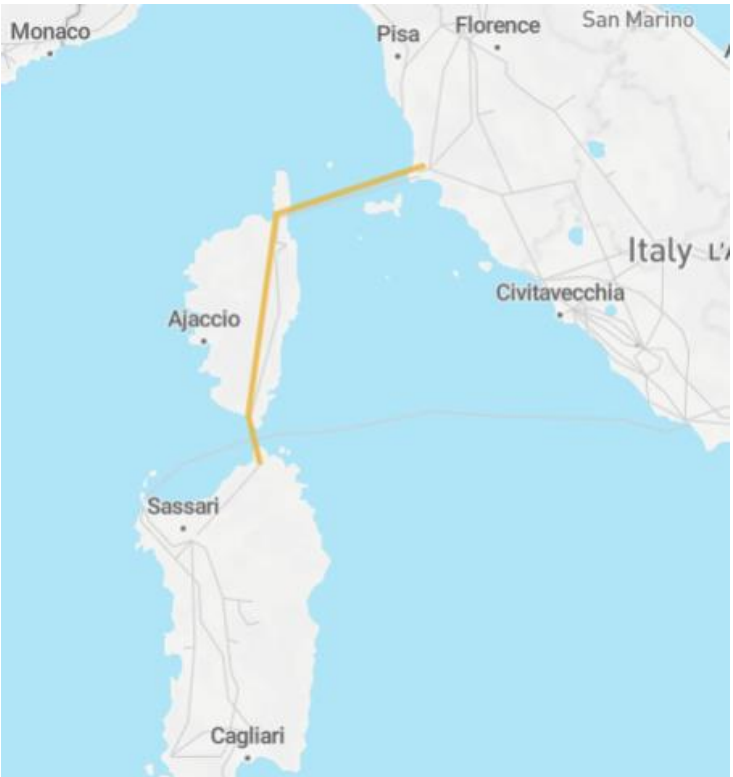
	Contribution: C-R 1, C-R 3, C-R 5, C-R 6
	Status: In Permitting - Delayed
	Promoting country (organization): Switzerland and Italy (Worldenergy SA)
	Commissioning: 12-2026

5.2.2.12 Central Northern Italy

	Project ID in TYNDP: TR 33
	Description: The project consists in the strengthening of interconnection between the northern and the central part of Italy. It will involve the upgrading of existing 220 kV over-head line to 400 kV between Colunga and Calenzano substations as well as the removing of limitations on the existing 220 kV network in Central Italy
	Contribution: C-R 4 and C-R 7
	Status: Under Construction - Investment on time
	Promoting country (organization): Italy (TERNA)
	Commissioning: 12-2023

5.2.2.13 SACOI3

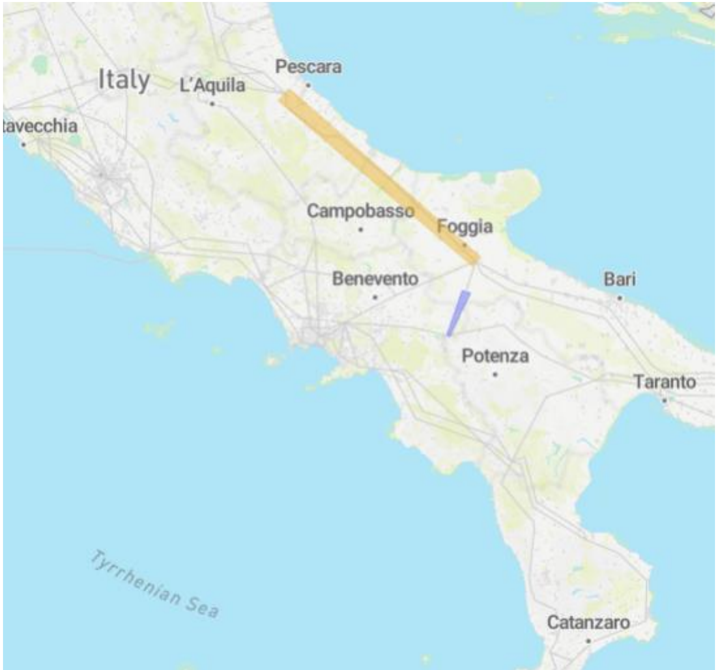
	Project ID in TYNDP: TR 299
	Description: New HVDC line between Italy mainland, Corsica and Sardinia replacing existing link SACOI2. Due to an update of the list of cross-border projects



interconnecting Italy with other EU MS within 2020, the 2020 interconnection ratio of Italy has been updated accordingly (from previous value of 9% calculated by ENTSO-E in TYNDP 2018 to roughly 8%). The Interconnection level of 10% was not reached by 2020, Italy was requested to investigate options of further interconnections. The project is also considered important in that sense.
Contribution: C-R 1, C-R 3, C-R 4, C-R 5
Status: In Permitting - Investment on time
Promoting country (organization): France and Italy (Terna, EDF)
Commissioning: 12-2026

5.2.2.14 Central Southern Italy

	Project ID in TYNDP: TR 127
	Description: The project consists in the reinforcement of southern Italy 400 kV network through new 400 kV lines. The activities will involve the network portions between the substation of Villanova and Foggia, Deliceto and Bisaccia. There are two main investments of the project: New 66km double circuit 400kV OHL between existing Foggia and Villanova 400kV substations, also connected in and out to the Larino and Gissi substations (Investment ID 86) and New 30km single circuit 400kV OHL between the future



substations of Deliceto and Bisaccia, in the Candela area (Investment ID 96).

Contribution: C-R 3, C-R 4, C-R 7

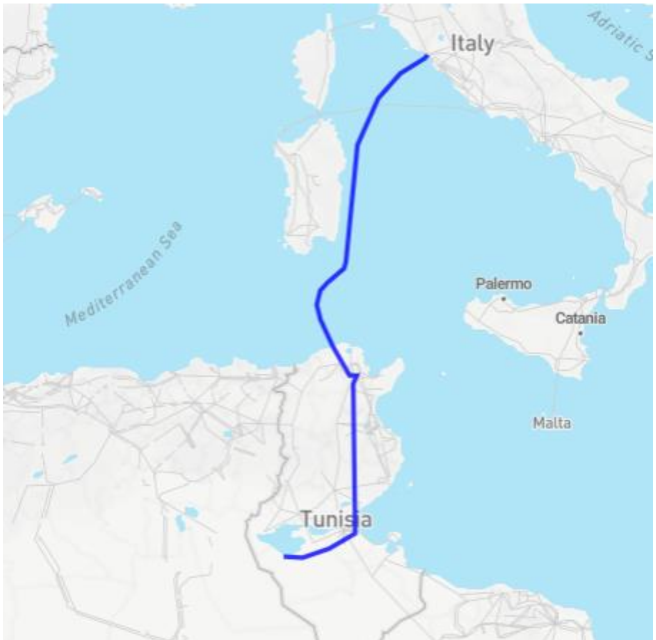
Status: ID-86 - In Permitting

ID-96 - Commissioned

Promoting country (organization): Italy (TERNA)

Commissioning: 12-2027

5.2.2.15 TuNur Italy



Project ID in TYNDP: TR 283

Description: TuNur Italy is a 2,000MW HVDC transmission system that will enable the delivery of 13TWh/yr of low-cost controllable solar power to European consumers under long-term CPPAs. The transmission project will connect a dedicated hybrid solar facility in Southern Tunisia, where solar resources are extremely high enabling the most efficient integration of solar PV coupled with 15h of thermal storage, to the Montalto di Castro 400kV substation in Italy, the identified connection point on Terna's HV network. The HVDC transmission architecture is based on two independent bipolar +/- 525kV systems of 1GW, with VSC HVDC Converter station technology ensuring high reliability and efficiency of the system. Each bipole will consist of a DC

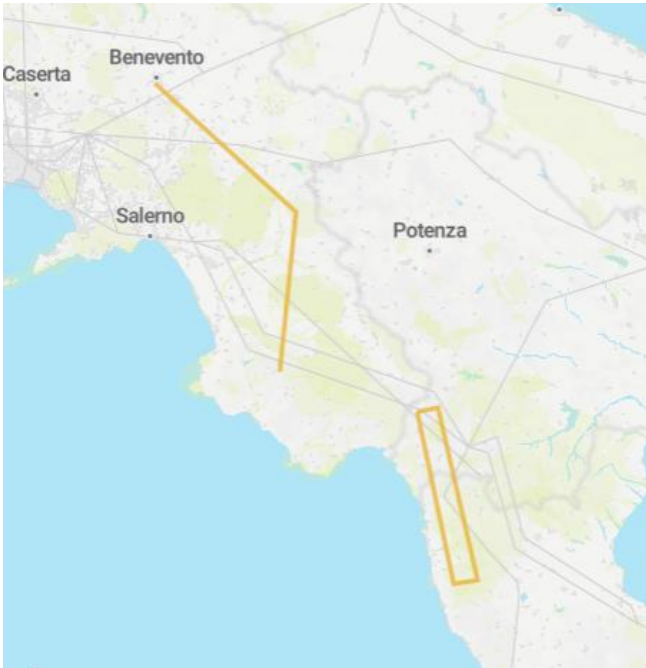
	overhead line to the landfall point in Northern Tunisia; a submarine DC cable to the shoring point at Montalto di Castro; two HVDC converter stations; and a short 400kV AC cable from the converter station to Terna's 400kV substation. The project will enable the integration of massive amounts of RES; create significant carbon dioxide reductions; improve security of supply through diversification of supply; and support Europe's Green Deal and the REPowerEU objectives.
	Contribution: C-R 1, C-R 2, C-R 4, C-R 6
	Status: Investment ID 1378 - Under Consideration – Delayed Investment ID 1430 - Under Consideration – Delayed
	Promoting country (organization): Italy and Tunisia (TuNur Ltd)
	Commissioning: Investment ID 1378 – 12/2028 Investment ID 1430 – 09/2028

5.2.2.16 Basilicata - Campania reinforcements

	Project ID in TYNDP: TR 1109
	Description: New 400 kV lines between Basilicata and Campania and in the northern area of Benevento will increase the southern/northern artery, will reduce congestions by increasing NTC between market zones and will integrate new RES power attended in the South of Italy.
	Contribution: C-R 3
	Status: Planned But Not Yet Permitting

Promoting country (organization): Italy (TERNA)	
Commissioning: 12-2030	

5.2.2.17 Southern Italy



Project ID in TYNDP: TR 1059	
Description: New 400 kV lines in Campania and in Calabria, affecting existing 400 kV substation. The link will remove grid constraints and congestions due to the new renewable installed capacity.	
Contribution: C-R 2 and C-R 7	
Status: In Permitting	
Promoting country (organization): Italy (TERNA)	
Commissioning: 12-2028	

5.2.2.18 Tyrrhenian link

	Project ID in TYNDP: TR 339

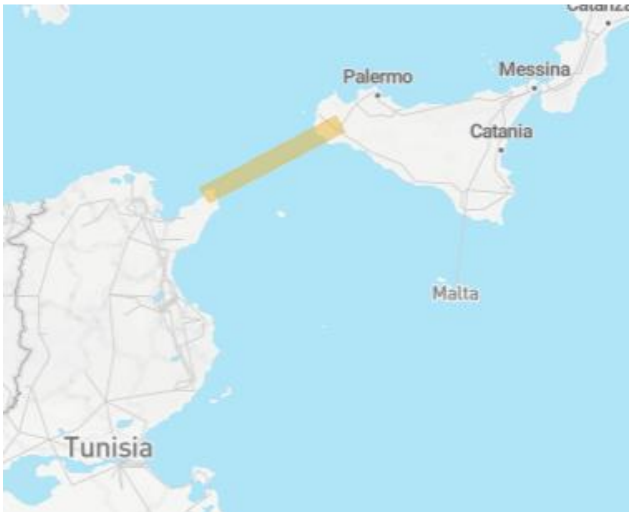
Description: Italian HVDC link between Campania, Sicily and Sardinia
Contribution: C-R 1, C-R 3 and C-R 4
Status: Planned But Not Yet Permitting
Promoting country (organization): Italy (TERNA)
Commissioning: 12-2028

5.2.2.19 Sicily - Calabria

Project ID in TYNDP: TR 1110
Description: New 400 kV subsea cable between Sicilia and Calabria will increase NTC between market zones and will integrate new RES power attended in Sicily and reduce dispatching cost for the system.
Contribution: C-R 1 and C-R 3
Status: Planned But Not Yet Permitting
Promoting country (organization): xxxx
Commissioning: 12-2026

5.2.2.20 Italy-Tunisia

	Project ID in TYNDP: TR 29 **PCI number 2.33 (5th list)**
	Description: The project consists in a new interconnection between Tunisia and Sicily to be realized through an HVDC submarine

<table>
<tr><td rowspan="5">
</td><td>cable. The realization of the project is supported by the Italian and Tunisian Governments to increase the interconnection capacity of the Euro-Mediterranean system. Moreover, the project will contribute to reduce, under specific conditions, present and future limitations to the power exchanges on the northern Italian border, with France, Switzerland, Austria and Slovenia, and therefore it will allow to significantly increase the transmission capacity and its exploitation by at least 500 MW on that boundary.</td></tr>
<tr><td>Contribution: C-R 1, C-R 2 and C-R 3</td></tr>
<tr><td>Status: In Permitting</td></tr>
<tr><td>Promoting country (organization): Italy and Tunisia (Terna, STEG)</td></tr>
<tr><td>Commissioning: 12-2027</td></tr>
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5.2.2.21 Malta-Italy Cable Link No.2

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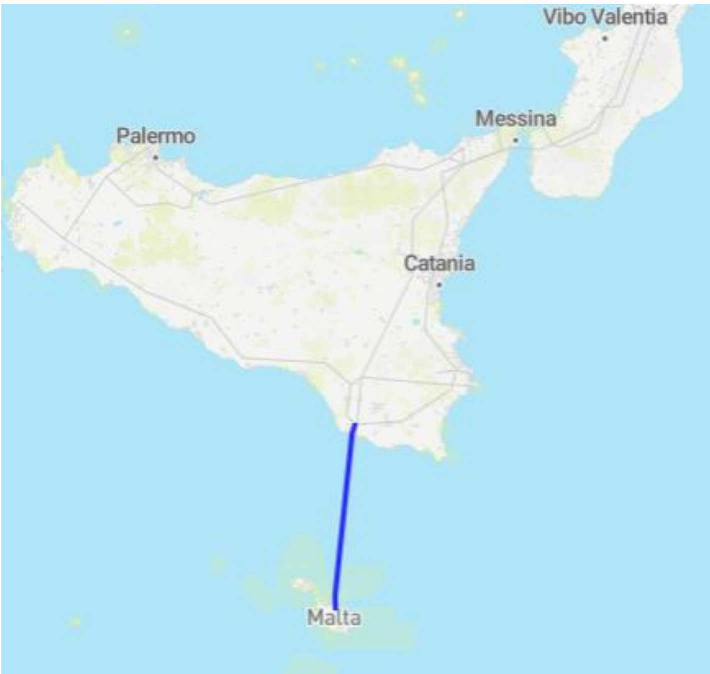
<tr><td rowspan="2">
</td><td>Project ID in TYNDP: TR 1085</td></tr>
<tr><td>Description: The project consists of a new ~118km long 200MWe HVAC electrical cable interconnection through a submarine cable operating at 220kV between Malta (Maghtab) and Sicily (Ragusa) to be laid in parallel but at a safe distance to the existing ac cable link. The project is part of Maltese Government’s future energy strategy in meeting the 2030 climate and energy targets and the longer-term decarbonisation objectives and shall feature in the next update of the Maltese National Energy and Climate Plan. It aims at diversifying the island's energy</td></tr>
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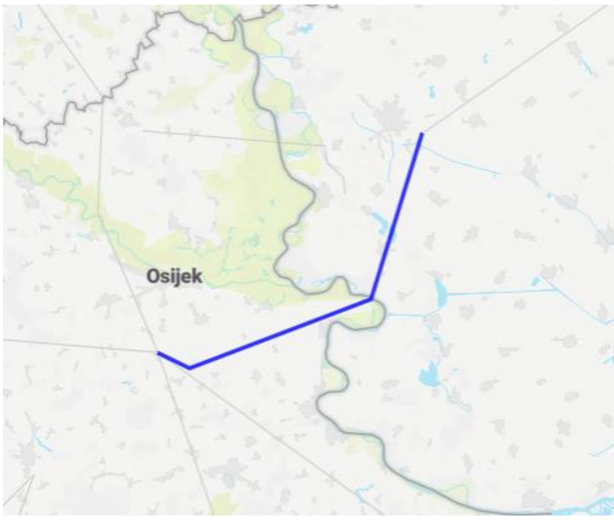
	sources and meet the projected increase in electricity demand from economic growth and electrification of the transport sector. The Project will also strengthen the electricity interconnectivity with the EU electricity network, allow for increased importation of electricity sourced from renewables, optimise the use of local power generation, whilst allowing the increase in local renewable energy sources through the enhancement of the grid stability and balancing of intermittent RES.
	Status: Under Consideration
	Promoting country (organization): Italy and Malta (Interconnect Malta Ltd)
	Commissioning: 12-2025

5.2.2.22 Obersielach (AT) - Podlog (SI)

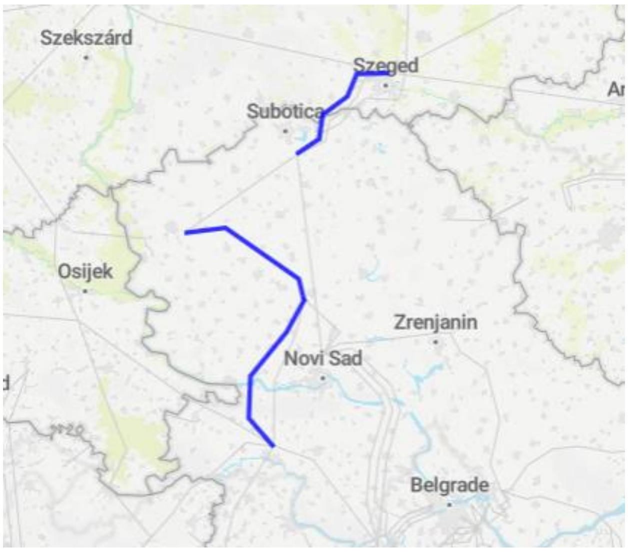
	**Project ID in TYNDP:** TR 325
	Description: Obersielach (AT) - Podlog (SI); 380-kV Upgrade; +500 MW NTC in both directions.
	Contribution: C-R 1, C-R 2 and C-R 3
	Status: Under Consideration
	Promoting country (organization): Austria and Slovenia (Austrian Power Grid, Eles)
	Commissioning: 06-2034

5.2.2.23 New 400 kV interconnection line between Serbia and Croatia

<table>
<tr><td rowspan="6">
</td><td>Project ID in TYNDP: TR 243</td></tr>
<tr><td>Description: Construction of new 400 kV interconnection line Sombor (RS) - Ernestinovo (HR), expected to provide a significant asset in terms of increasing the NTC between Serbia and Croatia, hence allowing the more prominent energy flow in the East-West direction across the CSE region, improving the market integration among the beneficiary countries and further ensuring the security of supply primarily in Serbia and Croatia, but, under certain circumstances, contributing to the reliable functioning of the systems in the rest of the countries in the region as well. Alongside that, it should be mentioned that the project will have a rather positive impact related to the possibility of integration of renewable energy sources in the Backa region.</td></tr>
<tr><td>Contribution: C-R 1, C-R 3, C-R 6 and C-R 7</td></tr>
<tr><td>Status: Under Consideration</td></tr>
<tr><td>Promoting country (organization): Croatia and Serbia (EMS, HOPS)</td></tr>
<tr><td>Commissioning: 09-2035</td></tr>
</table>

5.2.2.24 Pannonian Corridor

<table>
<tr><td rowspan="2"></td><td>Project ID in TYNDP: TR 1074</td></tr>
<tr><td>Description: The new 400 kV line connecting Serbian and Hungarian transmission systems, initially considered to connect SS Subotica 3 (RS) and SS Sándorfalva (HU). This is, however, not definitely decided, as the bilaterally developed Pre-Feasibility Study is expected to be done soon. This Study will provide much clearer insight into the situation in the area of interest and suggest the optimal substations that should be</td></tr>
</table>

	connected by the new line. Also, this project includes strengthening the North-to-South transmission corridor in Serbian system, by building two new 400 kV lines: SS Sombor 3 – SS Srbobran and SS Srbobran – SS Sremska Mitrovica 2. This is also deemed necessary, as numerous calculations have indicated that the new tie-line may not affect the NTC value enough if it is not accompanied by the two mentioned internal lines. The project can, alongside covering the needs seen in IoSN report, also be seen as a response to the ever-higher requests for integration of renewable sources in the Bačka region, while simultaneously strongly enhancing the security of supply and reliability of the transmission systems' operation in the included countries.
	Contribution: C-R 1, C-R 3, C-R 4 and C-R 6
	Status: Under Consideration
	Promoting country (organization): Hungary and Serbia (EMS, MAVIR)
	Commissioning: 09-2033

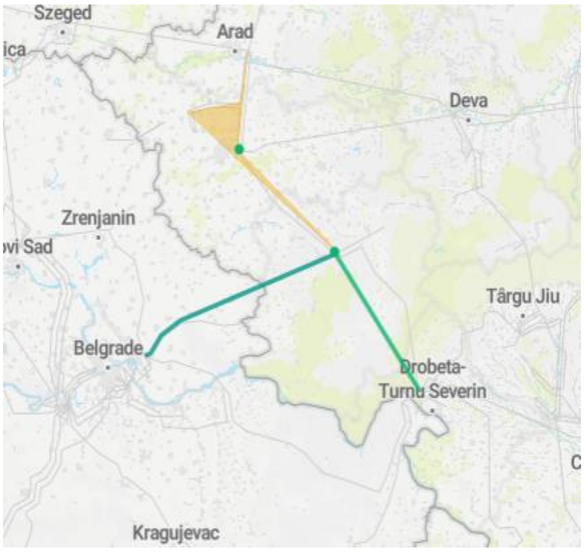
5.2.2.25 North CSE Corridor

	Project ID in TYNDP: TR 341
	Description: This project will consist of three investments. The investments of this project are SS 400/110 Belgrade 50, OHL 400 kV SS Belgrade 50 - WPP Cibuk and doubling existing OHL 400 kV Portile de Fier (RO) - Djerdap 1 (RS). Every investment included in this project represents a segment of the new significant corridor in the East-to-West direction, boasting the massive cross-border impact on the boundary between Serbia and Romania. This, in

	detail, means that the project will enhance the market integration in the region, allowing the lower difference in marginal energy costs, allow the connection of huge capacities of renewable sources that have applied for connection in the observed area (only in Serbia, there is over 3 GW of new wind and solar power plants foreseen in the Banat region) and affect the security of supply in the aforementioned region by increasing the available balancing capacity across the mentioned border. It is clear that the new renewable capacities, enabled for connection by this project's commissioning, will enormously change the generation mix in Serbia and provide a boost for the Serbian transition towards the sustainable and environmentally acceptable green energy production.
	Contribution: C-R 1, C-R 2, C-R 3 and C-R 6
	Status: Planned But Not Yet Permitting
	Promoting country (organization): Romania and Serbia (EMS, Transelectrica)
	Commissioning: 09-2029

5.2.2.26 Mid Continental East corridor

	Project ID in TYNDP: TR 144 **PCI number 3.22 (5th list)**
	Description: The project consists of one double circuit 400 kV interconnection line between Serbia and Romania and reinforcement of the network along the western border in Romania:

	one new simple circuit 400 kV line from Portile de Fier to Resita and upgrade from 220 kV double circuit to 400 kV double circuit of the axis between Resita and Arad, including upgrade to 400 kV of three substations along this path: Resita, Timisoara, Sacalaz. The main aim of this project is increasing the transmission capacity along the East-West corridor in the South-Eastern and Central Europe, simultaneously contributing to the market integration in the region of interest and enhancing the integration of large renewable sources in the Banat region, located in the close proximity of the Serbia-Romania and Hungary-Romania borders. Along with that, the commissioning of the project will strongly improve the security of supply in the mentioned area, thus fulfilling one of the primary postulates of the modern transmission systems' reliable operation.
	Contribution: C-R 3
	Status: In Permitting
	Promoting country (organization): Romania and Serbia (EMS, Transelectrica)
	Commissioning: 12-2029

5.2.2.27 Central Balkan Corridor

	Project ID in TYNDP: TR 342
	Description: This corridor will enable transmission of energy from east to west on the border between Bulgaria to Serbia and further to Montenegro and Bosnia and Herzegovina. It consists of several investments from SS Sofia West on the east to SS Pljevlja 2 and SS Visegrad on the west. In that way this corridor will be directly connected with project Transbalkan corridor (therefore, enabling the connection between Bulgarian energy market

and Italian energy market), which represent a direct prerequisite for the proper development of the Central Balkan corridor. Among the numerous other benefits expected once this project is commissioned, the increase of NTCs on the borders between the involved countries (implying both the market integration and additional resources in securing the reliability of transmission systems' operation) can be seen as one of the most prominent. This project could also prove to be a strong asset in fully utilizing the hydro potentials of Western Serbia.

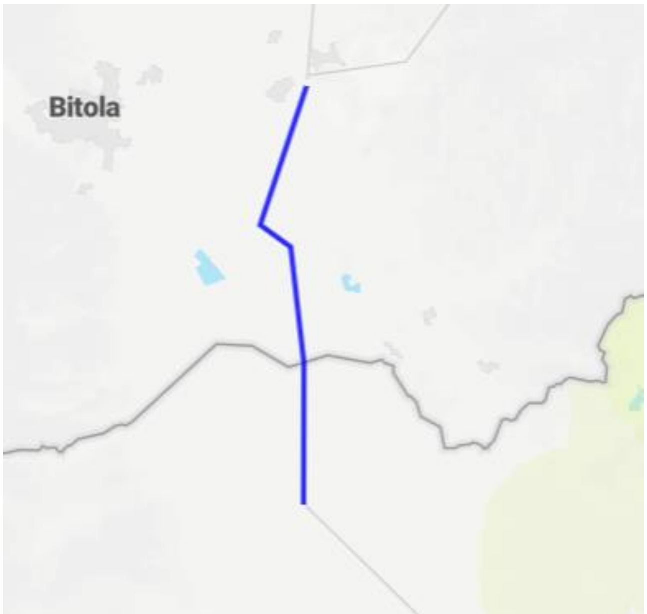
Contribution: C-R 1, C-R 2, C-R 3 and C-R 4

Status: Planned But Not Yet Permitting

Promoting country (organization): Bosnia and Herzegovina, Bulgaria, Montenegro, Serbia (JSC EMS-SR, ESO EAD-BG, CGES-MNR, NOS BiH-BA)

Commissioning: 09-2034

5.2.2.28 Refurbishment of the 400kV Meliti(GR)-Bitola(MK) interconnector



Project ID in TYNDP: TR 376

Description: The project aims at the reconductoring of the already existing 400kV interconnection line between Meliti (GR) and Bitola (MK), in order to increase transfer capacity between the power systems of Greece and North Macedonia.

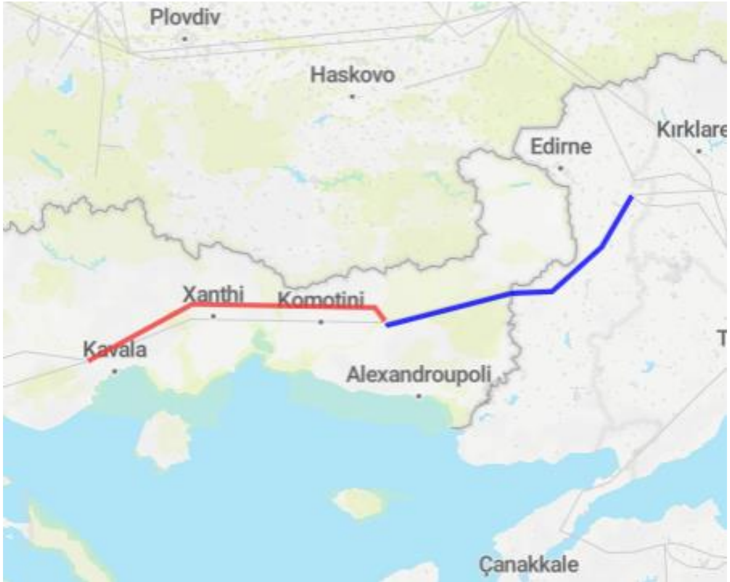
Contribution: C-R 5, C-R 6 and C-R 7

Status: Under Consideration

Promoting country (organization): Greece and North Macedonia (Admie, MEPSO)

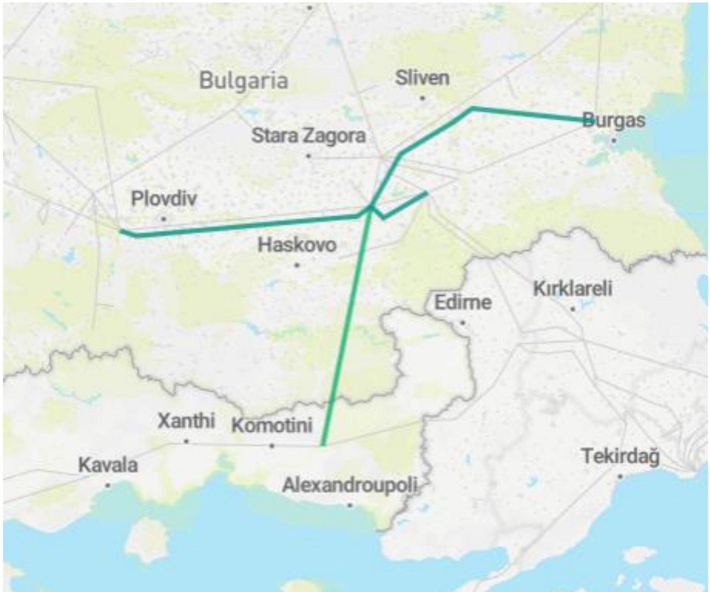
Commissioning: 06-2035

5.2.2.29 New AC 400 kV interconnection line Greece - Turkey

<table>
<tr><td rowspan="3">
</td><td>Project ID in TYNDP: TR 1067</td></tr>
<tr><td>Description: The project concerns the construction of a new AC 400kV interconnection Greece - Turkey. The proposed interconnection line with a total length 130 km will connect Nea Santa SS in Greece and Babaeski SS in Turkey (Investment ID 1738 - New AC 400 kV interconnection line Greece - Turkey (Nea Santa (GR)-Babaeski (TR)) and Investment ID 1787 - New 400 kV OHL Nea Santa - Filippi). This project, together with the project for a new interconnection between Bulgaria and Turkey, compose the project “East Balkan Corridor” that will contribute to the increase of the cross-border transfer capacities between ENTSO-E countries and Turkey and address a system need, identified in ENTSO-E's System Needs study. The construction of the two interconnections will also improve the stability of the connection of a large electricity system such as the Turkish one to the unified electricity system of the countries of continental Europe. Furthermore the project will allow integration of more renewables to the grids, support the convergence of market price between the neighboring countries and thus will help the realization of clean energy package targets.</td></tr>
<tr><td>Contribution: C-R 1, C-R 5, C-R 6 and C-R 7</td></tr>
</table>

	Status: Investment ID 1738 - Under Consideration Investment ID 1787 - Planned But Not Yet Permitting
	Promoting country (organization): Greece and Turkey (Admie)
	Commissioning: Investment ID 1738 – 06/2035 Investment ID 1787 – 12/2027

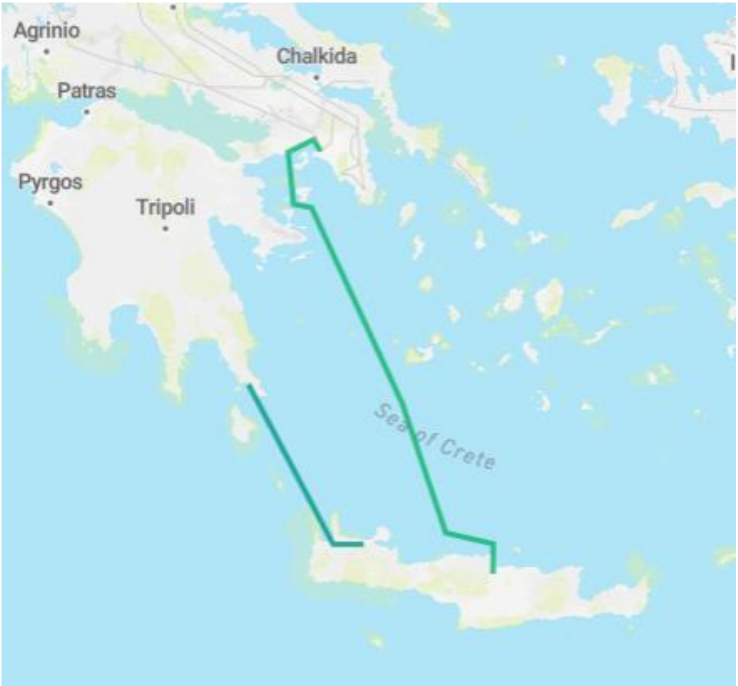
5.2.2.30 CSE4



Project ID in TYNDP: TR 142
Description: The project concerns the construction of a new AC 400kV interconnection between Bulgaria and Greece and new AC 400kV overhead lines at the south part of Bulgaria. This project will increase cross border transfer capacity between Bulgaria and Greece.
Contribution: C-R 1 and C-R 3
Status: Under Construction
Promoting country (organization): Bulgaria and Greece (ESO, ADMIE)
Commissioning: 06-2023

5.2.2.31 Interconnection of Crete to the Mainland System of Greece

	Project ID in TYNDP: TR 1055
	Description: Crete is the largest electrically non-interconnected island system in Greece, representing a particular case, due to large size, rapid growth, remote



location and large RES potential. The project aims to increase security of supply and improve stability issues of the island by its interconnection to the mainland system. It is expected to contribute to the reduction of the operation of oil-fired units that currently supply the island and in the long run to allow their progressive decommissioning, thus contributing to the reduction of production variable costs and greenhouse gas emissions. It will allow the full exploitation of local RES potential. The project shall ensure a more reliable and cost-effective supply of electricity to the island. This interconnection will be implemented in two phases. In Phase I Crete will be connected to Peloponnese with a 150 kV AC double circuit submarine cable interconnector of 2x200 MVA nominal transfer capacity. In Phase II Crete will be connected to Attica with a bipolar submarine HVDC-VSC link of 2x500 MW capacity transfer. The project in total contributes in achieving the EU-wide targets and policy objectives set in the 2030 climate and energy framework.

Contribution: C-R 2 and C-R 3

Status: Under Construction

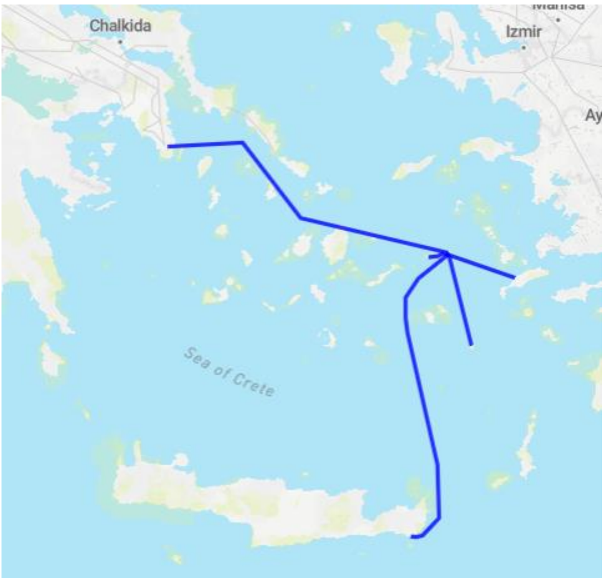
Promoting country (organization): Greece (ADMIE)

Commissioning:

Investment ID 1717 – 06-2024

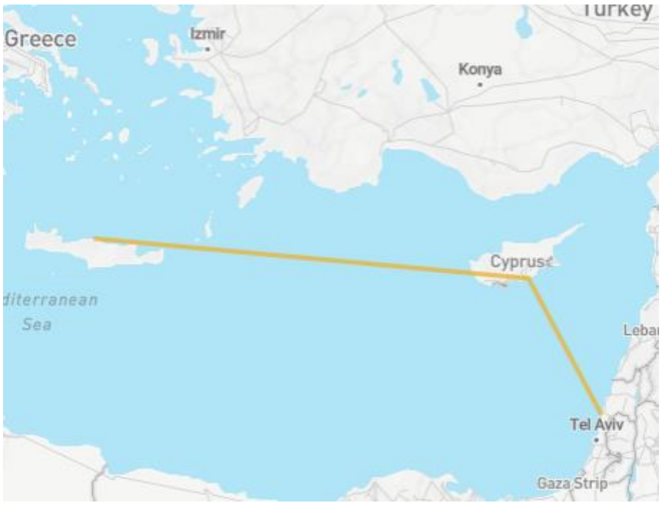
	Investment ID 1716 – 05-2021 (Completed)

5.2.2.32 Southern Aegean Interconnector

<table>
<tr><td rowspan="5">
</td><td>Project ID in TYNDP: TR 293</td></tr>
<tr><td>Description: The project refers to the construction of a submarine DC transmission link to connect the licensed RES plants, located on 23 small uninhabited islands at the South Aegean Sea, with mainland Greece and the islands of Crete and Kos (Dodecanese). The main link will be an HVDC link connecting the island of Levitha to both the metropolitan area of Athens and the island of Crete; the 400kV substation at Lavrion area will be the connection point in the Athens area and the substation of Atherinolakkos will be the connection point in Crete (located in the South-East coast). The capacity of each link will be 600 to 800MW both directions using HVDC (High Voltage Direct Current) XLPE insulated technology and both links will consist of two parallel cables in order to increase the reliability of each link. Three conversion stations using HVDC VSC technology are foreseen in Lavrio, Levitha & Crete (Atherinolakkos). All the installations on the islands (converter stations, substations etc) will be of closed type using GIS technology. The project will provide 19TWh/year of wind energy, increasing the transfer capacity between mainland Greece, Crete and Dodecanese islands.</td></tr>
<tr><td>Contribution: C-R 2, C-R 3 and C-R 7</td></tr>
<tr><td>Status: Under Consideration</td></tr>
<tr><td>Promoting country (organization): Greece (Southern Aegean Interconnector SMSA (Member of Eunice Energy Group))</td></tr>
</table>

	Commissioning: 2026

5.2.2.33 EuroAsia Interconnector

	**Project ID in TYNDP:** TR 219 **PCI number 3.10.1 and 3.10.2 (5th list)**
	Description: The EuroAsia Interconnector PCI 3.10 is a multi-terminal VSC-HVDC scheme which will connect the transmission networks of Greece (Crete), Cyprus and Israel, and will comprise two converter stations with sea-electrodes, interconnected by HVDC cable systems. The initial development will allow the bidirectional transfer of 1000 MW. At full deployment, it will allow the transfer of 2000 MW. Its total offshore length is 1208 km (310 km CY-IL, 898 km CY–Crete) while its onshore length is 25 km. The cables will be laid at a max. water depth of 2200 m between IL and CY and 3000 m between CY and CR. The EuroAsia Interconnector is a European Project of Common Interest (PCI) since 2013 listed in the 'NSI East Electricity' priority corridor. It is defined as a cluster PCI 3.10 consisting of the following PCIs: • PCI 3.10.1 – Interconnection Hadera (IL) - Kofinou (CY) • PCI 3.10.2 – Interconnection Kofinou (CY) - Korakia, Crete (EL)
	Contribution: C-R 1, C-R 3 and C-R 5 + Infrastructure improves voltage stability by offering reactive power controllability of converters by system operator(s)
	Status: In Permitting

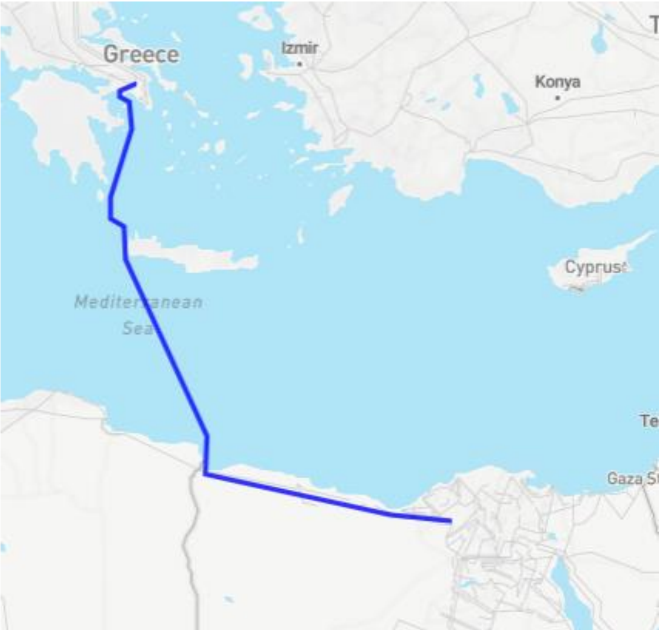
	Promoting country (organization): Cyprus, Greece and Israel (EuroAsia Interconnector)
	Commissioning: 12-2026

5.2.2.34 Greece - Africa Power Interconnector (GAP Interconnector)

	**Project ID in TYNDP:** TR 1048
	Description: The project refers to the construction of a submarine DC transmission link of total capacity 2000MW (2x1000MW) interconnecting Egypt's North Mediterranean coast and Greece at the island of Crete. A new HVDC conversion station close to the existing thermal power plant of Atherinolakkos in South-East Crete will be the connection point to Greece. Crete interconnection with mainland Greece is already under way by the Greek TSO (IPTO) with the implementation works expected to be completed before 2030 (both AC and DC links). Moreover, the Southern Aegean Interconnector" project will provide another transmission route of the transfer capacity through the Aegean Sea. The connection point in Egypt will be at its Northern coast located South of Crete, where the bulk of Egypt's electrical load and HV transmission grid infrastructure is located. All the aforementioned installations (converter stations, substations etc) will be of closed type using GIS technology. The proposed Greece - Africa interconnection project will provide energy stability to the Eastern Mediterranean Sea area as intercontinental energy transfers will be facilitated and generation adequacy of the region will be increased.

	Contribution: C-R 1, C-R 2, C-R 3 and C-R 7
	Status: Under Consideration
	Promoting country (organization): Egypt and Greece (Greece Africa Power Interconnector SMSA (Member of Eunice Energy Group))
	Commissioning: 01-2028

5.2.2.35 GREGY Green Energy Interconnector

	**Project ID in TYNDP:** TR 1041
	Description: GREGY Interconnector concerns the possibility to create a new energy highway within the Mediterranean Basin, by interconnecting Egypt and Greece. GREGY project consists of an HVDC interconnection from Wadi-El-Natroon (Egypt) to Attica area (Greece) of about 1472 km total length. GREGY will supply renewable power on a permanent basis (8760 h) up to the capacity of 3000MW. The project will exploit part of the 61 GW RES capacity that will be installed in Egypt by 2035 according to the long-term Egyptian Development Plan. GREGY will allow 100% RES energy exports, contractually ensured by bespoke Power Purchasing Agreements (PPAs), from Egypt to Greece, and vice versa, at times of high-RES generation, contributing to a significant increase of participation of RES in the energy mix and reduction of greenhouse emissions of the power sector. In addition to RES increase, benefits such as market coupling, enhanced security of supply (Adequacy, Flexibility, Stability) and socio-economic welfare are enabled through GREGY

	establishing a new interconnection between two large synchronous areas.
	Contribution: C-R 1, C-R 3, C-R 6 and C-R 7
	Status: Under Consideration
	Promoting country (organization): Egypt and Greece (ELICA S.A.)
	Commissioning: 01-2028

5.2.3 Critical issues and bottlenecks. New opportunities and roadblocks.

It seems that the current energy crises made decision makers across Europe to focus their plans for an energy transition away from fossil fuels and towards electrification. However, the new decarbonized and decentralized electricity system raises number of challenges. One of the solutions to cope with these challenges are investment in electricity networks and efficient usage of the existing ones, as well as new cross-border interconnection capacities. Also, in order to address those challenges new market designs are needed.

It is necessary to increase market competition and create one unique European market and transmission system. To do so, EU has adopted an electricity interconnectivity targets for 2020 and 2030. These targets are adopted to reflect the energy transition process and increasing share of renewable energy sources in the EU transmission system.

The EU has set an interconnection target of at least 10% by 2020 and of at least 15% by 2030 of their installed electricity production capacity, respectfully. In other words, each country in 2030 should have constructed interconnection transmission lines capacity that allow at least 15% of the electricity generation on its territory to be transported across its borders to neighbouring countries.

In addition, the EU has raised the issue about the limited usage of cross-border interconnection lines by defining the so-called 70 % minimum target for cross-zonal capacity. The *Regulation (EU) 2019/943 of 5 June 2019 on the internal market for electricity* sees the curtailments of interconnector capacities as one of the most serious obstacles to the development of the internal EU market for electricity. Therefore, it calls for providing the maximum interconnector capacity to market participants, with full respect to safety and security standards of the transmission network operation and prescribes that at least the 70 % of the net transmission capacity of active power will be put on disposal for market participants. These targets also have to be followed by the EU EUSAIR countries.

The above-mentioned targets and requirements related to interconnection capacity targets and available cross-border interconnection are not binding for the non-EU EUSAIR countries in the same manner as they apply for the EU EUASIR states. However, non-EU EUSAIR countries TSOs have the obligation to maximise the cross-border capacity offered to the market and from this point of view the targets applied in the EU represent a firm benchmark towards which the CPs shall work85. It is worth mention that non-EU EUSAIR countries are exceptionally well interconnected (mainly legacy of former Yugoslavia) among each other which is huge opportunity in developing future common electricity market.

[85] https://www.energy-community.org/dam/jcr:97afc332-0495-479b-a1d6-848a2c6877a2/ECS_Interconnection_Targets_022021.pdf

6 Section 6 - Natural gas supply and networks in the Adriatic-Ionian Region

6.1 Overview and description of the EUSAIR countries national gas system

6.1.1 Total gas supply, national gas production, gas import shares according to their origin

Domestic natural gas production in the EUSAIR area is driven by production in the Italian regions bordering the Adriatic Sea.

Historically, offshore extractions have represented the prevalent share of Italian production, but in the last thirty years they have drastically dropped (reaching approximately 1.9 billion cubic meters in 2020 compared to 7.7 billion in 1990) reaching the Italian onshore production (also decreased by over 60% in the same period).

Currently, however, the Italian production represents, in the EUSAIR area, about 77% of the total production. Only Croatia and Serbia have significant domestic production (equal to approximately 860 and 400 million cubic meters respectively), while Albania, Greece and Slovenia have marginal productions (equal to approximately 50, 8 and 6 million cubic meters respectively).

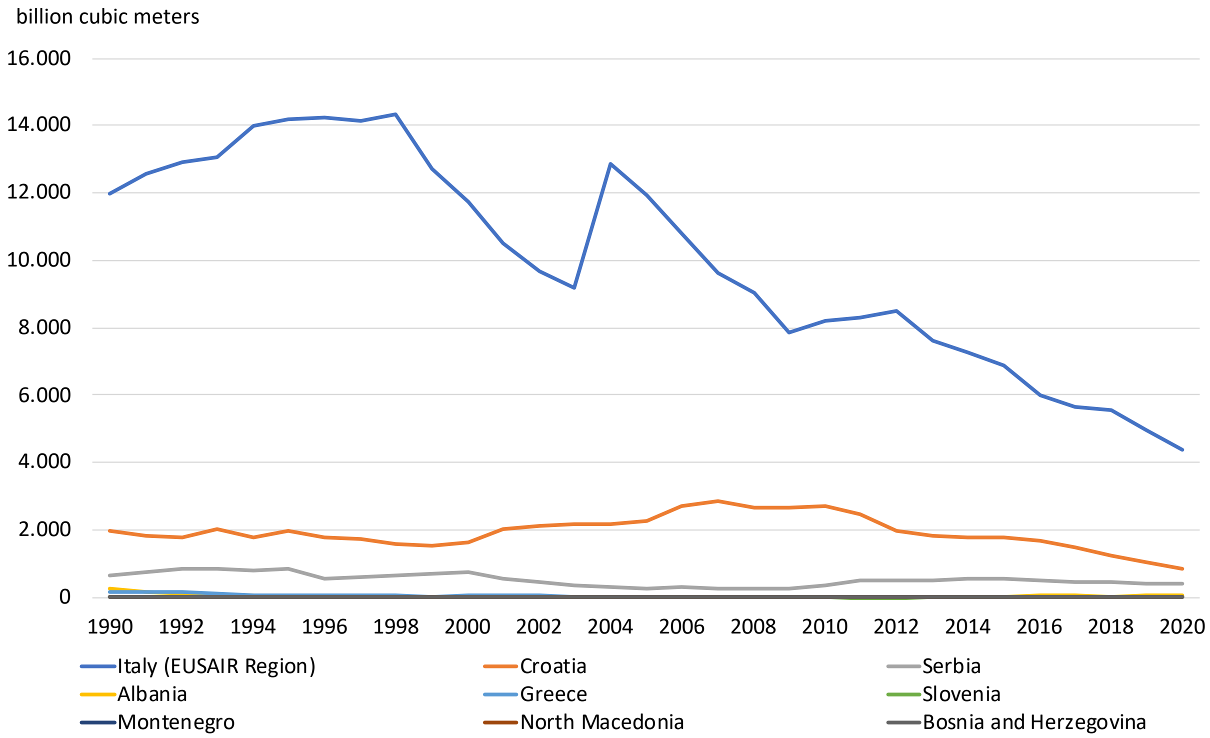


Figure 79 – Natural gas production in EUSAIR Countries

Source: Consultant’s elaboration on Eurostat and Italian Economic Development Ministry data

Most of the consumption, therefore, is met through natural gas imports, both through pipelines (the main share) and, in some cases, through LNG regasifiers.

The largest importer is obviously Italy, which in 2020 imported a total of over 66 billion cubic meters of natural gas, of which 12 billion in the form of LNG.

Other large gas importers are Greece, with volumes of almost 6 billion cubic meters of imported gas (of which about half through LNG), Croatia and Serbia, which both imported about 2 billion cubic meters exclusively by land, and Slovenia, also an importer only by land for about 900 million cubic meters of gas.

Bosnia Herzegovina and North Macedonia import gas from Russia alone for volumes of 200-300 million cubic meters.

Montenegro and Albania, on the other hand, have no gas imports.

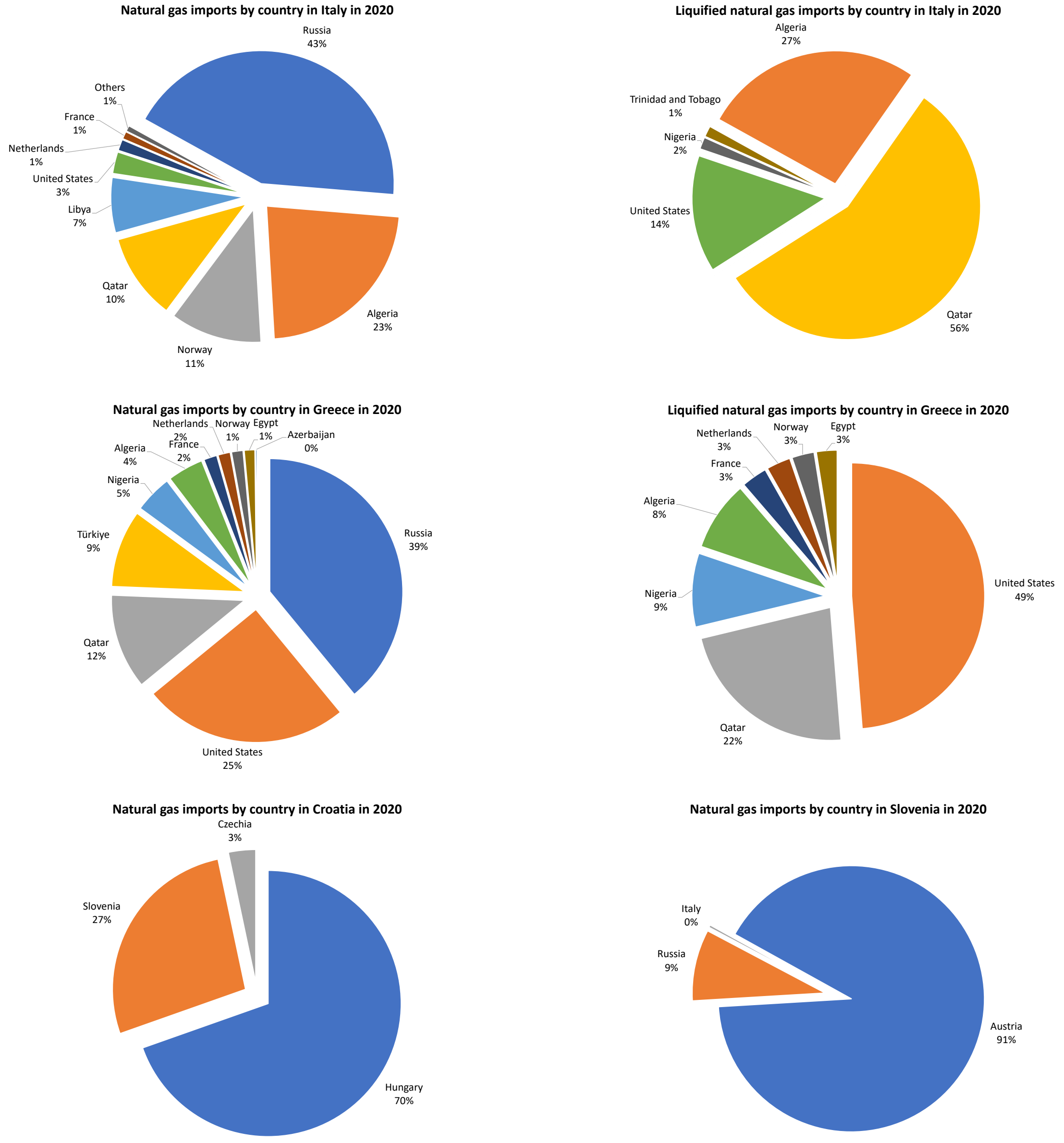


Figure 80 – Natural gas imports by country

Source: Consultant's elaboration on Eurostat data

6.1.2 Natural gas demand sectors and their shares in national demand

Natural gas consumption in the EUSAIR area reached 65 billion cubic meters in 2019, of which over 52 billion cubic meters in the Italian regions (81% of the total).

Almost half of the gas consumption in the EUSAIR countries (46% to be exact) was used for the production of electricity and heat; 23% in the housing sector, 15% in industry and 10% in services.

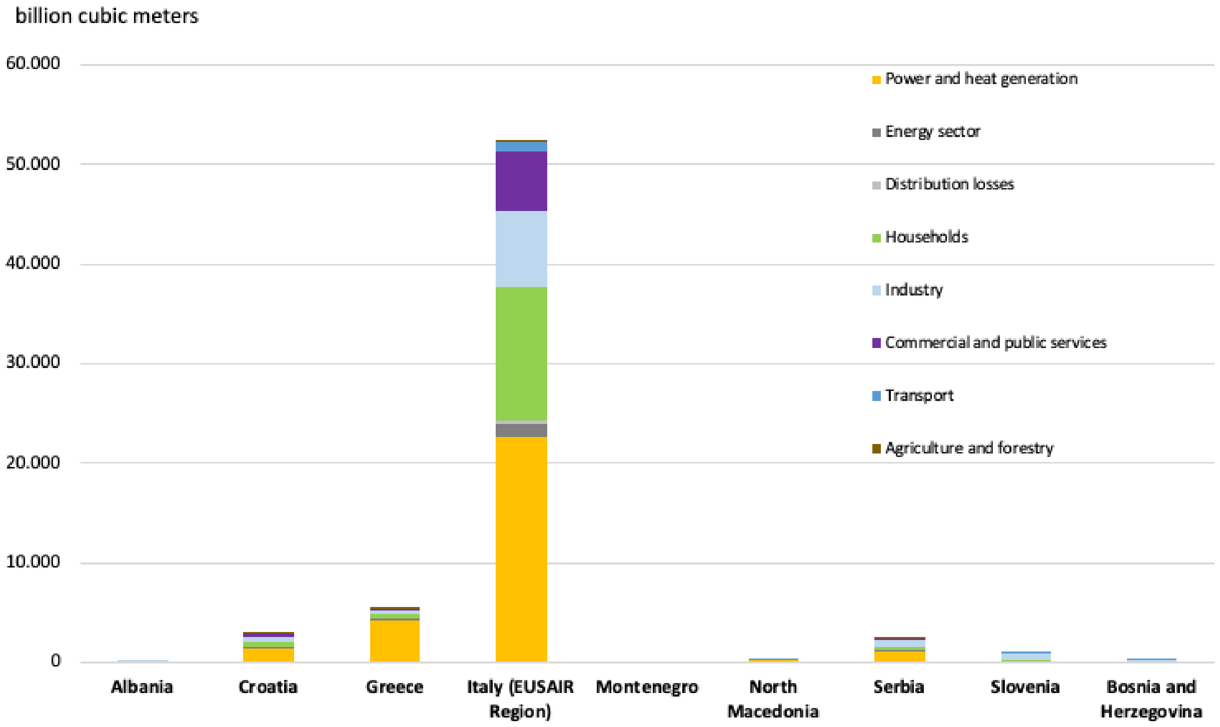


Figure 81 – Natural gas consumption in 2019

Source: Consultant's elaboration on Eurostat data

At the level of individual countries, there is a strong propensity for Italy to use natural gas, especially for electricity and heat production and in the domestic sector, where since the second post-war period there has been a strong path of methanisation.

The second largest consumer of gas, after the Italian regions, is Greece, which uses it mainly for electricity and power generation (about 77%), and a minority share in the domestic and industrial sectors.

Croatia, the third consumer, has a gas consumption structure similar to the Italian one, with about half of the gas used for electricity production and widespread consumption in other sectors, in particular domestic and industrial.

In addition to a significant share of gas for heat and electricity production (mainly heat), Serbia also uses gas extensively in industry.

Slovenia and Bosnia also use gas massively in industry (over 60% and 40% respectively), while North Macedonia and Albania use it mainly in the electricity and energy sectors.

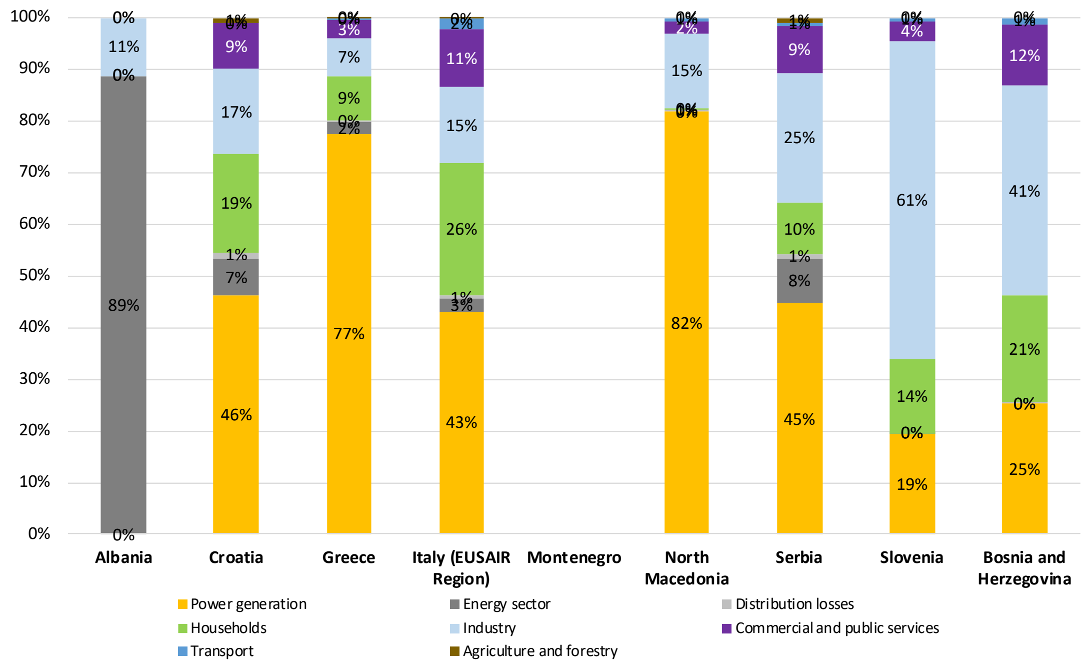


Figure 82 – Natural gas consumption in 2019

Source: Consultant's elaboration on Eurostat data

6.1.3 Trends for the period 2000-2019 and gas prices

Very high gas prices have been recorded throughout Europe in 2022 as a consequence of recovering from Covid-19 pandemic, decrease of coal and nuclear production, war between Russia and Ukraine started in February 2022 and still ongoing while this study has been conducted, thus provoking shortage of gas supplies.

For the purpose of this study, 2019 has been selected as a reference year even though trend on gas prices includes the period up to 2021. Albania and Montenegro are not having and using gas and are not connected to international gas networks at the moment, thus excluded from this analysis on gas prices (according to Eurostat data, in Albania the minimum gas consumption - about 70 million cubic meters - is linked to the energy and industrial sector).

In 2019, gas prices, including taxes and levies, were significantly lower in non-EU countries than in EU member countries of the EUSAIR.

In the non-EU countries of the EUSAIR, the gas market is dominated by the state-owned gas supply companies. Incumbents are still supplying all households and industry applying regulated entry and exit tariffs and keeping them at politically low level.

The gap between residential price in the non-EU and the EU-27 countries remains significant. If we consider only the cost of energy and supply, it is lowest in Croatia 0,0229 €/kWh, followed by Bosnia and Herzegovina 0,0249 €/kWh and Serbia 0,0261 €/kWh. Although higher in Italy than in aforementioned countries, with its 0,0348 €/kWh, it represents 38% of the end-consumer's gas price, which is the lowest among all EUSAIR countries, meaning that the taxes and levies in Italy are considerably higher than in other EUSAIR Countries.

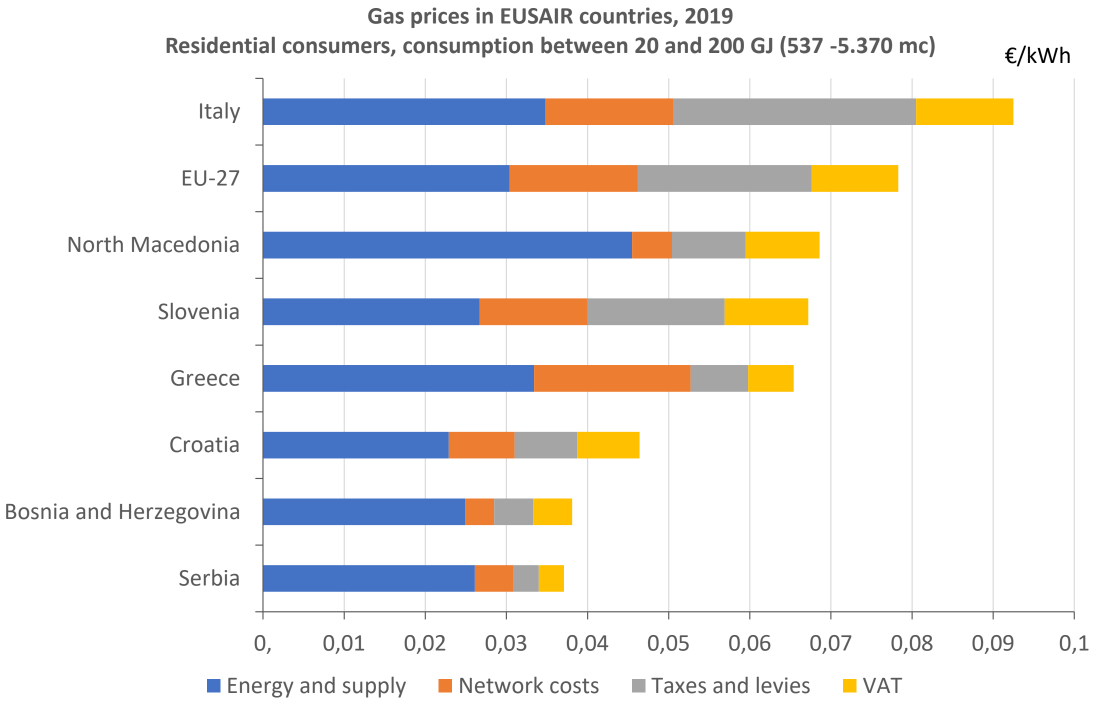


Figure 83 – Gas prices in EUSAIR countries in 2019[86]

Source: Consultant's elaboration on Eurostat data

It is interesting to analyse the differences between nominal prices and purchasing power standards (PPS), which considers the differences in income and living costs between countries. PPS is a common reference currency that eliminates general price level difference between countries. Using PPS, the prices in national currency are adjusted in order to allow the comparison on the basis of purchasing the same amount of goods and services.

As regards the residential prices, the lowest nominal prices including tax and levies and VAT are found in Serbia, Bosnia and Herzegovina and Croatia and but these rankings change when relative purchasing power is taken into account. In PPS terms, the countries with the highest difference are North Macedonia, Bosnia and Herzegovina, Serbia and Croatia. Although their nominal prices appear low, once these are adjusted for local income, they become much more expensive. For example, Macedonian and Bosnia's and Herzegovina gas prices are 119% and 95% respectively more expensive once corrected for purchasing power.

[86] Residential consumers, consumption between 20 and 200 GJ (537 – 5.370 mc)

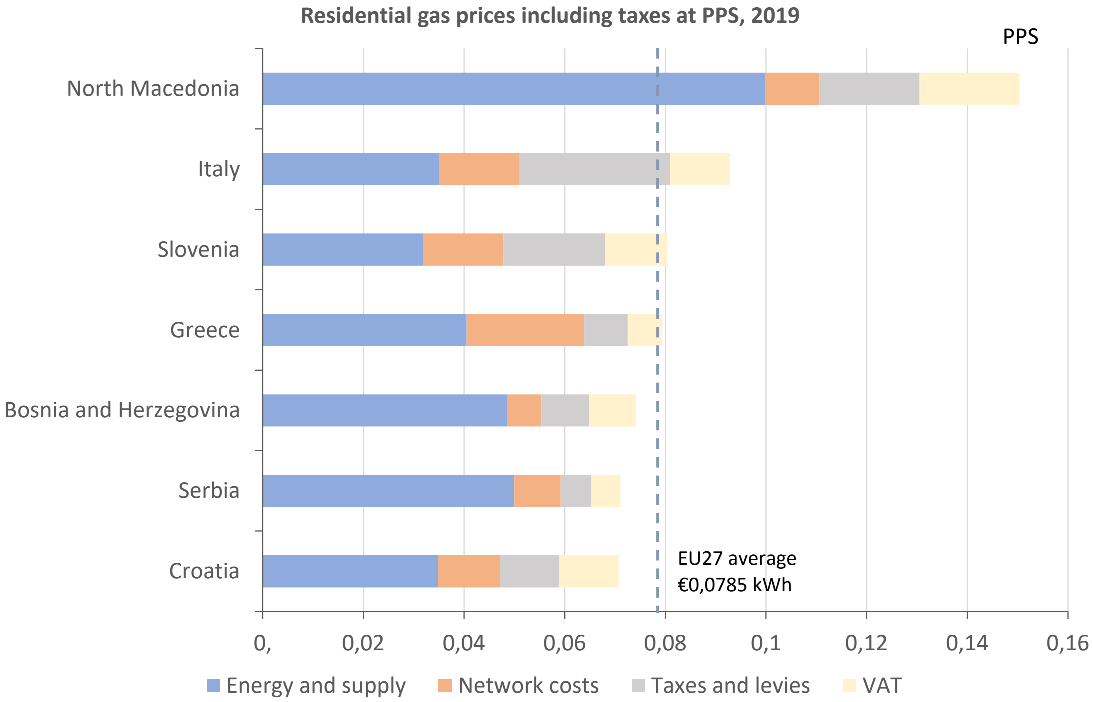


Figure 84 – Residential gas prices, including taxes at PPS

Source: Consultant's elaboration on Eurostat data

Considering trend of gas prices, the prices charged to residential sector consuming annually between 20-200 GJ (537-5.370 mc) has dropped significantly in 2009 in EU-27, Slovenia, Croatia, Italy due to economic downturn which impacted energy demand and prices. The prices started to increase in 2010 when a cold winter hit many parts of EU and non-EU countries. In 2016, gas prices dropped and then hiked in 2018. Following the decreasing trend of 2019 and 2020, the gas price is constantly increasing since 2021. The ongoing energy crisis significantly impacted gas prices which almost doubled in 2021.

From 2013 to 2021, gas prices increased by 2,3% on average in all EU-27 countries on a year-on-year basis. Italy has registered the highest increase of 3,5%, followed by Croatia (+2,7%), North Macedonia (+2,8) and Greece (1,75), while an annual decrease was registered in Serbia (-3,1%) and Bosnia and Herzegovina (-2%).

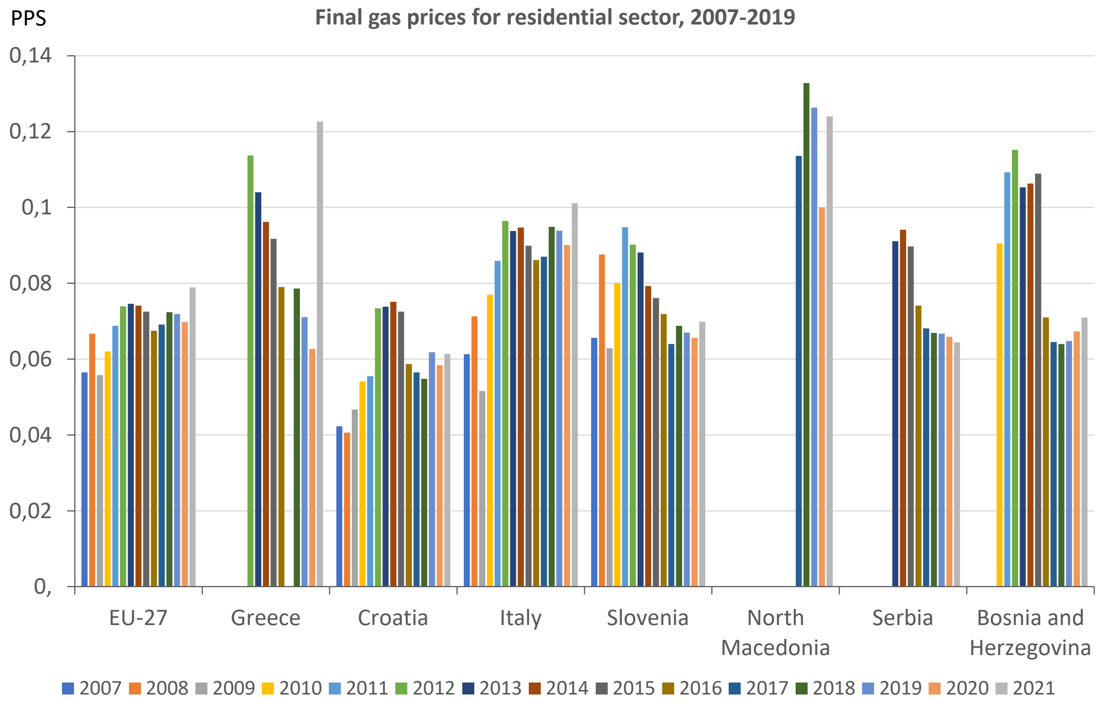


Figure 85 – Final gas prices for residential sector at PPS, 2007-2019

Source: Consultant's elaboration on Eurostat data

As regards the prices to industry, the gas prices without taxes and charges in non-EU is close to EU-27 or even exceeds it. In Serbia and Bosnia and Herzegovina, for example, is 62% higher than in the EU-27.

In 2019, final gas prices for industry were the highest in Bosnia and Herzegovina, 0,435 €/kWh, almost two-times higher that in Italy that registered the lowest value, 0,0244 €/kWh

The gap between industrial prices in non-EU countries and EU is still wide due to the different regulatory approach of each country and levels of cross-subsidisation in industrial and residential prices.

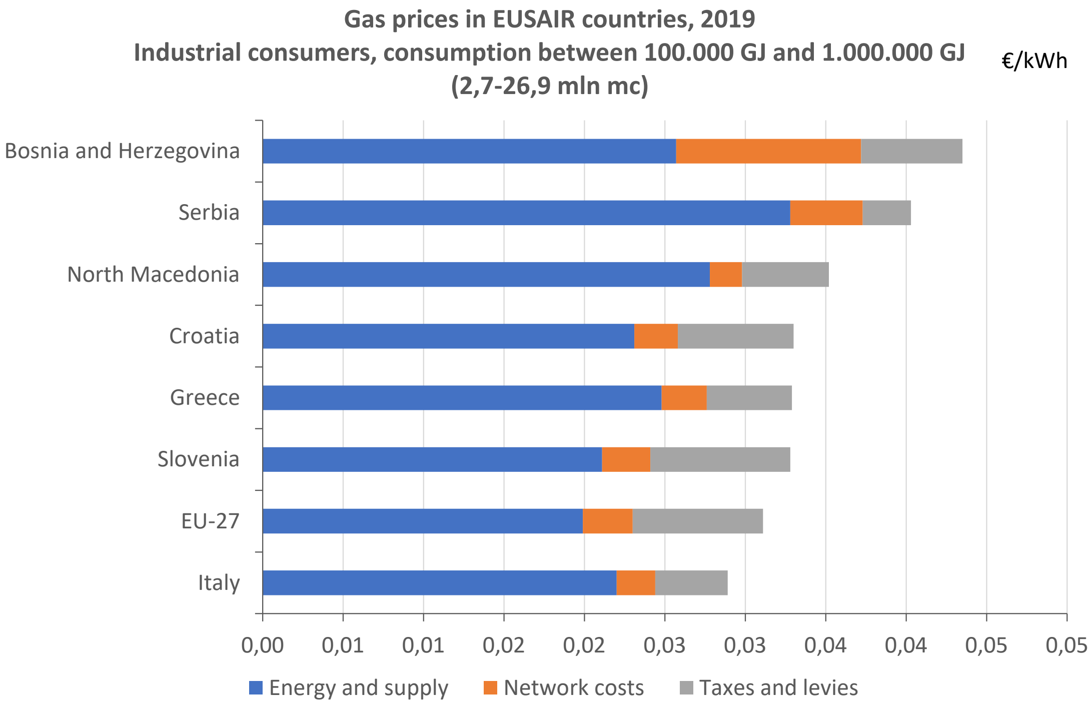


Figure 86 – Gas prices in EUSAIR countries in 2019[87]

Source: Consultant's elaboration on Eurostat data

As regards industrial prices, the lowest prices in PPS terms are found in Italy, Slovenia and Greece and generally in EU-27 average meaning that these countries become less expensive in comparison to Bosnia and Herzegovina, North Macedonia and Serbia that become much more expensive when it comes to adjustment for local income.

[87] Industrial consumers, consumption between 100.000 GJ and 1.000.000 GJ (2,7 – 26,9 mln mc)

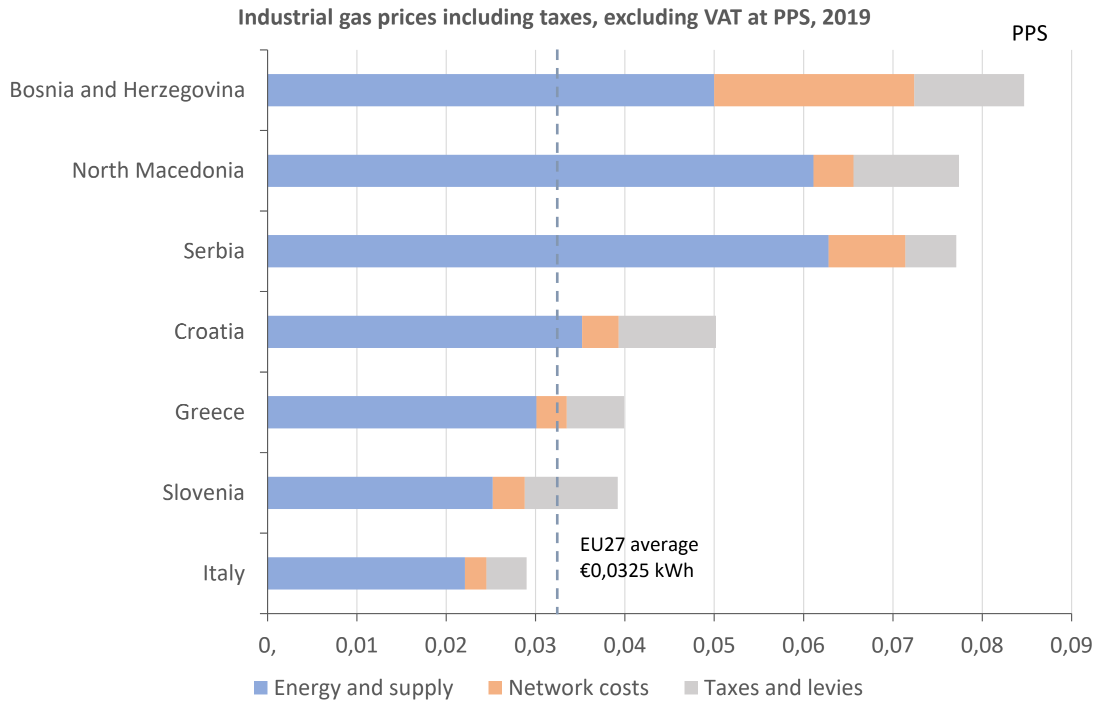


Figure 87 – Industrial gas prices including taxes, excluding VAT at PPS in 2019

Source: Consultant's elaboration on Eurostat data

Figure below shows the evolution of industrial gas prices in the EUSAIR Countries for the consumption at PPS between 100.000-1.000.000 GJ (2,7-26,9 mln mc), which is the most common value of industrial sector. It may be observed that between 2013 and 2019, the gas prices generally decreased by 29% in all EUSAIR countries (6% on average on year-on-year basis). Industrial prices increased in all EU countries of the EUSAIR by almost 70% on average from 2019 to 2021, while this increase was lower in North Macedonia and Bosnia and Herzegovina by 4% on average. Only in Serbia, a decrease by -5% was registered thanks to the regulated gas prices. More precisely, the decrease was registered between 2019 and 2020 caused by lockdowns due to Covid-19 pandemic and the slowdown in industrial production in all countries. The prices then started to rise from 2021 with a continuous upward trend and then tripled in 2022.

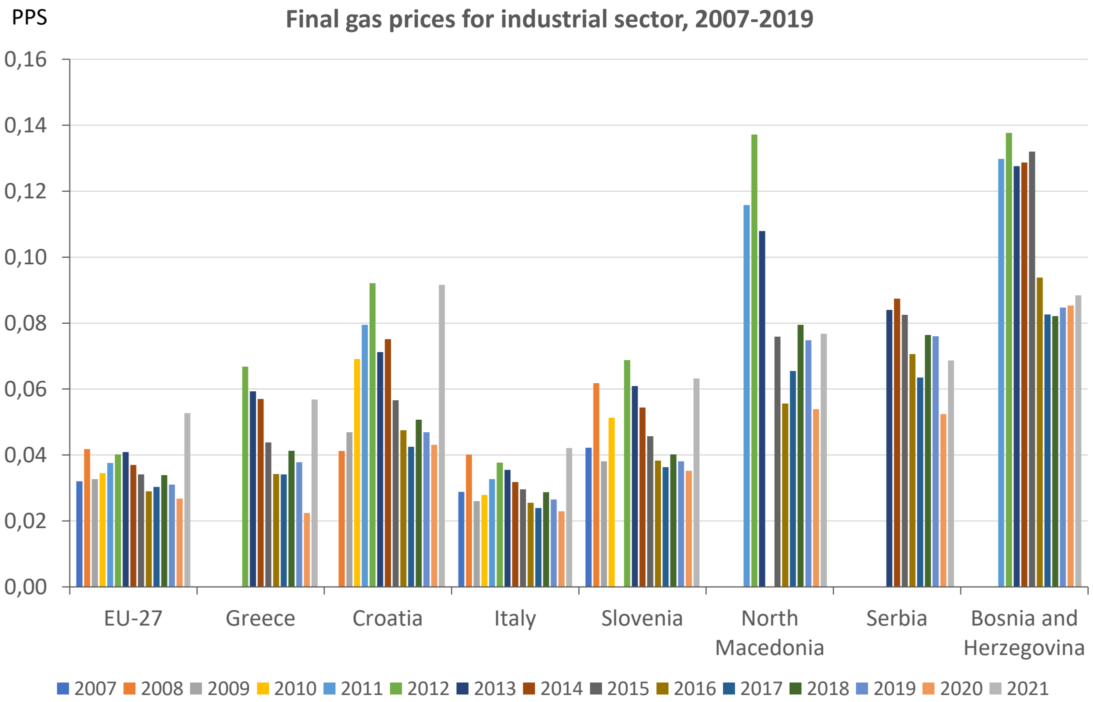


Figure 88 – Final gas prices for industrial sector at PPS, 2007-2019

Source: Consultant's elaboration on Eurostat data

Since September 2021, the increased energy cost accompanied by high inflation rate have been at the center of attention across the EUSAIR Countries. Reasons are multiple: economic recovery after lockdown and the consequent increase in production, whether conditions that increase demand, surging prices of natural gas as well as filling of gas storage units. But not all EUSAIR countries are affected at the same degree by the surging energy, and especially gas prices. Every country has different mix of sources to generate electricity (coal, natural gas, renewable sources), different distribution costs and different levels of energy and VAT taxes, all these lead to different residential and industrial gas prices.

6.1.4 Organisation and governance of the national gas system

The following sub-section provides a snapshot on organisation and governance of the national gas systems of each EUSAIR country classified by themes: unbundling supply and distribution, regulated vs no-cost reflective prices and tariffs, permitting procedures: What is still to be done in most countries is the full unbundling of system operators and deregulation of their gas markets. However, the establishment of organised markets and their integration remain the biggest regional challenge.

1.1.d.1 Unbundling supply and distribution

Italy

Distribution system operators are legally and functionally unbundled.

Slovenia

Distribution system operators are not legally separated, as there are not more than 100,000 consumers connected to each distribution system. Given that other energy and market activities were carried out by distribution system operators, they prepared separate accounts in accordance with Article 235 of the EZ-1. System operators are required to prepare annual financial statements as required by the Companies Act for large companies. In the notes to the audited annual financial statements, natural gas undertakings have to disclose the criteria for business allocation. The adequacy of the criteria and the correctness of their application have to be audited annually by the auditor who makes a special report

Croatia

Pursuant to the provisions of the *Gas Market Act* on the unbundling of energy activities, activities of the transmission system operator, distribution system operators, gas storage system operator, and LNG system operator, including operators that are part of the vertically integrated energy entity, must be organised in legal entities that are separate from other activities in the gas sector. Out of a total of 33 operators, 11 distribution system operators were organised as independent legal entities engaged only in gas distribution, whereas 22 energy entities were organised as vertically integrated legal entities with fewer than 100,000 customers and were active both in gas distribution and gas supply.

Greece

The Law 4336/2015 (Gazette A’ 94/14.8.2015) amended the regulatory framework in the retail gas market, unbundling the regulated monopolistic distribution activity from the liberalized competitive supply activity, to fully liberalize the gas supply, and all consumers, including household consumers, to have become eligible by 1.1.2018. n this context, from 1.1.2017 the three Companies that had been active in the retail market and supplied household consumers with natural gas, i.e. EPA Attica, EPA Thessaloniki and EPA Thessaly, which until then had a single license for the supply and distribution of natural gas, proceeded to a functional and legal unbundling of the distribution activities from the supply activities, with the establishment of new Gas Supply and Distribution Companies.

Albania

The domestic transmission system operator Albgaz was certified but the conditions in the certification decision are not yet implemented.

The TAP certification conditions were fulfilled before its commercial operational date on 31 December 2020.

Bosnia and Herzegovina

Only one of the three existing transmission system operators in Bosnia and Herzegovina, Gas Promet Pale, is unbundled and certified. Distribution of gas is bundled with supply and trade of natural gas as allowed by the Directive’s de minimis clause. The distribution system operators supply less than 100.000 customers. Gas Promet Pale, one of the entity’s transmission system operators, operates the pipeline sections Šepak-Karakaj and Karakaj-Zvornik. Its system rules adopted by RERS are yet to comply with gas Network Codes. The company signed an interoperability agreement with the Serbian operator. The rules established a virtual trading point for Republika Srpska, which at present is non-functional. All transactions are based on bilateral contracts. The entity regulator certified Gas Promet Pale under the ownership unbundling model in November 2020 taking into account the Secretariat's Opinion. The entity regulator obliged Gas Promet to meet all certification conditions fully otherwise any legal decision would be null and void. The other transmission system operator in the entity is Sarajevo-gas a.d. Istocno Sarajevo, a vertically integrated undertaking, acting also as a supplier and distribution system operator, which is still not unbundled and thus breaching the gas acquis. In Republika Srpska, all customers are free to choose their supplier and only households are eligible for public supply, which in 2020 accounted for 7,18% of the retail market. The amendments to the Gas Law of 2021 prescribed that the mandate of the public supplier (selected in a competitive procedure) will be limited to a five-year period. The dominant supplier, the public GAS RES, is the only importer of natural gas for Republika Srpska and serves 83% of the retail market in this entity.

Montenegro

Montenegrobonus d.o.o. was appointed by the Government as the future transmission system operator. Montenegrobonus will have to be unbundled under the ownership unbundling model.

North Macedonia

The transmission system operator is not unbundled and certified in line with the Third Energy Package. The state took over the full ownership of GA-MA,a licensed gas transmission system operator, and decided to merge it with another state company, NER, responsible for gas transmission system development. The merging process is still ongoing. Concrete actions to establish one national transmission system operator and certify it are still ongoing. Distribution companies have less than 100.000 customers and are thus exempt from the unbundling rules.

Serbia

The Government fails to implement the unbundling plans for Srbijagas and Yugorosgaz adopted in April 2021. Srbijagas's subsidiary, Transportgas Srbija, is not unbundled and certified in line with the Third Energy Package, nor is Yugorasgaz Transport. Gastrans, exempted and certified by the regulator in disregard of the Secretariat's Opinion, was licensed as an independent transmission operator.

1.1.d.2 Reserve capacity and storage peak loading

Italy	197,73 TWh
Slovenia	No gas storage
Croatia	5,22 TWh Podzemno skladište plina Ltd is continuously working on preparation activities for the construction of the new peak storage facility Grubisno Polje-new underground gas storage, which was included in the list of strategic investment projects of the Republic of Croatia by the decision of the Ministry of

Greece	No gas storage
Albania	No gas storage
Bosnia and Herzegovina	No gas storage
Montenegro	No gas storage
North Macedonia	No gas storage
Serbia	Serbiagas (49%) and Gazprom (51%) have completed the Banatski Dvor natural gas storage with active volume of 450 mcm. Project partners are working on the Banatski Dvor UGS expansion up to 750 mcm. This UGS facility ensures natural gas security supply for Serbia and B&H.

1.1.d.3 Regulated vs no-cost reflective prices and tariffs

Italy

Energy Authority ARERA defines the price for the customers under protection regime, as sum of international wholesale price at hub and the other regulated cost for logistic.

Considering sales in the strict sense and thus excluding self-consumption, 89% of gas is purchased on the free market and the remaining 10.3% in the protection regime. In terms of customers, however, 34.6% buy on the reference price market, while 65.4% buy on the free market. Considering only the household sector, it can be seen that the share of volumes purchased on the free market in 2021 reached 63.9% for households and 85.2% for central heating

Slovenia

The Energy Agency actively monitors prices on the retail market on the basis of public data and market data from household and small business consumers, which are obtained from suppliers in the framework of benchmarking services of the single contact point. The gas prices in the supply offers depend mainly on the business decisions of each supplier and on the purchasing conditions provided by suppliers during trading. The level of the purchase price paid by the supplier is influenced by several factors. Thus, natural gas prices depend on the characteristics of gas purchase contracts, developments in oil and petroleum prices, developments in foreign currency exchange rates, weather effects, international situation. In the context of monitoring the market concerned, the Energy Agency determines the retail price index (RPI). RPI is based on the cheapest, affordable offer available to all consumers on the market, which allows consumers to switch supplier at any time without any contractual penalty.

Croatia

The regulated retail gas price, applied to household final customers using the public service gas supply, is established pursuant to the *Methodology for setting tariffs for gas supply as a public service and guaranteed supply*.

The tariffs for gas supply as a public service and guaranteed supply for all public service gas suppliers in Croatia in 2020 were established in the relevant decisions on tariffs for gas supply as a public service. Pursuant to the *Methodology for setting tariffs for gas supply as a public service and guaranteed supply*, in 2020 the gas price for final customers using the public service consisted of the reference gas price, the cost of gas distribution, and the cost of gas supply. The reference price of gas was the highest price at which the wholesale market supplier could sell gas to public service suppliers for household final customers, and was determined as the sum of the purchase price and the premium as the fixed part of the reference price of gas.

Greece

The tariffs charged by the new Gas Supply Companies[88] to their customers were separated from the regulated tariffs for the transmission and distribution of the natural gas. For reasons of transparency and proper information of the consumers, since 1.1.2017 the Gas Supply Companies have been required to indicate separately in the bills the supply, distribution, and transmission charges to non-eligible customers, as well as to announce the applicable tariffs per month and per category of final consumers[89.]

Albania

There is no national natural gas market. The REMIT Regulation was transposed. Retail market **31%** Despite the lack of a national gas market, secondary legislation regulating supply to customers was developed.

Bosnia and Herzegovina

Bosnia and Herzegovina has a foreclosed gas market, organised in two parallel entity markets. Republika Srpska's wholesale market prices are not regulated, but the market lacks liquidity. In the Federation, the prices are regulated by the Ministry. The REMIT Regulation was not transposed. Retail market **10%** Customers in Federation of Bosnia and Herzegovina are still captive. In Republika Srpska, only a small portion of the retail market is supplied under regulated tariffs. Switching rules are in place.

Montenegro

Montenegro does not have a gas market. REGAGEN adopted supply rules for natural gas in spite of the lack of a gas market.

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[88] As per article 4, par. 3 and 6, par. 1 of Law 4336/2015 (Gazette A' 94/14.8.2015),

[89] Retail Supply issue.Based on article 49 of L. 4001/2011, and RAE Decision 313/2019.

North Macedonia

There are only two active traders in the wholesale market, selling at market prices. All contracts are concluded bilaterally, on a monthly and yearly basis. However, the market remains illiquid, without a virtual trading point.

All customers are formally eligible, and end-user gas prices are deregulated. Customer protection measures are defined in line with Annex I of Directive 2009/73/EC.

Serbia

Srbijagas continues to dominate the wholesale and retail markets. It acts as a supplier of all public suppliers in Serbia and as a supplier of last resort, appointed by the Government on a yearly basis. Regulated entry exit tariffs continue to apply for transmission. The wholesale market still consists of bilateral contracts between traders and suppliers. The price of gas sold to non-household customers is not regulated (83% of the market in 2020). In retail gas supply, Srbijagas is the dominant market player, accounting for some 90% of the retail market in 2020.

1.1.d.4 Permitting procedures

Italy

One-stop-shop: Ministry for Economic Development, designated by Decree of the President of the Council of Ministers of 5 December 2013, No 158 scheme coordinated: manual of procedures

Article 7(3) TEN-E Reg.)- status of the highest national significance or a similar status exists: YES

Slovenia

One-stop-shop: Ministry of Infrastructure and Spatial Planning (now divided into two ministries), designated by Decree implementing Regulation (EU) No 347/2013, effective from 25 January 2014.

Scheme coordinated - Not laid down in law or in the manual of procedures but confirmed in interviews (not compliant with rt 8(3) of Ten-E Reg)

Article 7(3) TEN-E Reg.)- status of the highest national significance or a similar status exists: YES

Croatia

One-stop-shop: Ministry of Economy, designated by Governmental Decision of 20 November 2014, although in practice there is potential confusion with the Centre for Monitoring Business Activities in the Energy Sector and Investments (CEI)

Scheme collaborative Commission Pilot procedure on Croatia No.

6273/14 ENER (not compliant with rt 8(3) of Ten-E Reg)

Article 7(3) TEN-E Reg.)- status of the highest national significance or a similar status exists: NOT

Greece

One-stop-shop: General Directorate of Strategic Investments of the General Secretariat of Strategic and Private Investments of the Ministry of Development and Competitiveness, designated by Law 4271/2014, 28.06.2014 (competences determined by Presidential Decree 157/2013, 07.11.2013) schemes: both coordinated and collaborative - manual of procedures (not compliant with rt 8(3) of Ten-E Reg)

Article 7(3) TEN-E Reg.)- status of the highest national significance or a similar status exists: YES

Albania

There was no progress in the implementation of the Decision on the Approval of Practices for the Promotion of Joint, Regional Investment in the Energy Infrastructure adopted in 2018 that transposed Regulation (EU) 347/2013. The Decision obliges the national competent authority to define and publish the manual of procedures and to annually inform the Electricity and Gas Groups, including the Secretariat, about the realization and current status of Albanian regional PECI/PMI projects. It has failed to do so. It is necessary to update the Law on Power Sector as it currently fails to task the national regulatory authority with defining and publishing the methodology and criteria to evaluate investments in electricity and gas and the higher risks incurred by them. Full implementation of the Regulation in Albania is important due to its potential to facilitate the realization of ongoing strategic infrastructure projects, particularly the 400 kV OHL interconnection between Albania and North Macedonia (PECI 2018, under construction). The project is expected to improve security of supply and overall operation of the energy system of Albania, as well as positively influence the regional market and its coupling. The same goes for the ongoing preparations for gasification and gas infrastructure projects, especially the ALKOGAP project (PECI 2020) and the Ionian Adriatic Pipeline (PMI 2020).

Bosnia and Herzegovina

Bosnia and Herzegovina has not made any progress related to the transposition of Regulation (EU) 347/2013 in the reporting period. A national competent authority has still not been established although discussions between the Ministry and entities are ongoing.

There is no methodology and criteria used to evaluate investments in electricity and gas infrastructure projects defined by the regulatory authority. Bosnia and Herzegovina has been working for years to find consensus with the relevant entity institutions on the decision on establishing the national competent authority but without any success. The Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina did not manage to create even a working group that would prepare a legal act transposing Regulation (EU) 347/2013. The Guidelines for Investors in the Electricity Sector, published in November 2018, fall short of properly transposing the Regulation. The infringement based on the non-transposition of the Regulation, established by Ministerial Council Decision 2018/8/MC-EnC, is still not rectified. The Regulation's transposition is particularly important due to its potential to facilitate the realization of ongoing strategic infrastructure projects, which will improve the security of supply and overall operation of the energy system in both electricity and gas, as well as positively influence the regional market. Bosnia and Herzegovina participates in one PECI electricity project (Transbalkan corridor) and in two PMI gas projects (interconnectors Bosnia and Herzegovina – Croatia North & South), recognized as projects of domestic significance and having a significant regional impact.

Montenegro

The national competent authority has not been designated to date although this was announced several years ago.

There is no manual of procedures for the permitting process of the Projects of Energy Community Interest or Projects of Mutual Interest.

The regulator published its methodology and criteria used to evaluate investments in electricity and gas infrastructure projects in 2017. The adoption of the new Law on Cross-border Energy Infrastructural Projects, which aims to transpose Regulation (EU) 347/2013, originally envisaged for 2019 has now been postponed for the second year in a row until the end of 2021. The national competent authority should be designated and should publish the manual of procedures for the permit granting process applicable for Projects of Energy Community Interest and Projects of Mutual Interest as soon as possible. It should also report regularly to the Secretariat and the Electricity Group. The transposition of the Regulation will support the realization of ongoing strategic infrastructure projects in electricity (Transbalkan corridor), as well as planned infrastructure projects in gas Ionian Adriatic Pipeline. Montenegro will benefit from improved security of supply and the overall operation of the country's energy system. The Law will also have a positive impact on the regional market and its coupling.

North Macedonia

The Law on Strategic Investments, adopted on 16 January 2020, is currently undergoing a revision to properly transpose Regulation (EU) 347/2013.

The manual of procedures has not been defined yet.

The national regulatory authority did not publish the methodology and the relevant evaluation criteria for investments in electricity and gas infrastructure projects. In the last reporting period, the Ministry of Economy had prepared amendments to the Law on Strategic Investments to transpose Regulation (EU) 347/2013. The Government should act as the national competent authority, supported by the special Commission for strategic investment projects. North Macedonia must proceed with the Regulation's transposition immediately, followed by swift implementation. Transposition should facilitate the realization of PECI and PMI infrastructure projects. North Macedonia is developing important gas projects like interconnectors North Macedonia – Serbia (PECI 2020), North Macedonia – Kosovo **Errore. Il segnalibro non è definito.**(PECI2020) North Macedonia – Albania TEN-E and North Macedonia – Greece (PMI 2020).

Serbia

The national competent authority was previously defined as an inter-ministerial working group on strategic energy projects but did not report any progress on Projects of Energy Community Interest or Projects of Mutual Interest to the Secretariat to date.

There is no manual of procedures published by the national competent authority for the permitting process of PECI/PMI projects.

The methodology and criteria to be used to evaluate investment in electricity and gas projects and the higher risks incurred by them has not been published to date. Amendments to the Energy Law, adopted in April 2021, created the preconditions for transposition of Regulation (EU) 347/2013. They stipulate that the Government prescribes in more detail the conditions and manner of promoting strategic energy projects. Obligations of competent institutions in terms of monitoring the implementation of strategic energy projects are also defined, as well as the procedure for preparation and implementation of strategic investment projects in the field of energy identified as PECI and PMI projects. The amended Law also stipulates that the manual of procedures will be passed within six months from entry into force. The amended Law creates the legal basis for the development of the methodology for investment and risk assessment for strategic infrastructure projects in areas of electricity, natural gas and oil. The regulatory agency shall adopt the methodology and criteria to evaluate investments within six months from entry into force. Further progress in adopting Regulation (EU) 347/2013 is expected as soon as possible. The full transposition of the Regulation would facilitate faster realisation of the electricity and gas infrastructure projects in Serbia like the Transbalkan corridor (PECI 2016, 2018, 2020) and the gas interconnectors Serbia - Bulgaria, Serbia – North Macedonia and Serbia – Croatia; Phase I.

1.1.d.5 Cybersecurity

The International Telecommunication Union defined a **Global Cybersecurity Index (GSI),** a multi-stakeholder initiative that ensures countries' global cybersecurity commitment. The methodology of GSI is to identify the threats a country faces and the corresponding security measures it takes. The index consists of groupings of values given to legislation, organizations, cooperation formats and outcomes of these parts in defending against cyberattacks. The total number of countries part of the GCI is 194.

The following table sets out the score and rank for each EUSAIR country in 2021.

Country	Score	Rank
Italy	96.13	20
Greece	93.98	28

Croatia	92.53	33
North Macedonia	89.92	38
Serbia	89.8	39
Slovenia	74.93	67
Albania	64.32	80
Montenegro	53.23	87
Bosnia and Herzegovina	29.44	110

Italy

- NIS Directive Transposed.
- Single point of contact: National Cybersecurity Agency (ACN)
- National competent authorities for OES - Energy (Gas): Ministero dello Sviluppo Economico - Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione (ISCTI)
- National CSIRT: CSIRT Italia - National Cybersecurity Agency (ACN)

Slovenia

- NIS Directive Transposed.
- Single point of contact. Information Security Administration
- National competent authorities for OES: Same as single point of contact.
- National CSIRT: SI-CERT

Croatia

- NIS Directive Transposed.
- Single point of contact: The Office of the National Security Council
- National competent authority for DSPs: Ministry of Economy and Sustainable Development
- National competent authorities for OES, not for natural gas (only electricity and oil).
- National CSIRT: CARNET (National CSIRT for Banking, Financial market infrastructures, Digital infrastructure, DSPs); Information Systems Security Bureau (National CSIRT for Energy, Transport, Health sector, Drinking water supply and distribution, Public government services)

Greece

- NIS Directive Transposed.
- Single point of contact: National Cyber Security Authority (General Secretariat of Telecommunications and Post - Ministry of Digital Governance)
- National competent authority for DSPs: National Cyber Security Authority (General Secretariat of Telecommunications and Post - Ministry of Digital Governance)
- National competent authorities for OES: Same as the national competent authority for DSPs.
- National CSIRT: Hellenic Cyber Security Incident Response Team (CSIRT)

Albania

- Albania has partially transposed the cybersecurity acquis.
- The responsible authority NAECCS operates as the national CSIRT.
- Only power system operators are considered as owners of critical information infrastructure. Other energy operators should be included.

- An energy CSIRT should be established.

The Law on Cybersecurity defines security measures and corresponding obligations, while cybersecurity risk assessment is conducted by NAECCS. The obligations are implemented by corresponding acts of both regulators, NAECCS and the energy regulator ERE. Measures for inter-sectoral and regional cooperation and increasing transparency are lacking. The main legal act relevant for cybersecurity in the energy sector is the Law on Cybersecurity of 2017, which partially transposes Directive (EU) 2016/1148 and Directive 2008/114/EC, with cross-border and regional cooperation missing.

The National Authority for Electronic Certification and Cyber Security (NAECCS) was established in 2017 as a cybersecurity authority responsible for all sectors of the economy, including energy.

Based on its competence to promote security of energy supply, the energy regulator ERE adopted the Regulation on Cybersecurity of Critical Infrastructures in the Power Sector in 2020.

A new National Strategy for Cybersecurity, adopted in December 2020, defines policy objectives also for the energy sector and aims to further align the national legal framework with EU directives and regulations. It also envisages strengthening institutional collaboration and international cooperation with strategic partners in cybersecurity and cyber defence.

Bosnia and Herzegovina

There is no compliant state-level legal framework. Both entities are developing their own legal acts in the area of cybersecurity. A roadmap for transposition of the NIS Directive in the energy sector of Bosnia and Herzegovina is in development.

There is a single CERT operating in Republika Srpska.

Critical energy infrastructure is defined in Republika Srpska: some obligations for energy operators come from data protection acts and the entity's law on critical infrastructure. However, no energy-specific act is in place. Federation started developing draft acts on entity level. Energy regulators should build up their cybersecurity competences. There is no State law on cybersecurity or protection of critical infrastructure. The information security management policy 2017 - 2022 addresses a broad scope of data security risks pertinent to society and promotes the establishment of an information security management system and application of ISO/IEC 27000. The Law of Republika Srpska on Information Security and the rulebooks on information security measures and standards lay down a set of broad obligations but fail to transpose Directive (EU) 2016/1148 (NIS Directive).

The Law on Security of Critical Infrastructure adopted in 2019 transposes Directive 2008/114/ EC in this entity: It regulates security competences, obligations of risk assessment, security planning, coordination and protection mechanisms and data security management. The energy sector and in particular the assets for energy production and fuel resource management, systems for transmission, storage and transport of fuel and energy products and systems for distribution are identified as critical infrastructures in Republika Srpska. Cybersecurity developments in Federation of Bosnia and Herzegovina are fragmentary and delayed. There is no corresponding strategy in place. Its Law on Electronic Documents of 2013 barely introduced the need of digital data protection. The draft Law on

Information Security transposing Directive (EU) 2016/1148 awaits adoption in this entity. There is no common CSIRT structure in Bosnia and Herzegovina. The computer emergency response structure in Republika Srpska is CERT-RS, established in 2015. It coordinates cybersecurity incident prevention and response, and provides recommendations, notifications of cyber threats and technical assistance to its registered constituents from the entity. In the Federation, based on the draft Law on Information Security, a working group has been assembled to prepare the development of a federal CERT, hosted by the Federal Ministry of Transport and Communications. There is no overarching cybersecurity strategy in Bosnia and Herzegovina. Protection of critical infrastructure according to the ISO/IEC 27001 standard is applied by the independent system operator NOS BIH. The establishment of a national CERT is a priority in the strategy for preventing and combating terrorism 2015 - 2020. However, the strategy was never implemented. Guidelines for strategic cybersecurity framework developed in 2019 cover the energy sector: they promote the set-up of a cybersecurity management cycle based on the NIS Directive; a task force is currently developing a roadmap for the implementation of the NIS Directive in the energy sector to be completed in 2022.

Montenegro

Montenegro's main policy act in the domain of information security is the Cybersecurity Strategy 2018 - 2021, which defines objectives in the cybersecurity domain, including boosting incident response capacity, protection of critical information infrastructure and public awareness. There are no energy-specific policies in the strategy. Drafting of a follow-up Cybersecurity Strategy 2022 - 2026 is under way. The Law on Information Security of 2010, as amended in 2021, only partially transposes Directive (EU) 2016/1148 (NIS Directive). It defines the basic rules for protection of information and the tasks, powers and operation of the national CIRT. CIRT-ME is established as a unit within the National Security Authority operating under the Ministry of Public Administration, as the main contact point for security threat analysis and incident reporting. A reference contact point for the energy sector is the Ministry of Economic Development. CIRT-ME provides cybersecurity services and coordinates assistance in case of cybersecurity incidents. The Law on Designation and Protection of Critical Infrastructure of 2019 transposes Directive 2008/114/EC. It defines general criteria for identification and requests the specific criteria and measures for protection to be defined by the sectoral ministries. The Law imposes the development of security plans and inventory of critical assets. The Law on Information Security defines the basic criteria for critical information infrastructures and tasks the Government to specify the critical assets and the Ministry of Public Administration to implement the measures. The methodology for the selection of critical information infrastructure includes the infrastructures used in production, transmission, system operation and distribution of electricity and natural gas, storage of gas, and production, refining, storage and distribution of oil and derivatives. Supply of electricity, gas and oil are treated as essential services. The Law on Critical Infrastructure defines a general set of criteria related to the development of security plans and appointment of security coordinators and outlines the basic obligations for the operators of critical infrastructures. Consequently, the energy operators have an obligation to report to the Ministry of Economic Development, which is responsible for the energy sector. The Law on Information Security provides a basic structure for information security risk definition and management, cybersecurity requirements and reporting obligations for the operators of critical information infrastructures, applicable to the energy sector. The energy regulatory authority REGAGEN does not have competences on cybersecurity.

North Macedonia

The Cybersecurity Strategy 2018 - 2022 developed by the Ministry of Information Society and Administration aims to provide resilient information and communication technology (ICT) infrastructures, and boost cybersecurity capacity and culture, cyber defence, international cooperation and exchange of information. Specific targets include the transposition of Directive (EU) 2016/1148 (NIS Directive), legal enforcement for critical infrastructures in sectoral laws and establishment of a National Cybersecurity Council. The Strategy for Information Society of 2005 and the Law on Electronic Communications, as amended in 2021, provide the basic legal framework for security management of ICT infrastructures, applicable also to energy. There is no compliant cybersecurity law in force. The draft Law on Security of Network and Information Systems that transposes the NIS Directive, developed in 2019 and updated in 2021, is not adopted. The protection of critical infrastructure lacks clear criteria for identification and designation applicable to the energy sector. The draft Law on Security of Network and Information Systems contains provisions addressing the criteria for critical ICT infrastructures. Based on the Law on Electronic Communications, the responsible authority is the Agency for Electronic Communications, hosting the MKD-CIRT. The CIRT acts as the point of contact for reporting and coordination in dealing with security incidents in ICT systems, providing a coordinated response, education and risk analysis, including for the operators of critical infrastructure and large enterprises in the energy sector. The methodology for cybersecurity risk assessment and rules on reporting obligations addressing the energy sector are not applied. MKD-CIRT performs assessments of threats in the ICT domain and communicates with stakeholders. The CIRT has established an incident reporting mechanism, which is mandatory for all public bodies and utilities. Security risk management and operators' obligations related to the supply chain for critical ICT components are enforced by the law. Amendments to the Energy Law addressing cybersecurity mechanisms in the energy sector, enforcing identification and designation of critical energy infrastructures and providing cybersecurity competences to the energy regulatory authority, were adopted in October 2022. The establishment of a specific energy CIRT is foreseen in a draft Cybersecurity Law. The Energy Regulatory Commission (ERC) has adopted Recommendations including criteria for identification of critical energy infrastructures in the electricity sector in cooperation with MKDCIRT and the Ministry of Economy: ERC is drafting a cybersecurity strategy of the energy sector including requirements and obligations for public and private operators, application of ISO 27001 standards and methodologies for risk assessment and critical asset management

Serbia

The Strategy on the Development of Information Society and Information Security 2021 - 2026 sets targets in the application of security measures with respect to critical information and communication infrastructures, establishment and operation of CERTs and information security audits, handling of threats, and international cooperation. Proposed measures include capacity building, application of new technologies, further digitalization of services and enhanced information security in the public and private domain. The Law on Information Security, last amended in 2019, transposes the NIS

Directive. It promotes risk management, comprehensive protection on all levels and time horizons, application of good practices and development of permanent awareness and competence. It also governs the establishment of a security audit and promotes cooperation between the public and private sector, academic community and civil society through a coordination body. The Ministry of Trade, Tourism and Telecommunications is responsible for its implementation. The Law identifies the information and communication technology (ICT) systems used in electricity production, transmission and distribution, coal production and processing, oil and derivatives production, processing, transport, distribution and trade, and natural or liquid gas production, processing, transport and distribution, as ICT of Special Significance. The Ministry keeps a registry of specific operators. A Government regulation of 2019 sets a list of activities carried out through ICT systems of special significance including energy activities. The competent authority is the Regulatory Agency for Electronic Communications and Postal Services (RATEL). It hosts the national computer emergency response team SRB-CERT that covers the ICT security of the energy sector. The CERT acts as a focal point and performs risk assessment, shares risk and incident related information and coordinates prevention and protection activities. The Law obligates the operators to adopt rules on ICT system security and to set up liaison officers. Risk assessment, testing and reporting is further implemented by the Government Decree on More Detailed Contents of Enhancement on Security of ICT of Special Significance. Security requirements are enhanced by the Decree on Closer Regulation of Protection Measures for ICT of Special Significance, referring to organizational structure, safety in remote operation, identification of assets, classification of data and protection levels, and qualification and responsibility of the personnel. Reporting obligations are detailed in the Decree on Incident Notification Procedure for the ICT of Special Significance, which defines the reporting criteria, content and details for different types of incidents. The energy regulatory authority AERS does not have any powers or obligations in the domain of cybersecurity.

6.1.5 Main players in gas sector by country

The following sub-section provides an overview on the main players in gas sector of each EUSAIR country.

The **Croatian** Energy Regulatory Agency (HERA) regulates energy activities and is responsible for the improvement and implementation of by-laws, issuing licenses, setting tariffs, certifying the eligible producer status, etc. The Croatian Energy Market Operator (HROTE) organizes the energy market based on the rules defined by HERA. The gas transmission network operator is PLINACRO d.o.o.

Croatia	
Suppliers	Prvo plinarski drustvo, MVM CEEnergy Croatia, MET Croatia Energy Trade, Gradska Plinara Zagreb-Opskrba
Transmission and Distributors	Plinacro
Regulatory Authority	Croatian Energy Regulatory Agency (HERA)

Ministry or istitution for planning and supervision	Ministry of Environment and Energy Environmental Protection Agency

Energy agency of the **Republic of Serbia** (AERS) was established by the Energy Law as a regulatory body with competences covering electricity, natural gas, oil and oil product, and CHP heat energy sectors. Transportgas Srbija, Serbijagas and Yugorosgaz are the main transmission and distribution operators and Banatski Dvor storage operator.

Serbia	
Suppliers	Srbijagas, Yugorosgaz
Transmission and Distributors	Srbijagas, Yugorosgaz, Transportgas Srbija (Srbijagas), Gastrans
Regulatory Authority	Energy Agency of Republic of Serbia (AERS)
Ministry or istitution for planning and supervision	Ministry of Mining and Energy, Ministry of Finance, Commission for Protection of Competition

In July 2006, Gasification – **Macedonia** GA-MA AD Skopje was formed by the Government and the privately owned oil trading company Makpetrol. GA-MA currently owns a License for carrying out energetic activity – management of the natural gas transmission system and a License for carrying out energetic activity- natural gas transmission, issued by **the Energy Regulatory Commission of the Republic of North Macedonia.**

On 27 August 2021, the Agreement settlement signed between Makpetrol JSC Skopje and the Republic of North Macedonia resolving the dispute concerning their respective shares in the gas TSO GA-MA has finally been implemented. The dispute has been blocking the gas sector development in North Macedonia for the past 22 years.

The dispute has been resolved through mediation under the Energy Community Dispute Resolution and Negotiation Centre, where the parties settled for a 50% - 50% shareholding in GA-MA, and the Government agreed to purchase Makpetrol's share in GA-MA. The wholly state-owned gas TSO will now have to be unbundled and certified in accordance with the Third Energy Package.

National Energy Resources (NER) is in charge for development of the natural gas network, and is 100% stated owned. In August 2022, the Government issued a statement that GA-MA AD Skopje and NER will merge together and form a new company NOMAGAS (North Macedonia Gas) – the only state-owned company in charge of gasification of the country. When the merger is completed, the ERC can issue a license for transmission system operator to NOMAGAS.

At the moment there are 3 DSO's active in the City of Skopje, Kumanovo and Strumica in Public ownership.

The future development of the distribution network for natural gas on the whole territory of the state will be done by a private company through a PPP. The Energy Regulatory Commission commenced its operation on 23 July 2003 through the Decision by the Parliament of the Republic of Macedonia.

North Macedonia

Suppliers	Makpetrol Prom gas, Technological Industrial Development Zones (TIDZ), Strumica GAZ and Kumanovo GAZ own licenses for supplier of last resort. There are additional 7 suppliers on the market.
Transmission and Distributors	TSO Gasification – Macedonia (GA-MA) – DSO TIDZ, DSO Strumica gas and DSO Kumanovo-Gas
Regulatory Authority	Energy Regulatory Commission (ERC) Commission for Protection of Competition (CPC)
Ministry or institution for planning and supervision	Ministry of Economy

Montenegro does not have a gas market nor the gas network

Regulatory Authority	Energy and Water Regulatory Authority of Montenegro (REGAGEN) Agency for Competition Protection (ACP)
Ministry or istitution for planning and supervision	Ministry of Economy

In the absence of a single legislative framework, **Bosnia and Herzegovina**'s two entities (Federation of Bosnia and Herzegovina and Republic of Srpska) have adopted two distinct regulatory regimes. Regulatory Commission for Energy in Federation of Bosnia and Herzegovina **(FERK)** established with Law on Electricity in 2002 is an independent, no-profit organisation providing monitoring and regulation of electricity market, usage of renewable resources and cogeneration and oil products. Regulatory Commission for Energy of Republic of Srpska **(RERS)** was founded in 2002 as Regulatory Commission for electricity of Republic of Srpska (RS), in order to regulate monopolistic behavior and provide all participants on the electricity market in Republic of Srpska with transparent and non-discriminatory position, pursuant to the Law on electricity, regulating the market of electricity, gas and oil. In 2020, RERS certified the company **Gas-Promet** (established in 1998), headquartered in Pale, as the operator of the gas transmission system in the RS, only for the sections Sepak-Karakaj and Karakaj-Zvornik. The other transmission system operator in the entity is **Sarajevo-gas a.d**. Istocno Sarajevo, a vertically integrated undertaking, acting also as a supplier and distribution system operator.

BH-Gas doo (BH-Gas) is a state-owned operator of natural gas transmission system. It carries out import, transmission, wholesale and trade of natural gas in Bosnia and Herzegovina. The company is primarily responsible for the development and management of gas transmission and operates most of the system in the country.

Bosnia and Herzegovina	
Suppliers	Energoinvest KJKP Sarajevogas, Gas Mcompany, Gas Res Banja Luka, Sarajevo gas, Visoko Ekoenergija, Bijeljina gas
Transmission and Distributors	BH-Gas doo (BH-Gas) Gas Promet Pale Sarajevo-gas a.d.
Regulatory Authority	Regulatory Commission for Energy in Federation of Bosnia and Herzegovina (FERK) Regulatory Commission for Energy of Republic of Srpska (RERS)
Ministry or institution for planning and supervision	Ministry of Industry, Energy and Mining

The **Energy Regulatory Authority (ERE)** is an independent public entity tasked to ensure a sustainable and secure electricity supply for the Albanian consumer by establishing an operational and competitive electricity market, taking into account the consumer's interest. Albgaz is a state-owned gas infrastructure operator, created in January 2017 and is responsible for the construction and management of Albanian gas market infrastructure.

Albania	
Suppliers	Divjake, Ballaj-Kryevidh, Povelce, Panaja, Finiq-Karne, and Frakull – AlbPetrol Delvina – Delvina Gas Company Ltd
Transmission and Distributors	Trans Adriatic Pipeline
Regulatory Authority	The Energy Regulatory Entity (ERE) Albanian Competition Authority (ACA)
Ministry or institution for planning and supervision	(Albgaz, a state-owned company established to kick-start gas penetration in Albania, has not commenced any activities so far) National Agency of Natural Resource

Agencija za Energijo is the Energy Agency in the **Slovenian** energy market. Plinovodi d.o.o. is a company managing the gas transmission network.

Slovenia	
Suppliers	Geoplin, Enos LNG
Transmission and Distributors	Plinovodi
Regulatory Authority	Energy Agency
Ministry or istitution for planning and supervision	Ministry of Infrastructure (Energy Directorate)

Regulatory Authority for Energy (RAE) is an independent body overseeing the energy market in Greece. Also responsible for licensing activities (including the construction of new power plants) related to electricity generation. **The National Natural Gas System Operator (DESFA)** S.A. is responsible for the gas transmission networks, manages system capacity and supervises the gas market.

Greece	
Suppliers	Mytileneos, Copelouzos, Gas company Tessaloniki, Attiki gas, Depa commercial, Gas supply company Thessaloniki, Attiki gas supply company, Hellenic company of energy
Transmission and Distributors	National Natural Gas System Operator (DESFA), Trans adriatic pipeline Greece, Helleinc natural gas distribution, Attiki gas distribution (EDA ATT), DEDA and Thessaloniki gas distribution (EDA THESS)
Regulatory Authority	Regulatory Authority for Energy (RAE)
Ministry or institution for planning and supervision	Ministry of Environment, Energy and Climate Change

The **Italian** Regulatory Authority for Energy, Networks and the Environment (Autorità di Regolazione per Energia Reti e Ambiente, **ARERA**) is an independent body created under Italian Law No. 481 of 14 November 1995 implementing regulatory and control activities for electricity and natural gas. **Snam** is Europe's leading operator in natural gas transport and storage, with an infrastructure enabling the energy transition. It is also one of the main operators in LNG (Liquified Natural Gas) regasification.

Italy	
Suppliers	Enel Energia, Eni Gas e Luce, Acea Energia, a2a, Edison, Hera Comm, Iren Luce Gas e Servizi, Agsm Energia, Eon, Illumia
Transmission and Distributors	Snam Rete Gas, F2i Reti Italia, Hera, Iren, A2A, Italgas

Regulatory Authority	Autorità di Regolazione per Energia Reti e Ambiente (ARERA)
Ministry or istitution for planning and supervision	Ministero dell'Ambiente e della Sicurezza energetica Ministero dell'Economia e delle Finanze Ministero dello Sviluppo Economico

6.2 The natural gas networks and pipelines

It is generally assumed that the gas sector will grow faster in the EUSAIR countries mainly as a key driver for power generation. Thus, the natural gas networks and pipelines have been a main topic in the countries' energy agenda. Natural gas in the non -EU EUSAIR countries gas production and demand are relatively low. Albania, Montenegro and Bosnia and Herzegovina are not connected to the European gas pipeline network, while Macedonian gas system is connected to EU via Bulgaria. Only Serbia produces any significant amount of gas. Some countries have developed gas networks and the region is heavily dependent on Russian gas supply. The share of imported gas in total gas consumption will increase in forthcoming years.

These facts indicate the need for better inclusion of the EUSAIR countries in European flows and the natural gas market, and better connection of the gas transport system with neighboring systems countries, as well as with new supply projects.

Gas is delivered to Europe via gas pipelines from Russia and Norway and through the LNG regasification terminals, and to a lesser extent from Africa and Caspian Sea. To the east and Central Europe, gas is delivered via the Nord Stream gas pipeline, which connects Russia and Germany through the Yamal-Europe system. The Yamal-Europe system through Belarus and Poland connects Russia, Eastern and Central Europe. Slovakia, Hungary and Poland are connected to Russia via northern Ukraine southern Ukraine, the Trans-Balkan gas pipeline system, and Romania, Bulgaria, Greece, North Macedonia and Turkey are connected via Turkish Stream.

The Trans-Balkan Pipeline had been one of the key gas supply routes in Europe, being historically used for Russian gas exports shipped via Ukraine to Moldova, Romania, Bulgaria, Turkey, Greece and the Republic of North Macedonia. Since January 2021 Romania, Bulgaria, Turkey, Greece and the Republic of North Macedonia are connected via Turkish Stream.

Taking into account the war in Ukraine and its consumed gas transport system, the largest gas consuming countries in Europe are trying to reduce dependence of Russian gas and to ensure the stability of gas supply.

On the other hand, Russia after the cancellation of the South Stream gas pipeline project in 2014 which was proposed to transport Russian natural gas across Europe via Bulgaria to Balkan countries and Italy, completed the construction of the **Turkish Stream Pipeline** which follows the same corridor as the South Stream pipeline, comprising a new route towards Turkey. Construction started in May 2017 and gas deliveries to Bulgaria via the pipeline began on 1 January 2020. From Bulgaria, through Serbia, the Turkish Stream is serving Europe. Romania, Greece, North Macedonia and Turkey are also connected via Turkish Stream.

Another pipeline from Russia to Germany, running through the Baltic Sea is the **Nord Stream 2**, the expansion of the Nord Stream 1 gas pipeline that increased the total capacity of direct supply from the existing 55 billion m3 per year to 110 billion m3 per year. The pipeline was completed in September 2021 but had some problems for entering the service due to the Russia-Ukraine war and damage on one pipe after the sabotage occurred in September 2022.

However, Europe has put big efforts to reduce dependence on Russian gas which has important implications to the non-EU EUSAIR countries.

First, the **Trans Adriatic (TAP)** gas pipeline that brings gas from Azerbaijan to Europe through Turkey's TANAP pipeline crossing Greece and Albania to Italy which was 40% dependent on Russian gas in 2021. TAP has started its operations in 2021 and is expected to operate at its full capacity of 10 bcm per year in 2022 and 2023. The project of doubling the TAP capacity is under discussion.

Second, **Interconnector Greece-Bulgaria (IGB)** which consists of a cross-border and bi-directional gas pipeline, connecting the Greek gas network with the Bulgarian gas network as well as the construction of a new liquefied natural gas (LNG) receiving terminal at Alexandropoulos by 2023 linked with both IGB and TAP. Both infrastructures will break the Russian hold on gas supplies to Bulgaria and North Macedonia.

Third, the **EastMed Pipeline Project** interconnects the available and already in production gas fields in the Levantine basin to the European markets via Cyprus and Greece. This project is currently assigned to transport up to 20 bcm/y up to the inlet point with Poseidon Pipeline Project.

Fourth, the Krk Island Floating Storage Regasification Unit **(FSRU) LNG import terminal in Croatia** and the proposal for expansion of its capacity permit to neighboring countries such as Slovenia, Hungary or Bosnia and Herzegovina to benefit from diversified supplies.

Fifth, the **Floating Storage and Regasification Unit (FSRU) off the Port of Ravenna (Italy)** with Connection to the National Gas Network, scheduled to commence in the third quarter of 2024, will be the second floating regasification unit, thus making a decisive contribution to the country's energy security and diversification. The two FSRUs acquired by Snam will contribute 13% of the national gas demand alone, bringing regasification capacity to over 30% of demand, as soon as the permits to positioning them and get them connected to the national transmission network will be get. The vessel's position in the upper Adriatic Sea will allow the new unit to intercept potential new LNG flows from North Africa and the Eastern Mediterranean.

Benefits of all these gas pipelines include: significant decrease of dependence on Russian gas in the EUSAIR region, providing diversity of supply of natural gas, providing security of supply of natural gas, introducing the ecologically sound energy source in the region, reducing CO_2 emissions in the region, and facilitating economic development.

The development of projects in Western Balkans and South East Europe is primarily based on the creation of interconnections that would from larger corridors, UPP terminals or domestic production led to larger markets or areas that are not yet supplied with gas. Although the EUSAIR countries are working to expand renewable energy and have set targets under the Energy Community framework, they are also pursuing the expansion or introduction of gas supply in parallel. For the two countries, Albania and Montenegro, without domestic gas connections, Albania is moving towards a potential development of a **liquefied natural gas (LNG) project in the Port of Vlora** that includes developing an LNG import terminal, converting and/or expanding the existing Vlora thermal power plant, and establishing small scale LNG distribution to Albania and the surrounding Balkans region. Montenegro may be able to obtain gas if **Ionian-Adriatic gas Pipeline (IAP)** proceeds and a possible FSRU LNG import project at the Port of Bar is being constructed. The IAP project has been based on the idea of connecting the existing gas transmission system of Croatia via Montenegro and Albania with the TAP gas transmission system. The total length of the gas pipeline from Split to Albanian Fieri is 511 km with 5 bcm/year capacity.

Of three Russian gas importers from non-EU countries, North Macedonia has been the most focused on phasing out coal. The government seeks to expand the natural gas network through **Greece-North Macedonia interconnector** which will enhance the diversification of North Macedonia's gas supplies as the country is solely dependent on Russian gas supply as well as Greece's planned underground gas storage facility in the depleted gas field in South Kavala, which is expected to collaborate with both the **planned FSRU in Alexandroupolis** and the existing LNG terminal at Revithoussa, Greece's sole LNG terminal that completed its expansion in November 2018. In Bosnia and Herzegovina, **Croatia-Bosnia gas interconnector** is planned under an agreement between BH-Gas and HR Plinacro for operation in 2024 that will help to expand and diversify gas supplies. Serbia is the largest gas consumer. It is mainly dependent on coal for power, and gas use is limited to CHPs and district heating systems.

Here follows the short description of the existing gas pipelines and LNG regassification units by country. Maps for each country has been sourced by the European Network of Transmission System Operators for Gas, ENTSO-G of 2019-2020:

Figure 89 – European Natural Gas Networks: EUSAIR

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Croatia

Gas is delivered to the transmission system through nine entry measuring stations. Six entry stations accept gas from the domestic gas fields; two stations are interconnections and entry stations for gas from the import's routes (from Slovenia and Hungary); one connection is in the function of gas withdrawal from underground gas storage Okoli.

The **Croatian LNG terminal on the island of Krk in Omišalj** was launched in January 2021 and has brought diversification not only for its own market but also for the region. The terminal is using its own floating storage and regasification unit (FSRU) with total regassification capacity of 2.9bcm annually with a possibility for further expansion to at least 3.5bcm and storage capacity of 140,206 cubic metres of LNG.

The Krk terminal is currently supplying the domestic market and central European companies, primarily in Hungary via a combination of swaps and physical flows at the Drávaszerdahely interconnection point.

The country has an annual demand of 3bcm and has been receiving supplies mainly via the Krk LNG terminal as well as pipeline supplies from Russia transited via the Drávaszerdahely border point. Croatia is also importing volumes from Slovenia via the Rogatec interconnector in the western part of the country. The interconnector itself is linked primarily to the Austrian TAG pipeline via the Slovenian transmission system.

Figure 90 – European Natural Gas Networks: Croatia

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Greece

The Greek gas market has been a crucial point for the Southern Gas Corridor, linking the Caspian region to Italy via Greece and Albania. It has an important LNG facility asset that receives LNG cargoes, temporarily stores and regasifies LNG and supplies the National Natural Gas Transmission System.

This asset is the **LNG importing terminal at Revithousa**, 45km West of Athens with total regasification capacity of 8.25 bcm annually and storage capacity of 225,000 cubic metres. The terminal as well as the domestic pipeline network and interconnections with Greece and Turkey are operated by the transmission system operator DESFA.

The Trans-Adriatic Pipeline (TAP), which links up with the Trans-Anatolian Pipeline on the Turkish-Greek border is designed to deliver volumes to the Greek market and through a connection with the Interconnector Greece-Bulgaria (IGB) which runs from Komotini (GR) to Stara Zagora (BG) to S.E.European markets.

The Alexandroupolis terminal in northern Greece and close to the Bulgarian border is at an advanced stage. Three other FSRUs with a combined sendout capacity of 40mcm/day are expected to cater for the domestic and regional markets. Finally, the bidirectional interconnector Greece-North Macedonia will link the Hellenic VTP to Gevgelija – in North Macedonia. The interconnector is due to have an initial capacity of 1.5bcm/year, when commissioned in 2025 and could be doubled, depending on demand by 2025.

Figure 91 – European Natural Gas Networks: Greece

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Slovenia

Due to the lack of own sources, the supply of natural gas to the Slovenian market depends entirely on imports. The supply of natural gas to Slovenia takes place mainly from Russia and individual hubs of the European gas market. From Austria, natural gas flows via the Ceršak entry point, and from Italy, via the Šempeter entry point.

A project relevant to the EUSAIR Region is the **Upgrade of Rogatec Interconnection between Slovenian and Croatian Gas Systems (M1A/1 Interconnection Rogatec)** is still in planning phase and relates to the development of transmission system of Slovenian and Croatian TSO, increasing the transmission capacity and enabling bidirectional operation.

Figure 92 – European Natural Gas Networks: Slovenia

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Italy

In Italy, imported natural gas is introduced into the national network at eight entry points, where the network connects to the import pipelines (Tarvisio, Gorizia, Passo Gries, Mazara del Vallo, Gela) and at the LNG regasification terminals (Panigaglia, Cavarzere, Livorno). Italy's major supplier is Russia; 40% of natural gas imports originate from Russia and is injected into the national network at the entry point of Tarvisio and Gorizia. The second most important exporter is Algeria with 32%, followed by Libya (8%) and Netherlands (5%). Natural gas produced in Italy is injected into the national network at 53 entry points from the production facilities or from their collection and treatment plants; natural gas storage facilities are also connected to the network.

While diversifying its supply routes, the most important project in Italy is the **Trans Adriatic Pipeline (TAP),** 870km long natural gas pipeline that runs from Greece to Italy, via Albania and the Adriatic Sea.

The route links Europe to a new gas source in the Caspian (Shah Deniz II). The pipeline has the capacity of 10 bcm of gas a year with the possibility for increase of the capacity. TAP started commercial operation on 16 November 2020.

Figure 93 – European Natural Gas Networks: Italy

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

North Macedonia

North Macedonia is fully dependent on Russian gas imports that had been sourced via Bulgaria via the existing Bulgarian section of the Trans-Balkan line towards the North Macedonian border. Since January 2021 the country receives gas via Turkish Stream.

The country has only one interconnection point which is unidirectional from Bulgaria and has a firm capacity of 32GWh/day.

There have also been discussions to make the existing interconnector with Bulgaria bidirectional and to establish new links with Kosovo*, Albania and Serbia but more details are yet to emerge.

Figure 94 – European Natural Gas Networks: North Macedonia

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Bosnia and Herzegovina

Bosnia and Herzegovina does not have its own natural gas extraction so it has been relying exclusively on Russian gas since 1978, which is transited on the Beregovo-Horgos-Zvornik import route via Ukraine, Hungary and Serbia. Gas use in the country is limited by the distribution network which is only present in Sarajevo, Zenica, Zvornik and Visoko. The used route via Ukraine, Hungary and Serbia was replaced by the new route across Turkey, Bulgaria and Serbia in 2021, by the Turkish Stream pipeline. Both routes enter the country near Zvornik, some 140 km northeast of the capital Sarajevo. Bosnia and Herzegovina's annual natural gas consumption was 235 million cubic meters in 2019 mostly concentrated in the winter period due to the heating of Sarajevo.

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[*] Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

There are several interconnection projects natural gas of Bosnia and Herzegovina and Croatia foreseen by the Ten-Year Network Development Plan (TYNDP) by ENTSO-G and Energy Community in different stages of implementation: Southern, Northern and Western Interconnection BA-HR Gas Pipeline that will help to establish new supply route for Bosnia and Herzegovina providing reliable and diversified natural gas supply increasing security of supply. The most likely to happen first is the southern interconnection from Split.

Country is interested in various energy sources, including gas from the liquefied natural gas (LNG) terminal in Alexandroupolis in northern Greece. In order for that gas to reach the users in BiH, it is necessary, among other things, to complete the construction of the gas interconnection between Serbia and Bulgaria.

Figure 95 – European Natural Gas Networks: Bosnia and Herzegovina

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Serbia

Supplies from Russia cover the consumption in Serbia almost entirely. It also produces natural gas from its natural gas reserves located in Vojvodina, the northern province of Serbia. The gas pipeline for imports from Hungary stretches from the Hungarian border to Niš.

The Serbia-Bulgaria gas interconnector is a very important project for the EUSAIR region since supporting the regional energy security while ensuring diversification of directions and sources of supply. The projected capacity of this new gas pipeline will allow flow of 1.8 billion cubic metres of natural gas annually. Finalisation of the pipeline construction is planned for Q4/2023. With its projected capacity the new gas pipeline will provide additional 80% capacity increase relative to Serbia's current annual gas needs (approx. 2.4 bcm/y) and largely increase the overall security of natural gas supply and contribute to cleaner energy targets.

Figure 96 – European Natural Gas Networks: Serbia

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Albania

Albania currently generates almost 100% of its electricity from hydropower plants and has no gas. But the government plans to gasify the country. Two projects are planned to achieve efficient distribution of natural gas. These include expanding the **Ionian-Adriatic pipeline** and the development **of the Vlora thermal power plant.**

The IAP aims to integrate the gas markets of Croatia and Albania via Montenegro, with the possibility to extend to Bosnia and Herzegovina (BiH), which is currently supplied by Russia via Serbia. If completed, the 5bcm/year pipeline could join up with TAP at Fier in Albania, allowing it to access Caspian gas or LNG imported via the Vlorë terminal. Albania and BiH could use 1bcm/day each, Montenegro could offtake 0.5bcm/year, while Croatia could take 2.5bcm/year.

Figure 97 – European Natural Gas Networks: Albania

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

Montenegro

Montenegro does not have own natural gas infrastructure but there have been long-standing gasification plans, primarily through the **Ionian Adriatic Pipeline** which should connect to TAP and bring Azeri gas from Albania to Montenegro. The Montenegro government has also opened its territorial waters in the Adriatic Sea for oil and gas drilling.

Figure 98 – European Natural Gas Networks: Montenegro

Source: Consultant elaboration on the European Network of Transmission System Operators for Gas, ENTSO-G Map

6.3 Regional gas market challenges

The global surge in energy prices and inflation are threatening the EUSAIR region with a range of challenges. Russia's war on Ukraine has weakened the Region's already fragile energy security. The non-EU countries of the EUSAIR region source much of their energy from fossil fuels, especially coal. With the exception of Albania, which relies mainly on hydropower, Serbia, Bosnia and Herzegovina and North Macedonia are largely dependent on Russia for natural gas, but this accounts less for their energy mix.

All non-EU EUSAIR countries have joined EU sanctions on Russia, except Bosnia and Serbia, given their limited use of natural gas, meaning that this protects them from the direct impact of surging gas prices. But rising energy demand and costs for imported electricity mean that these countries are vulnerable and will not come out of crisis untouched.

Among EU countries of the EUSAIR, Italy is the most dependent country on gas imports from Russia, which accounted for 40% in 2021. Like other EU countries, Italy has been rushing to diversify its gas imports after the Russia's invasion of Ukraine in order to overcome shortfalls of gas supplies. Italy has secured alternative supplies of gas from North Africa to cover the remaining supplies it still gets from Russia. Total independence from Russian gas may be achieved in the medium-long term by increasing of gas storage and expansion of regasification, as well as the usage of renewable energy resources.

The non-EU EUSAIR countries should also diversify their energy production and supply chains in order to become energy secure. Thus, it's important the adoption of the EU's regulations and policies, especially with regard to the Green Agenda and the transition to renewable energy. But the commitment of these countries to the European Green Deal which foresees a 55% reduction in carbon emissions (compared to 1990 levels) by 2030 must be postponed given the immediate pressure of the energy crises. These countries will need to continue burning coal in the short term and delay plans to phase out their coal-fired power plants over the next few years. Furthermore, to survive the energy crisis, these countries will also need to improve their cooperation within the framework of the Berlin process90 through preparing joint investment proposals in renewable energy and integration of the electricity and gas markets. The European Commission's REPower EU outlines the plan to cut Europe dependence on Russian fossil fuels by the end of 2030 that will have a strong impact on the EUSAIR countries. The plan focuses on accelerating the green transition and diversifying supply through investment in liquefied natural gas terminals and other gas infrastructure thus these countries could become an important transportation corridor for Europe's energy, particularly gas supplies. The EUSAIR countries would be connected through various pipelines with countries on the Caspian Sea, such as Azerbaijan, to Greece - Bulgaria interconnector, and to TAP through planned liquified natural gas terminals in Greece, Albania and Italy.

However, although the non-EU countries of the EUSAIR only have small energy markets, they could be crucial to the EU's energy policy. Energy security and climate neutrality can only be achieved if all

[90] The Berlin process was set up in 2014 as a platform for high-level cooperation between high official representatives of the Western Balkan Six (WB6).

EUSAIR countries rely on a strong and fully interconnected electricity and gas market, and a well-functioning carbon market.

Transition towards sustainable, renewable energy is becoming a crucial part of most EUSAIR countries. The current state and future development of energy infrastructure are key factors for sustainability of the EUSAIR countries' long-term energy mixes and their alignment with both national and EU decarbonisation goals.

The deployment of biomethane and other renewable gases (e.g. hydrogen, biomethane, synthetic gas) is another challenge. Concerning, especially, the biomethane, that is directly interchangeable with natural gas and has a promising potential to be exploited, there is a need to unlock the full biogas and biomethane potential across the States to promote and increase biomethane sustainable production and use through its integration into modern, improved, and digitalized gas distribution networks. Since the EUSAIR constitutes a long-term strategic policy in the Adriatic and Ionian Region, aiming to promote socio-economic growth in the area, the initiative of facilitated integration of biomethane into the internal markets contributes to the reduction of the area's dependence on the imported natural gas (hence to the security of supply), helping, also, the EU energy transition and the local economies in general while being fully compliant with the provisions of REPowerEU.

7 Section 7 - Natural gas system and network planning towards the year 2030

7.1 Overview and description of the EUSAIR countries of the New Policies Scenario and its commitments as compared with the Current Policies Scenario

In this section will be developed and assessed two scenarios for each EUSAIR Country up to 2030, based mainly on the information contained in National Energy and Climate Plans (NECPs):

- the **Current Policy Scenario** (**CPS**) will be based only on existing trends of energy consumption linked to specific variables of each sector of final energy use, without envisaging any new policies nor new significant structural change, both in policies and of consumer technologies or new energy sources: <u>this scenario is much the same as the “With Existing Measure (WEM)” scenario contained in NECPs</u>;
- the **New Policy Scenario** (**NPS**) will be developed considering the targets set by each Country in its NECPs, thus taking into account technological changes and the related energy consumption trajectories up to 2030: <u>this scenario is much the same as the “With Additional Measure (WAM)” scenario contained in NECPs</u>.

The CPS and NPS scenarios are therefore based on the information available in the NECPs of the individual Countries.

If available, the data from the WEM and WAM scenarios relating to the **consumption of natural gas** in the individual sectors of use (power generation, industry, residential, tertiary, transport, etc.) are used directly.

If only indirect information is available in the NECPs, the CPS and NPS scenarios are created by processing, where possible, this information, also starting from the reference data for the 2019 base year.

If the NECP information are not available for some EUSAIR countries, for the CPS and NPS scenarios will be used respectively the Stated Policies Scenario (STEPS[91]) and the Sustainable Development Scenario (SDS[92]) of the IEA World Energy Outlook 2020 (WEO 2020[93]). In this case, according to regional

[91] The Stated Policies Scenario (STEPS) is based on 2021’s policy settings. In this scenario, GDP also returns to pre-covid 19 levels in 2021, and energy demand in early 2023, but outcomes vary sharply by fuel: renewables meet 90% of the strong growth in global electricity demand over the next two decades, led by continued high levels of solar PV deployment, but global coal use never gets back to previous levels.

[92] The Sustainable Development Scenario (SDS) sees a near-term surge of investment in clean energy technologies over the next ten years, along with action to reduce emissions from existing infrastructure; this is enough to make 2019 the definitive peak year for global CO_2 emissions.

[93] Available here: https://www.iea.org/reports/world-energy-outlook-2020

groupings in WEO, the scenarios will be related to “European Union” for Italy, Slovenia, Croatia and Greece and “Europe” for Albania, Bosnia and Herzegovina, North Macedonia, Montenegro and Serbia.

The following table reports main energy indicators used for EUSAIR natural gas scenarios based on IEA WEO 2020.

	Europe		European Union	
	Stated Policies Scenario	Sustainable Development Scenario	Stated Policies Scenario	Sustainable Development Scenario
Primary demand	**-0,5**	**-2,1**	**-0,8**	**-2,4**
Power sector	**-0,5**	**-1,9**	**-0,2**	**-1,6**
Total final consumption	**-0,6**	**-2,5**	**-1,0**	**-2,9**
Industry	-0,0	-1,0	-0,2	-1,1
Industry final consumption	-0,5	-2,2	-0,7	-2,4
Transport final consumption	1,2	-0,2	-1,0	-2,2
Buildings final consumption	-0,6	-2,5	-1,1	-3,1

Table 14 – CAGR 2019-2030 (%) for natural gas consumption in Europe and European Union based on IEA WEO 2020 scenarios

Source: Consultant’s elaboration on NECP, Eurostat, IEA and European Commission data

7.1.1 National commitments as reflected in the National energy and Climate Plans (NECPs)

7.1.1.1 Albania

Albania has committed to prepare its first NECP 2021-2030 during the year 2020. The development period had to be extended due to the COVID-19 pandemic and the draft of NECP has been published in July 2021.

This NECP builds on the National Energy Strategy and the first NDC and has been aligned with the draft of the revised NDC.

The main targets contained in NECP are the following:

- GHG emission savings (Reduction relat. WEM): -18,7%
- Energy Efficiency (Final Energy Consumption reduction relat. WEM): -8,4%
- Renewable energy share in final energy demand: 54,4% (178% for RES in electricity sector, 34,6% for RES in transport sector and 16,6% for RES in heating and cooling sector)

7.1.1.2 Bosnia and Herzegovina

At the moment, the NECP for Bosnia and Herzegovina is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the

NECP[94]. The development of the draft NECP focused on the refinement of the policy and the reference scenarios, in part to reflect the negotiations on the Energy Community 2030 targets for Bosnia and Herzegovina[95]. The legal basis for the NECP, i.e. climate law and accompanying by-laws, as well as the adoption of the entity energy and climate plans, are still pending.

In April 2023, the NECP for Bosnia and Herzegovina (BiH) for the period until 2030 was publicly presented for the first time at the Energy Summit in Neum (BiH)[96]. In accordance with the undertaken obligations towards the Energy Community, the draft NECP is planned to be submitted to the Energy Community Secretariat by the end of June 2023.

The NECP foresees reaching the share of RES in FEC of 43.62%, with FEC of BiH of 4,340 ktoe.

The NECP also envisages decommissioning of coal-fired TPPs with installed overall capacity of 410 MW, ceasing construction of new coal-fired TPP units and switching of some existing capacities to biomass.

Putting into RES power plants with overall capacity of 2,000 MW is foreseen (1,500 MW of solar PV power plants, and the remaining capacities covered by wind, HPPs and biomass).

Policies and measures listed in the NECP include establishing of organized electricity and natural gas markets, introduction of an emission trading scheme (ETS) in accordance with EU ETS, as well as introduction of guarantees of origin. With the Energy Community Secretariat's support, Bosnia and Herzegovina drafted a roadmap for introducing carbon pricing by the end of 2025.

On the basis of the Decision on the implementation of the Directive 2009/28/EZ, an obligatory target for RES share in FEC of 40% in the year 2020 was set for Bosnia and Herzegovina[97]. In this regard, both entities in Bosnia and Herzegovina (Federation of Bosnia and Herzegovina, and Republika Srpska) have drafted their own Renewable Energy Action Plans, and on this basis together with evaluating the situation in the Brcko District, the RE Action Plan on national level (National Renewable Energy Action Plan – NREAP) was drafted and released in 2016[98].

7.1.1.3 Croatia

Croatia submitted its NECP for the period from 2021 to 2030 in December 2020 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

Following are the most important targets that the NECP sets for 2030:

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94 Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

95 Energy Community – Bosnia and Herzegovina Annual Implementation Report (November 2022), https://www.energy-community.org/dam/jcr:90f246f0-0e7e-469e-8895-d2bc4538ec58/IR2022_Bosnia_Herzegovina.pdf.

96 https://balkangreenenergynews.com/rs/predstavljen-nekp-za-bih-gase-se-termoelektrane-a-otvaraju-elektrane-na-obnovljivu-energiju-snage-2-000-mw/.

97 https://www.vladars.net/sr-SP-Cyrl/Vlada/Ministarstva/mper/std/Documents/StrategijaEnergetike2035Latinica.pdf.

98 https://www.energy-community.org/dam/jcr:ef59bc5d-a6c3-48a8-9653-2a40e5721d58/NREAP_2016_BH.pdf.

- Reduction in greenhouse gas emissions for the ETS sector, compared to 2005: at least 43%
- Reduction in greenhouse gas emissions for non-ETS sectors, compared to 2005: at least 7%
- Share of RES in gross final energy consumption: 36,4%
- Share of RES in final energy consumption in transport: 13,2%
- Primary energy consumption (total energy consumption without non-energy consumption): 344,38 PJ
- Final energy consumption: 286,91 PJ

Projections of the most important energy and climate indicators included in the WAM scenario in NECP by 2030, are the following:

- Immediate energy consumption is expected to amount to 286.9 PJ in 2030, representing a change of 8.1% and -15% in comparison to 2005 consumption
- The expected reduction in greenhouse gas emissions from energy sources amounts to 31.2% by 2030, compared to 1990 levels
- The renovation rate in the period 2021 to 2030 is growing from the current 0.7% per annum for the period 2014-2019 in steps of 1.1% to 3.0%, reaching a 10-year average of 1.6%. The rate of abandonment of the existing building stock is significantly increased, as evidenced by the increase in temporarily unoccupied units in the period between two consecutive censuses.
- The penetration of electric, hybrid and hydrogen-powered vehicles is expected to reach 3.5% of total road passenger activity in 2030
- Increase in the share of renewable energy sources in gross final energy consumption to 36.4% by 2030
- Decarbonisation of electricity production by increasing the share of renewable energy sources to 63.8% by 2030

Increasing energy efficiency is strongly present in all sectors of consumption, with the strongest effects expected in the building sector and transport.

In the building sector, a continuation of good practices and strengthening of energy efficient of all buildings (residential and non-residential) is expected, targeting renovation according to the nZEB standard, which also implies a greater utilization of RES (photovoltaic systems, solar thermal collectors, biomass boilers, heat pumps).

7.1.1.4 Greece

Greece submitted its NECP for the period from 2021 to 2030 in December 2019 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The NECP has set the following objectives for 2030.

Initially with regard to climate change and emissions, a much higher core objective for **reducing greenhouse gas** (GHG) emissions by more than 42% compared to emissions in 1990 and more than 56% compared to emissions in 2005, thus exceeding even the core EU targets.

Also, in respect of climate change and adaptation policies, the NECP sets out the initiatives to be undertaken in the context of the National Strategy for Adaptation to Climate Change, which defines the general objectives, guidelines and tools for the implementation of necessary climate adaptation measures at national, regional and local levels. It also sets out initiatives for the completion of physical planning, in urban areas in particular with respect to sustainable land use and the promotion of sustainable urban mobility. Waste management is an integral part of the national energy and climate plan, and therefore the relevant initiatives for revising the national and regional waste management plans (NWMP and RWMP) are presented. The objective of these plans is to intensify a number of integrated waste management measures, always in line with the requirements of the circular economy.

Moreover, the circular economy is a core element of Greece's development strategy, and its implementation includes, inter alia, a four-year strategic plan that covers the entire range of the value chain. In this context, the NECP sets out the axes of the relevant policy.

With regard to **renewable energy sources** (RES), the objective concerning the RES share in gross final energy consumption provide for a minimum target of 35%. This is also much higher than the core EU previous objective for RES of 32%.

The energy transformation has to take place especially in power generation, as provision has been made for the RES share in electricity consumption to exceed 60%. In this context specific initiatives are already being promoted and implemented by the government, e.g. simplifying and speeding up the licensing framework, ensuring optimal integration of RES in electricity networks, operating storage systems and promoting electromobility.

With regard to improving **energy efficiency**, there is a quantitative objective for final energy consumption in 2030 to be lower than that recorded in 2017. Therefore, the NECP's objective is fully compatible with the relevant EU indicator. There is also a 38% qualitative energy efficiency improvement achieved in final energy consumption, in accordance with a specific EU methodology, compared to the corresponding core EU objective of 32,5%. Attaining this ambitious objective will strengthen the competitiveness of the Greek economy and the protection of consumers. The NECP sets out a set of energy efficiency improvement measures, the most ambitious ones relating to buildings and transport.

A key objective for the NECP is the highly ambitious, but realistic programme for sharply and definitively reducing the share of lignite in power generation, i.e. the so-called lignite phase-out, by implementing a relevant front-loaded programme in the following decade and putting a complete end to the use of lignite for power generation in Greece by 2028. The NECP also sets out the timeframe for shutting down the lignite-fired power plants that are currently in operation, which will be completed by 2023.

The lignite phase-out plan for power generation in Greece also involves adopting integrated programmes for supporting lignite-producing areas in Greece, to smooth out the transition to the post-lignite era. The Greek government is committed to shutting down lignite-fired plants by 2028 in a well-coordinated and responsible manner. Maintaining jobs and utilising the expertise of human resources in these areas are a top priority.

Lignite phase-out is a sea change in the national energy map, but also a huge opportunity for Greece. The spirit of innovation that was ushered by the use of lignite will be passed on to the clean forms of energy and the new energy mix of the 21st century.

The NECP includes and sets out corresponding measures for other strategic policy priorities such as:

- speeding up the electrical interconnection of the islands;
- launching the new electricity market model without further delay;
- strengthening energy interconnections;
- developing strategic storage projects;
- digitising the energy networks;
- promoting electromobility;
- promoting new technologies;
- coupling the final sectors;
- developing new financial instruments; and
- taking initiatives for research and innovation and for enhancing competitiveness.

7.1.1.5 Italy

Italy submitted its NECP for the period from 2021 to 2030 in December 2019 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The following are the main objectives of the 2030 NECP on renewables, energy efficiency and greenhouse gas emissions:

- Share of energy from RES in the gross final consumption of energy: 30% (22% in transport sector)
- Reduction in primary energy consumption compared to the PRIMES 2007 scenario: -43%
- Reduction in GHG vs 2005 for all plants subject to ETS rules: -43% (EU target)
- Reduction in GHG vs 2005 for all non-ETS sectors: -33%
- Overall reduction in greenhouse gases compared to 1990 levels: -40% (EU target)

With regard to the strategy concerning each of the five dimensions of the Energy Union, a number of main elements contained in NECP are provided below.

Dimension decarbonisation

Italy intends to accelerate the transition from traditional fuels to renewable sources, by promoting the gradual phasing out of coal for electricity generation in favour of an electricity mix based on a growing share of renewables and, for the remainder, gas. Making this transition a concrete reality requires and is subject to the planning and construction of replacement plants and the necessary infrastructure.

Italy will implement the policies and measures needed to achieve the objectives of reducing greenhouse gases agreed at European and international level. For those sectors covered by the European Union Emissions Trading System (EU ETS) – primarily the thermoelectric sector and energy-intensive industries – factors contributing to this goal include: the phasing out of coal, scheduled by the end of 2025, as mentioned within the limits of, and as long as the replacement plants and necessary infrastructure are constructed in good time; a higher CO2 price level than in recent years; and a significant acceleration of renewables and energy efficiency in manufacturing processes. The coal phase-out could be implemented through, among other things, the construction of additional gas-fuelled thermoelectric units, which are necessary in view of the increased proportion of renewables in electricity generation to maintain the system at adequate levels. At present, no gas infrastructure developments are planned, but a temporary increase in gas consumption is envisaged.

For those other sectors included in the objectives established by the Effort Sharing Regulation (ESR), measures that take into account the potential and costs of reducing emissions will be developed; the most important contribution will, in any case, come from the transport and civil (residential and tertiary) sectors, combining measures for using and increasing the efficiency of renewables. For the ESR segments, the involvement of local authorities with direct competence for the transport, residential and services sectors is of fundamental importance.

Italy will promote the further development of renewables while also protecting and enhancing pre-existing products, by exceeding, if possible, the 30% target set, which must, in any event, be assumed to be a contribution towards meeting the EU target. This will be achieved through the use of instruments calibrated on the basis of the sectors of use, types of measures and size of the plants, with an approach aimed at limiting soil consumption and the impact on the landscape and environment, including requirements on air quality. With regard to the electricity sector, and with an additional view to the electrification of consumption, the intention is to make widespread use of built-up areas or areas already in use in some other way, by raising the profile of the different forms of self-consumption, including through distributed generation and storage. A further aim is to promote the creation of systems, starting with a few small islands disconnected from the national networks, in which an accelerated decarbonisation process and electrification of consumption with renewable sources can be trialled. In the heating sector, it will be particularly important to ensure coordination with the instruments for energy efficiency, in particular for buildings, and coherence of the instruments with air quality objectives.

Dimension energy efficiency

The intention is to use a mix of fiscal, economic, regulatory and policy instruments, primarily calibrated by sector of activity and type of target group.

However, attempts will be also be made to integrate the energy efficiency aspect into policies and measures whose main purpose is something other than efficiency, in order to optimise the cost-benefit ratio of the actions. In this respect, the significant potential for efficiency in the building sector may be better exploited through measures aimed at, for example, the energy renovation of buildings and neighbourhoods, together with the structural renovation, earthquake-proofing, systems upgrading and refurbishment thereof, in line with the strategy for energy renovation of the building stock by 2050. It will thus be possible to give due consideration to the potential contribution to decarbonisation of existing building stock, and of stock not undergoing significant refurbishment, which makes up most of the total built environment. In this context, solar heating, electric and gas heat pumps, and micro and mini high-efficiency cogeneration (HEC) technologies should be carefully considered, especially if fuelled by renewable gas.

With regard to transport, priority is given to policies for reducing demand for mobility and increasing collective mobility, in particular rail transport, which includes shifting freight transport from road to rail. 'Improve' measures (regarding vehicle efficiency and emissions) must be supplemented with instruments to reduce mobility needs ('avoid' measures) and with efficiency in travel ('shift' measures).

As for the remaining demand for private mobility and the mobility of goods, the aim is to promote the use of alternative fuels and, in particular, electricity. This will be done by increasing the share of renewables through economic and regulatory instruments, in coordination with local government bodies.

Along with the ordinary instruments, it will also be possible to use resources from the EU's development and cohesion programming cycle for 2021-27. In this regard, in the discussions with partners, which involve the Regions, among others, a specific national energy programme has been proposed. Taking the INECP as reference, this is intended to support initiatives to modernise and improve the efficiency of buildings and build new infrastructure, including infrastructure for sustainable mobility. The national programme, when approved, will be coordinated with regionally managed programmes.

Dimension energy security

In terms of security of supply, the aim is, on the one hand, to become less dependent on imports by increasing renewable sources and energy efficiency and, on the other hand, to diversify sources of supply (for example through the use of natural gas, including liquefied natural gas (LNG), with infrastructure consistent with the scenario of deep decarbonisation by 2050).

With regard to the security and flexibility of the electricity system, and notwithstanding the need to promote the extensive involvement of all available resources – including storage, renewables and demand – account must be taken of the transformation of the system resulting from the growing importance of renewables and distributed generation. New operational methods and structures must be tested, including with the active participation of the transmission system operator (TSO). Similarly, the vital need for storage systems must be considered, to prevent overgeneration by electricity plants fuelled by renewables. As evidence of this need, estimates of the power needed from wind and photovoltaic alone to meet the 2030 renewables goals are of the same order of magnitude as the annual peak power demand on the network.

In addition, to achieve the security and flexibility objectives, the intention is to explore the potential offered by growing integration of the electricity and gas network infrastructure. In this context, it will be important to explore the costs and benefits of power-to-gas technological solutions which, especially over the long term, make it possible to absorb any imbalances between renewable electricity production and energy demand, especially with high levels of photovoltaic penetration. Hydrogen could contribute to this, including for non-electricity consumption.

Particular attention will be paid to the resilience of the systems, in particular of transmission and distribution networks, through preventive measures proportionate to the expected increase in extreme events and periods of heavy load, and operational rules that enable the systems to be quickly restored to normal functioning levels.

In addition, with the Plan for the Sustainable Energy Transition of Suitable Areas (PSETSA) has been possible to establish a framework of reference of those areas in Italy in which hydrocarbon exploration, research and production activities would be planned, with the aim of improving their environmental, social and economic sustainability. In this respect, the outcomes of the PSETSA analyses could change the national production scenario.

Consumption and sources of supply will be monitored in order to ensure compliance with Security Regulation No 2017/1938 concerning preventive action plans and emergency plans.

Dimension internal market

A greater degree of market integration is considered to be advantageous to the entire Union, and therefore the electricity interconnections and market coupling with other Member States will be enhanced; however, given Italy's geographical position, the interconnections with third countries will also be studied and developed, in order to facilitate efficient trade.

In terms of transmission infrastructure, the references are Terna S.p.A.'s development plans, which will be revised with a view to introducing additional measures, such as centralised storage systems, needed to ensure safe integration of renewable sources, and reducing over-generation, to be implemented in compliance with the provisions of the latest EU guidelines.

In any event, in the long term the electricity market must evolve towards different forms of trading because the cost of renewable sources, on which the focus must necessarily be placed in order to increase their contribution, is predominantly one of investment. Consequently, they make it possible for the producers concerned to present their offering following a different dynamic from gas-fuelled plants, which also have to deal with variable fuel costs. This entails a need to supplement and then adjust market regulation to create a context in which the offerings can be fairly compared and prevent negative effects on system adequacy, which would also have repercussions for the gas market.

The need for flexibility may also prove beneficial to system integration (between electricity, hydro and gas systems in particular), which should be implemented on a trial basis, including with a view to researching the most efficient long-term storage methods for renewable energy. Appropriate changes to the market and to the regulatory system could be analysed to foster the electricity-gas integration of technologies that convert electricity into a gas that can be injected to the network, in line with the provisions for energy storage systems in the recently approved Electricity Market Directive and Regulation. This would be done taking developments in storage systems, including those enabled by technologies that convert one form of energy to another, and the need to develop seasonal and long-term storage into special consideration.

The expected reduction in the cost of electrolysis technology will make it possible to obtain renewable hydrogen for the decarbonisation of energy-intensive industrial sectors and long-haul commercial transport.

With regard to energy poverty, to supplement the measures described below, studies are under way to introduce efficiency measures and measures for the installation of renewable energy plants with self-consumption.

Dimension research, innovation and competitiveness

There are three fundamental criteria behind research and innovation activities in the energy sector:

d) the finalisation of resources and activities geared towards the development of processes, products and knowledge that have an outlet into markets opened up as a result of support measures for the use of renewables, energy efficiency and network technology;

e) synergistic integration between systems and technologies;

f) viewing 2030 as a milestone in the process towards full decarbonisation, on which Italy is engaged in line with the long-term strategy to 2050, in which ambitious scenarios are proposed that envisage the reduction of emissions eventually to climate neutrality, in line with the EU approach.

Similarly, the support measures for innovation in sectors other than the energy sector will follow an approach, in the light of the Green New Deal, that fosters the modernisation of the production system in line with the medium and long-term energy and environment scenario.

With regard to competitiveness, the strategy outlined in the previous sections must be combined not just with the integration of the single market, but also with careful regulation of the energy markets, so that consumers and businesses can benefit from the positive effects of transparent competition, and prudent use of support mechanisms that may burden the community, as well as integration into the single market.

7.1.1.6 Montenegro

At the moment, the NECP for Montenegro is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the NECP[99]. As per obligation towards the Energy Community, the draft NECP should be submitted by 30/06/2023. Preparation of the NECP is incorporated into Montenegrin legislation, through the Energy Law[100]. In accordance with the Energy Law, monitoring of NECP implementation is performed by the line Ministry[101], which prepares biennial progress reports.

Prior to the NECP, Montenegro has prepared the following strategic documents in the field of RES:

- Energy Sector Development Strategy of Montenegro until the year 2030[102] (issued in 2014), and
- National Renewable Energy Action Plan until 2020[103] (also delivered in 2014).

The Energy Sector Development Strategy of Montenegro until the year 2030 envisages the following FEC.

Final energy consumption, in ktoe (Energy Sector Development Strategy of Montenegro until 2030), in ktoe

FEC / Year	2015	2020	2025	2030
Total FEC	**768.7**	**874.9**	**1,005.7**	**1,107.8**

Table 15: Final energy consumption of Montenegro

Source: Consultant's elaboration

The national RES target (RES share in total gross FEC) of 33% (in the year 2020) has been determined for Montenegro in accordance with the Decision 2012/04/MC-EnC of the Energy Community Ministerial Council (18/10/2012). The Decision obliged Montenegro to transpose the RED into Montenegrin legislation.

7.1.1.7 North Macedonia

Following up on the national Energy Strategy adopted in December 2019 and in response to the Recommendation of the Ministerial Council of the Energy Community (2018/1/MC-EnC) on preparing for the development of integrated national energy and climate plans by the Contracting Parties of the

99 Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

100 Official Gazette of Montenegro (OG ME) 5/2016, 51/2017 and 82/2020.

101 Ministry of Capital Investments – Energy Directorate.

102 https://wapi.gov.me/download/eac811f8-4b13-46ce-97c4-412b8d1ebb8a?version=1.0

103 https://wapi.gov.me/download/6d8db09e-a2b1-4e4a-bf98-42c39a0b3299?version=1.0.

Energy Community and the relevant Policy Guidance by the Energy Community Secretariat (PG 03/2018), North Macedonia prepared National Energy and Climate Plan (NECP), which covers the period from 2021 to 2030 prescribing the pathway to achieve the 2030 targets. The economy wide GHG emission reduction target for North Macedonia is 82% in 2030 compared to 1990, or 78% compared to BAU scenario (defined in the Energy Strategy). The NECP as an indicative planning document was adopted in May 2022, by the Government of Republic of North Macedonia.

As the Energy strategy does, the NECP also takes a holistic approach and address the five main dimensions of the Energy Union in an integrated way recognizing the interactions between the different dimensions.

The strategic policy under the **decarbonisation dimension** envisages the realization of all identified climate change mitigation actions that will further reduce GHG emissions, and at the same time will increase the share of renewable energy sources in the gross final energy consumption in a sustainable manner. Around 70% of the total GHG emissions in the country originate from fossil fuel combustion activities in the energy sector, particularly in the energy transformation, industry, and transport sub-sectors. Therefore, promoting the transition of the energy sector towards low-carbon technologies as a key objective includes a strong plan for gradual decommissioning of the coal power plants and accelerating the utilization of renewable sources in the electricity generation mix in conjunction with energy efficiency measures in all sectors. The introduction of a CO2 tax will speed up the phasing-out of conventional fuels, and at the same time stimulate the investments in RES and implementation of energy efficiency measures. In the area of renewable energy, the country will continue its current support mechanisms for RES electricity generation via feed-in tariffs and feed-in premiums with auctions (granted in a tendering procedure). The country will promote further utilization of RES in the electricity sector (without incentives), but also in the other sectors through the introduction of the “prosumer” concept and by electrification of the heating and cooling sector using high efficient heat pumps and district heating fuelled by CHP biomass, as well as by increasing the biofuels consumption in the transport sector.

The decarbonisation dimension also foresees policies and measures for GHG emissions reduction in the non-energy sectors. The measures related to agriculture, forestry and land use include improvement of feeding and manure management practices in livestock breeding farms, land conversions that will reduce the soil erosion, and increase the soil organic matter and carbon sinks, as well as management of forest fires and afforestation of forestland that will contribute to additional absorption of GHG. The NECP also envisages the potential for GHG emission reduction from the waste sector, by improving waste management and treatment practices.

Concerning the **energy efficiency dimension**, North Macedonia will strive to maximise the savings in primary and final energy consumption. The projection with the current policies shows that the consumption of both, primary and final energy will increase by 38% and 55%, respectively, in 2040 relative to 2017, due to continuing economic growth. Having in mind that the country has the limited potential of lignite and biomass, as the most dominant domestic resources that are currently used, the goal is to pay special attention to energy efficiency. Therefore, North Macedonia is planning to implement a number of policies and measures over the period 2020 – 2040, in order to reduce the energy consumption in buildings (households, commercial and public), industry sector, transport sector, and to reduce the losses the energy transformation, transmission, and distribution network. Considering that the secondary legislation that should deliver the targets and roadmaps for energy efficiency (as required by the new Energy Efficiency Law) is still not developed, the NECP provides some indicative savings that can be achieved in the future, when all the requirements from legislative acts will enter into force.

The polices and measures relevant for building sector will focus on improving the energy performance of buildings by refurbishing of the existing and construction of new buildings (including passive buildings), as well as through promotion and introduction of more advanced end-use technologies (if possible, in combination with RES), utilization central heating systems, green procurements, etc. Regarding the industry sector, a priority is given to the improvement of the processes by using more efficient and advanced technologies, in combination with the energy management of the processes. Concerning transport, priority is given to policies for replacement of the road vehicle fleet (including the promotion of electric vehicles), promotion of advanced mobility (biking, walking, etc.) and using collective modes of transport, as well as a modal shift in freight transport from road to rail. The implementation of these measures in combination with the measures envisaged in the decarbonisation dimension will keep the primary energy consumption at the current level. This indicates notable energy savings relative to the BAU scenario (presented in the Energy Strategy), which is used to evaluate the indicative EE targets. In addition, all these policies and measures will have a direct effect on emission reductions, decrease import dependence, and stimulate the domestic economy with local job opportunities.

In terms of **energy security**, the country aims to become less dependent on energy imports by increasing the utilization of renewable sources and energy efficiency but, at the same time, plans to diversify its sources of supply through the use of natural gas (mainly in the industry sector). Analysing the current situation, the identified potential risks for the security of supply include limited use of domestic resources in energy production (mainly based on lignite, biomass and hydro), depleting coal resources, single interconnection point for natural gas supply, and high dependence on energy import (with nearly 60% of the total primary energy consumption). The policies and measures relevant to the security of energy supply are already addressed in the other dimensions. Thus, the measures for increasing the RES share envisaged in the decarbonisation dimension are highly pertinent for the diversification of domestic resources, but also for the reduction of energy import dependence when combined with the measures under the energy efficiency dimension. The flexibility of the system is expected to be increased by combining the utilization of RES with the electrification of the transport. The NECP also envisages diversification of the supply routes, through developing the gas transmission network, considering the significance of using the natural gas in the industry sector as a less carbon-intensive fuel that will reduce the GHG emission and improve the air quality resulting from this sector.

Regarding the **internal energy market dimension**, the NECP aims to establish an organized day-ahead market in North Macedonia, to enable coupling with the Bulgarian day-ahead market and to participate in initiatives for the establishment of regional market. In terms of the electricity interconnectivity, the country plans to improve the currently high level of connection, by finishing the new interconnection with Albania (as a project on the PECI List), thus enhancing the interconnectivity of the region. The country also plans to diversify the supply routes by realizing the planned natural gas interconnection with Greece (as a project on the Projects of Mutual Interest (PMI) list) and interconnections with Kosovo* and Serbia (as projects on the preliminary Projects of Energy Community Interest (PECI) list), that will ensure the security of the supply in the region. Also, the NECP includes continuous investments in the electricity transmission and distribution network, as well as the development of the gas transmission and distribution network in the country. Other plans for the development of the internal energy market that will increase the flexibility of the system for higher RES integration include improvement of the demand response level and introduction of real-time price signals that will encourage the consumers to have a pro-active role in balance services, thus increasing the capacity of energy storage. The NECP also envisages developing of an annual program for vulnerable consumers that will ensure their protection from the price shocks.

Concerning **research, innovation, and competitiveness dimension**, Macedonia will strive to include the energy transition technologies and measures in its research and innovation (R&I) priorities. In 2018, the country launched the process for developing a Strategy for Smart Specialization, which identified the energy sector as one of the priority areas that need innovation strategies, based on the objectives of the Energy Strategy for utilization of renewable energy sources and enhancement of energy efficiency. The NECP also identifies the need for frequent revision of the energy-related curricula at all educational levels to follow the innovative trends in science and technology, especially the energy transition trends.

In terms of funding the research and innovation activities related to energy and climate, the country plans to continue the national support via the mechanisms of the Fund for Innovation and Technology Development (like grants, loans, etc.) for support of innovation activities in micro, small and medium-sized enterprises (MSMEs). The FITD's programs, also include possibilities for new mechanisms targeted also to the public sector and large enterprises. These support mechanisms will enable knowledge and technology transfer between the scientific institutions and the industry, thus enhance the competitiveness of the business sector and at the same time support the industry-driven science. Also, the access to international support from the EU research and innovation programs (like Horizon Europe) and other donor funds should be further enhanced by establishing effective project management units in the responsible ministries (comprised of multidisciplinary officers involved in the planning, evaluation and monitoring procedures) and by increasing the competences of the institutions to effectively absorb such funds.

In terms of competitiveness, the NECP identifies that the SMEs should be encouraged and supported to diversify their portfolio of services and products in RES and EE, by providing suitable financial and technical mechanisms. The mechanisms included in the FITD programs (like co-financing grants, business accelerators, technology transfer offices, Science Technology Park, etc.) could be a good

[*] Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo* declaration of independence.

starting point towards improving the business environment and ensuring the competitiveness of companies.

The following are the main objectives of the 2030 NECP on renewables, energy efficiency and greenhouse gas emissions:

Decarbonization (GHG emissions and removals):

- 82% GHG net emissions reduction relative to 1990 level
- 66% emissions reduction in Energy sector (mainly through decommissioning of coal fired TPP Oslomej in 2021 and TPP Bitola up to 2027)
- 45% emissions increase in IPPU sector
- 29% emissions reduction in Agriculture sector
- 95% removals increase in FOLU sector
- 21% emissions reduction in Waste sector

Decarbonization (renewable energy):

- 38% share in gross final energy consumption
- 66% share in gross electricity production
- 45% share in gross final energy consumption for heating and cooling
- 10% in final energy consumption in transport

Energy efficiency:

- 20,8% savings of final energy consumption relative to BAU scenario
- 34,5% savings of primary energy consumption relative to BAU scenario
- Establishment of Monitoring and Verification Platform by 2021
- Development of Building Renovation Strategy
- 19% savings of final energy consumption in the transport sector relative to BAU

Energy security:

Energy import dependency of 59%, mainly thought:

- Fulfilling the RES and EE targets
- Continuous creation of a positive investment climate in RES
- Continuous maintenance and improvement of the transmission and distribution networks
- Increasing the number of prosumers
- Creating a system of guarantees of origin that will increase the value of projects in RES

Increase the diversification of energy sources and supply from third countries thought:

- Fulfilling the RES target
- Construction of additional interconnection pipelines with Greece, Kosovo* and Serbia

Increase the flexibility of the national energy system thought:

- Implementation of balancing market
- Construction of hydro-power plants (including pump storage) or gas fired power plants (including CHP)
- Construction of biomass and biogas power plants
- Implementation of viable demand response options, including vehicle-to-grid, power-to-heat and battery storage.

Internal energy market:

Maintain the high interconnectivity level

Maintain and upgrade the energy transmission infrastructure through:

- finishing the already started project for electricity interconnector Bitola-Elbasan up to 2023
- implementation of the projects for construction of the natural gas pipelines to Greece, Kosovo* and Serbia
- increasing the access to the natural gas transmission network, especially of the industrial consumers

Increase market integration through:

- establishing a day-ahead market as soon as possible
- coupling with IBEX (Bulgarian day-ahead market) and participation in the initiative for establishing a regional electricity market
- increasing the level of demand response
- increasing the number of consumers that can provide balance services and aggregators
- increasing the capacity of energy storage

Decrease energy poverty level through:

- ensuring the implementation of the provisions for protection of consumers (vulnerable consumers) by the suppliers
- stimulating the installations of solar thermal collectors for hot water, especially for the vulnerable customers
- carrying out annual programs for vulnerable consumers, with an appropriate increase in the intensity of the measures, based on annual needs
- introduction of energy poverty as a term in the relevant laws

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R&D and competitiveness:

Increase funding for research and innovation, promote clean energy technologies and improve the competitiveness through:

- channelling more of the national funds into science
- research and innovation (R&I) activities related to energy and climate
- increasing the access to the EU funding programs for research and innovation (like Horizon Europe, the successor of Horizon 2020) and other international donors
- adjusting the energy-related curricula at all educational levels to be responsive to energy transition trends
- promote RES technologies and EE in the energy transformation and industry sector, in parallel with the electrification of heating and cooling sectors and transport
- development and adoption of Strategy for Smart Specialization
- encouraging and support of SMEs to diversify their portfolio of services and products in RES and EE by providing suitable financial and technical mechanisms

7.1.1.8 Serbia

The National Energy and Climate Plan for the period 2021-2030 with the vision until 2050 (NECP) for Serbia is currently being prepared, hence the targets have not been made public. However, preliminary analyses were done in the course of preparing the NECP-

In April 2021, a set of laws in the energy sector has been adopted, including:

- The Law on RES Utilization,
- The Law on Energy Efficiency and Rational Utilization of Energy, and
- Amendments to the Energy Law,

which have prescribed the obligation of preparing the NECP, as well as monitoring and reporting on its implementation, in accordance with the Energy Community regulations[104].

Prior to NECP, the following strategic documents in the energy sector had been adopted:

- The National Renewable Energy Action Plan until 2020 (NREAP), adopted in June 2013[105], which determined the goals/targets of using RES until 2020 as well as of the means of reaching these targets. The NREAP set the share of RES in final energy consumption in Serbia to increase (from 21.2% in the year 2009) to 27% in the year 2020. At the same time, the final energy consumption has been projected to increase from 9.1497 Mtoe (in the year 2009) to 10.3306

[104] https://www.energy-community.org/implementation/package/NECP.html.

[105] Conclusion of the Government of the Republic of Serbia of 04/06/2013 - OG RS 53/13; https://www.mre.gov.rs/dokumenta/sektor-za-zelenu-energiju/izvestaji/akcioni-plan-za-obnovljive-izvore-energije

Mtoe in the year 2020 (an increase of 12.9%), without additional EE measures, i.e. to 9.495 Mtoe in the year 2020 with applied EE measures. Apart from RES target in the overall FEC, Serbia undertook the obligation to ensure the share of energy from RES in all forms of transport (RES-T) in 2020 to be at least 10 % of the FEC in transport on state/country level.

- The Energy Sector Development Strategy of the Republic of Serbia for the Period until 2025 with Projections by 2030[106] (the Strategy) has been developed in 2015. This document has provided projections of FEC in Serbia, which will be presented in this chapter. The Strategy is followed by the Program for Implementation of the Strategy.
- National Energy Efficiency Action Plans (NEEAP):
  - First NEEAP for the period 2010-2012[107],
  - Second NEEAP for the period 2013-2015[108],
  - Third NEEAP for the period until 2018[109,] and
  - Fourth NEEAP for the period until 31/12/2021[110].

The validity of NREAP and NEEAP has expired, while the Program for the implementation of the Energy Strategy is valid until 2023. The NECP which is being prepared should replace the strategic documents which have expired.

7.1.1.9 Slovenia

Slovenia submitted its NECP for the period from 2021 to 2030 in February 2020 according to the Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action.

The key objectives and contributions of NEPN across the five dimensions of the Energy Union are set out below.

Dimension decarbonisation

Reduce GHG emissions in sectors not covered by the trading scheme by 2030 as laid down by the Effort Sharing Regulation for Slovenia, i.e. by at least 20% compared to 2005, achieving the following sectoral targets:

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106 Official Gazette of the Republic of Serbia (OG RS) 101/2015, https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/skupstina/ostalo/2015/101/1/r.

107 Adopted in June 2010.

108 Adopted in October 2013 - OG RS 98/13.

109Adopted in December 2016 - OG RS 1/17),

https://arhiva.mre.gov.rs/doc/efikasnost-izvori/efikasnost/Treci_akcioni_plan_za_energetsku_efikasnost_Republike_Srbije_za_period_do_2018_godine.pdf

110https://www.mre.gov.rs/dokumenta/sektor-za-energetsku-efikasnost-i-toplane/ostalo/cetvrti-akcioni-plan-za-energetsku-efikasnost-republike-srbije-za-period-do-31-decembra-2021-godine

- transport: +12%
- general consumption: -76%
- agriculture -1%
- waste management: -65%
- industry (part of the sector not covered by the ETS): -43%
- energy (part of the sector not covered by the ETS): -34%

Ensure that LULUCF (Land Use Land Use Change and Forestry) sectors will not produce net emissions by 2030 (after applying accounting rules), i.e. emissions in the LULUCF sector will not exceed sinks.

In the area of adaptation, reduce Slovenia's exposure, sensitivity and vulnerability to climate change, and increase society's resilience and adaptive capabilities.

To reduce the use of fossil energy sources and dependence on importing them by:

- phasing out consumption of coal: by at least 30% by 2030, and the decision to phase out coal consumption in Slovenia in line with the principles of just transition by 2021,
- a ban on the sale and installation of new fuel-oil boilers by 2023,
- support for the implementation of pilot projects for the production of synthetic methane and hydrogen (the indicative target is a 10% share of renewable methane or hydrogen in the transmission and distribution network by 2030).

Reach at least a 27% share of renewables in energy end-use by 2030, i.e. (indicative):

- at least 2/3 of energy consumption in buildings to come from RES by 2030 (the share of RES in end-use of energy products excluding electricity and district heating),
- at least a 30% share of RES19 in industry,
- 43% share in the electricity sector,
- 41% share in the heating and cooling sector,
- 21% share in transport (with a share of biofuels of at least 11%).

Dimension energy efficiency

Improving energy and material efficiency in all sectors (and therefore reducing energy and other natural resources) as first key measure in the transition to a climate-neutral society.

By 2030 improve energy efficiency by at least 35% compared to the 2007 baseline (in line with the Energy Efficiency Directive).

Ensure systematic implementation of the policies and measures adopted so that the energy end-use does not exceed 54.9 TWh (4 717 ktoe). When converted to primary energy level, 2030 usage will not exceed 73.9 TWh (6 356 ktoe).

Reduce final energy consumption in buildings by 20% by 2030 compared to 2005 and ensure the reduction of GHG emissions in buildings by at least 70% by 2030 compared to 2005.

Dimensions energy security and internal energy market

Provide additional financial, human and technical resources to expedite the integrated development and management of the electricity distribution network to increase capacity, reinforce resistance to disruption and future development potential, boosting connectivity and adaptability, making it possible to exploit flexible sources and loads and expedite the incorporation of heat pumps, the roll-out of e-mobility and the integration of renewable electricity production and storage facilities.

Slovenia's other energy security and internal energy market targets for 2030 are:

- to ensure a reliable and competitive energy supply,
- to maintain a high level of electricity interconnection with neighbouring countries,
- at least 75% of electricity supply from sources in Slovenia by 2030 and by 2040, and ensuring an adequate level of security of electricity supply,
- to continue to exploit nuclear energy and maintain excellence in the operation of nuclear facilities in Slovenia,
- to reduce fossil fuel import dependency,
- to increase electricity distribution network resilience to disruption - increase the share of the underground medium-voltage network from the current 35% to at least 50%,
- further development of system services and the active role of clients,
- development of energy storage technologies, infrastructure and services,
- to establish a development-oriented regulatory framework to determine the amount of the network charge for the transition to a climate-neutral society,
- to support the development of an efficient and competitive market for full use of the flexibility of the energy system and new technologies
- support for cross-sectoral integration and implementation of new cross-sectoral system services,
- to encourage development and research cooperation between companies in and outside the sector,
- to ensure the further development of the pipeline system in accordance with the gas flows and system performance, including new sources of renewable gas and waste,

- to prepare a regulatory and support environment for renewable gas alternatives in the natural gas network, while analysing and determining the maximum possible share of hydrogen in the natural gas network,
- to support the implementation of pilot projects for the production of synthetic methane and hydrogen (with an indicative target 10% share of renewable methane or hydrogen in the transmission and distribution network by 2030),
- to provide appropriate conditions to maximise the share of renewable energy stored and used, when and where necessary, and to maximise the capacity of RES generating facilities,
- to enable the mitigation and reduction of energy poverty by accelerating the implementation of social policy measures, general housing policy measures and existing targeted measures.

Dimension research, innovation and competitiveness

Slovenia's 2030 targets in the research, innovation and competitiveness dimension are:

- to increase investment in R&D - at least 3% of GDP by 2030 (of which 1% of GDP is public funding),
- to increase investment in human resources and new knowledge needed to move to a climate-neutral society,
- to support businesses for an efficient and competitive transition to a climate-neutral and circular economy,
- to stimulate targeted research projects and multidisciplinary R&D programmes and demonstration projects with the goal of achieving a climate-neutral society, in line with the direct interest of the economy or public sector, and meeting the country's development goals, in particular in the areas of energy efficiency, the circular economy and green energy technologies,
- to incentivise businesses to finance and become involved in R&D programmes and demonstration projects by means of an active tax policy,
- to promote new and bolster existing R&D programmes in line with the objectives of the NEPN and the Long-Term Climate Strategy,
- to promote the use of digitisation for climate action and increase cyber security across all strategic systems,
- to promote public and private sector R&D cooperation,
- to create competitive conditions for innovative research work in public companies.

7.1.2 Nationally Determined Contributions (NDCs) under the Paris Agreement

7.1.2.1 Albania

Albania has submitted its First NDC (2nd version) in October 2021.

Considering all sectors (including FOLU), emissions for the NDC scenario (with mitigation measures) increase from 10.139 kt CO2e in 2016 to 11.978 kt CO2e in 2030, which represents an increase of +18.1%. The difference, in 2030, with the BAU scenario, is -3.170 kt CO2e, which represents a mitigation impact of -20.9%.

Overall, the mitigation actions accounted in the NDC scenario could help avoid, in total during the period 2021-2030, 16.828 kt CO2e compared to the BAU scenario. This is the cumulative effect of the emissions reduction between NDC scenario and BAU scenario.

Regarding the energy sector, the NDC scenario takes into account the introduction of natural gas in almost all sectors (including energy industry, manufacturing industry, transport, commercial, residential and agriculture). It also considers the implementation of the different National Energy Efficiencies Actions Plans (NEEAP) to increase energy efficiencies in both supply and demand reaching a 15% gain in 2030. It also takes into account the National Renewable Energy Action Plan (NREAP) with objectives of a share of 38% of renewables in the final energy consumption in 2020 (already almost reached in 2019) and 42% in 2030.

7.1.2.2 Bosnia and Herzegovina

Bosnia and Herzegovina has submitted its First NDC (2nd version) in April 2021.

According to this version of NDC, the unconditional GHG emissions reduction target for 2030 is 12,8% compared to 2014 or 33,2% compared to 1990. The conditional target (with more intensive international assistance for the decarbonisation of mining areas) for 2030 is 17,5% compared to 2014 or 36,8% compared to 1990. GHG emissions reduction target for 2050 is 50,0% (unconditional) and 55,0% (conditional) compared to 2014, that is, 61,7% (unconditional) and 65,6% (conditional) compared to modelling 1990.

In the case of conditional target, more intensive international assistance is expected for faster decarbonisation of the power sector with an emphasis on fair transition of mining areas. Not all of these targets include GHG sinks. In the forestry sector, measures are planned to increase the sinks by 93 GgCO2eq until 2030.

Meeting the defined targets includes the following:

- Significant decarbonisation of the economy, especially power sector, with investments of approx. BAM 17 billion in the period until 2030, which is over 5% of GDP;
- Cessation of the long-standing emission growth trend in the short term;
- Ambitious reduction of GHG emissions in a relatively short period (2014 – 2030);
- Halving of emissions by 2050 compared to 2014;
- The targets imply reduction in GHG emissions by just over a third by 2030, and almost two-thirds by 2050 compared to 1990.

7.1.2.3 European Union

The European Union and its Member States submitted their intended nationally determined contribution (INDC) in March 2015 and it has been updated in December 2020.

The EU's INDC became its NDC when the EU ratified the Paris Agreement in October 2016.

The EU and its Member States, acting jointly, are committed to a binding target of a net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990.

The respective emissions reductions in force at time of this submission are as follows.

- Under Directive (EU) 2018/410 the EU Emissions Trading System: EU will reduce its emissions from the sectors covered by this legislation by 43% from 2005 levels by 2030;
- Under Regulation (EU) 2018/842, each EU Member State will reduce its emissions from sectors outside the EU ETS from 2005 levels by 2030 in accordance with the following percentage: Belgium 35%, Bulgaria 0%, Czech Republic 14%, Denmark 39%, Germany 38%, Estonia 13%, Ireland 30%, Greece 16%, Spain 26%, France 37%, Croatia 7%, Italy 33%, Cyprus 24%, Latvia 6%, Lithuania 9%, Luxembourg 40%, Hungary 7%, Malta 19%, Netherlands 36%, Austria 36%, Poland 7%, Portugal 17%, Romania 2%, Slovenia 15%, Slovakia 12%, Finland 39%, Sweden 40%.
- Under Regulation (EU) 2018/841 on the inclusion and accounting of greenhouse gas emissions and removals from land use, land use change and forestry in the EU framework, for the periods from 2021 to 2025 and from 2026 to 2030, each Member State shall ensure that emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all of the land accounting categories combined, as accounted in accordance with this Regulation.

7.1.2.4 Montenegro

Montenegro has submitted its First NDC (2nd version) in June 2021.

The updated NDC for Montenegro has set a target of at least a 35% reduction in total national GHG emissions (excl. LULUCF) by 2030 compared to 1990 (base year).

The mitigation benefits in the energy sector are related to renewable energies, and accordingly to a decrease in fossil fuel consumption. Also improvements to insulation will reduce the consumption of electricity and wood for heating and decrease cooling needs.

7.1.2.5 North Macedonia

The Republic of North Macedonia has submitted its First NDC (2nd version) in April 2021.

The enhanced nationally determined contribution to the global efforts for GHG emissions reduction by 2030 are following:

- 51% reduction in greenhouse gas emissions compared to 1990 levels.

  Disaggregated by sector (2030 vs.1990):
  - Energy: 66% reduction (mainly through decommissioning of coal-fired power plants Oslomej in 2021 and Bitola up to 2027);

- IPPU: 45% increase;
    - Agriculture: 29% reduction;
    - LULUCF: 95% removals increase;
    - Waste: 21% reduction.
- expressed in net emissions, 82% reduction compared to 1990 levels.

The enhanced NDC is focused on mitigation area, with a vision to include adaptation component in the subsequent submissions, once the relevant national strategic and planning documents are prepared and adopted.

The enhanced NDC is coherent with the following sectoral non-GHG targets in 2030 stipulated in the draft National Energy and Climate Plan (NECP):

- Renewable Energy Sources (**RES**)
    - 38% share in gross final energy consumption
    - 66% share in gross electricity production
    - 45% share in gross final energy consumption for heating and cooling
    - 10% in final energy consumption in transport
- Energy Efficiency (**EE**)
    - 20.8% savings of final energy consumption relative to BAU scenario
    - 34.5% savings of primary energy consumption relative to BAU scenario

The enhanced NDC echoes the Green scenario from the National Strategy for Energy Development up to 2040 and is fully aligned with the draft National Energy and Climate Plan (NECP). It is consistent with the following long term (2040) goals:

- % reduction of GHG emissions vs. 2005: 61.5
- % of RES in gross final energy consumption: 45
- % reduction of primary and final energy consumption vs. BAU: 51.8 primary, 27.5 final

7.1.2.6 Serbia

The Republic of Serbia has been Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 2001 and to the Paris Agreement since 2017. In 2015, the Government of the Republic of Serbia submitted its Intended National Determined Contributions (INDCs), defining a 9,8% greenhouse gas emissions reduction by 2030 compared to base year emissions (1990). The first NDC also refers to losses and damages associated with extreme weather events and indicates the need to adapt to climate change.

The Republic of Serbia communicated its updated Nationally Determined Contribution (NDC) in August 2022, increasing its ambition to the GHG emission reduction by 13,2% compared to 2010 level (i.e. 33,3% compared to 1990) by 2030.

7.1.3 Projects of Energy Community Interest (PECI), Central and South-Eastern Europe Gas Connectivity initiative (CESEC), EUSAIR-labelled projects for natural gas networks

Most of the planned projects compete with each other. Some are designated as Projects of Common EU Interest (PCI) by the EC that can benefit from accelerated permitting procedures and funding, some are designated as Projects of Energy Community Interest (PECI), Projects of Mutual Interest (PMI) by the Energy Community, some by the Central and South Eastern European Gas Connectivity – CESEC and some are included in the Ten-Year Network Development Plan (TYNDP) by ENTSO-G.

Following are the infrastructure gas projects listed by promoting country.

Croatia, Albania and Montenegro

1. **Ionian-Adriatic Pipeline (IAP)**

The IAP project has been based on the idea of connecting the existing gas transmission system of Croatia via Montenegro and Albania with the TAP gas transmission system (Trans Adriatic Pipeline). The total length of the gas pipeline from Split to Albanian Fieri is 511 km.

Its 5 bcm/y capacity provides the natural gas supply of Albania (1 bcm/y), Montenegro (0.5 bcm/y), the south BA (1 bcm/y) and Croatia (2.5 bcm/y). The implementation of the entire IAP project enables opening of the new energy corridor for the SEE region within the fourth EU transmission corridor, with the aim to establish a new natural gas supply direction from the Middle East and Caspian region. The IAP will have a bidirectional gas flow possibility, i.e. it will be able to provide natural gas supply of SEE from other sources, one of them the LNG solution on the island of KRK.

The comprehensive feasibility study financed by the WBIF has been completed in April 2014. The main benefits of IAP:

- gasification of Albania, Montenegro, southern part of Croatia and BA;
- SoS and Diversification of supply;
- Market integration, competition

The branch for BA will go through interconnection Imotski-Zagvozd-Posusje-Travnik. The project will be hydrogen ready.

Promoting countries: Croatia, Montenegro, Albania

Commissioning: 2025

Croatia and Slovenia

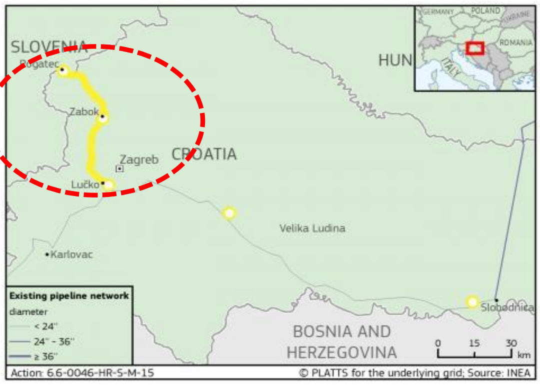
2. **Upgrade of Rogatec Interconnection between Slovenian and Croatian Gas Systems (M1A/1 Interconnection Rogatec)**

The upgrade of interconnection point between Slovenian and Croatian gas systems at Rogatec (Slovenia) is a part of the PCI:

6.26.1 Cluster Croatia-Slovenia-Austria at Rogatec, including:

- interconnection Croatia-Slovenia (Lucko-Zabok-Rogatec)
- compressor station Kidricevo, 2nd phase of upgrade (SI)
- compressor stations 2 and 3 at the Croatian gas transmission system - GCA 2015/08 Entry/Exit Murfeld (AT)

- upgrade of Murfeld/Cersak interconnection (AT-SI)
- upgrade of Rogatec interconnection.



Purpose:
Development of transmission system of Slovenian and Croatian TSO, increasing the transmission capacity and enabling bidrectional operation.
General criteria:

- removing bottlenecks
- improving N-1 for the Slovenian TSO
- improving SoS for AT, SI, CRO
- base for future LNG evacuation

Promoting countries: Slovenia, Croatia
Commissioning: December 2025

Croatia and Bosnia and Herzegovina

3. Southern Gas Interconnection Pipeline BA - HR (Split-Zagvozd-Posusje-Novi Travnik with a Main Branch to Mostar)

PECI: Gas_03 PMI Status
Project interconnects natural gas systems of Bosnia and Herzegovina and Croatia. Main goal is to establish new supply route for Bosnia and Herzegovina providing reliable and diversified natural gas supply increasing security of supply (BA current N-1 = 0). Having in mind limited capacity and age of the existing supply route, soon this pipeline could become the only gas supply route for Federation of BA. Project is included in Strategic Plan and Program of Development of Energy Sector of FBA. Also, it is included in Comprehensive Energy Strategy of BA until 2035 which is in adoption process.
Project is on the PECIPMI 2016 List and is included in ENTSOG TYNDP. Government of FBA in June 2017 has issued the Conclusion on Strategic Importance for FBA of South Interconnection project and on continuing and intensifying activities on its realisation.

The Project will enable diversification of the routes as well as sources of supply (access to LNG terminal Krk, natural gas storages in the neighbouring countries, gas sources in the Caspian region, EU Gas Hubs, etc.). Southern Gas Interconnection Pipeline of Bosnia and Herzegovina and Croatia together with the planned Northern Gas Interconnection Pipeline (Slobodnica (CRO) Brod (BA) – Zenica) forms a part of Energy Community Gas Ring. Project is also of great regional significance due to market integration by connecting the natural gas transmission system of Bosnia and Herzegovina with the neighbouring Croatian system as well as with European natural gas transmission systems. Project will significantly contribute to diversification of entry/exit points of the Croatian gas transmission system with the neighbouring countries. The Project also increases the utilization of the Croatian existing transmission system including LNG, and it increases the market for planned pipelines such as IAP and others.
Promoting countries: BA, HR

Commissioning year 2024

4. North Interconnection BA-HR Gas Pipeline Project Slobodnica (HR) - Brod (BA) - Zenica

North Interconnection BA-HR Gas Pipeline Project Slobodnica (HR) - Brod (BA) - Zenica

PECI: Gas_01 PMI Status

Project will integrate BA with Croatian and other neighbouring gas markets. Pipeline will be bidirectional and together with "South Interconnection BA-HR" creates a part of EnC gas ring. Main goal is to diversify gas rout and supply sources for BA. Expected benefits are to directly increase (N-1) for BA. Project is included in Strategic Plan and Program of Development of Energy Sector of FBA and in the Comprehensive Energy Strategy of BA until 2035 as well as Energy Strategies of both Republika Srpska and BA entities, which are all in adoption process. Project is included in ENTSOG TYNDP. This project is in preparation from the year 1988, and Project Documentation from this period exists.

Gas pipeline Brod-Zenica is the project that will enable new supply route for BA providing diversified and reliable natural gas supply. Except for the above, the realization of the project will contribute to the development of the gas market in the northern part of Bosnia and Herzegovina.

Gas pipeline route

Brod Gas pipeline will be be-directional and together with the Project Southern Interconnection (TRA-N-851) will create a part of EC Gas Ring. Project is in connection with Project Slobodnica-Bosanski Brod (TRA-N-66) located in Croatia

Promoting countries: Bosnia and Herzegovina, Croatia

5. Western Interconnection Gas Pipeline BA-HR (Licka Jesenica-Trzac-Bosanska Krupa with branches to Bihac and Velika Kladusa)

PECI: Gas_02 PMI status

Project will connect BA with Croatian gas transmission system and will enable gasification of part of Una-Sana Canton on the west side of BA. In the future there is possibility that the pipeline (via Jajce) will be connected to the existing gas transmission pipeline. Main goal is to enable development of natural gas market in the west part of BA and to introduce gas as environmental favourable fuel in residential, industrial and power generation sector.

Project is included in Strategic Plan and Program of Development of Energy Sector of FBA. Also, it is included in Comprehensive Energy Strategy of BA until 2035 which is in adoption process.

Project is on the PECIPMI 2016 List and is included in ENTSOG TYNDP.

Promoting countries: Bosnia and Herzegovina and Croatia

Commissioning year 2026

Croatia and Serbia

6. Gas Interconnector Serbia-Croatia (Phase I)

PECI: Gas_10 PMI status

The interconnection of Croatia and Serbia is planned on the route Slobodnica - Sotin - Bačko Novo Selo. The main goal of the project is to connect the Serbian and Croatian transmission systems in order to ensure market integration, diversification of gas supply sources and increase security of supply in both countries. It will also provide Serbia with the access to the Croatian LNG terminal.

The first phase of the project would be the construction of the Negoslavci - Sotin - Bačko Novo Selo gas pipeline (15 km) and Osijek - Vukovar (30 km) gas pipeline.

The completion of their construction is planned in 2025.

Project is on the PECI PMI 2020 List and is included in ENTSOG TYNDP.

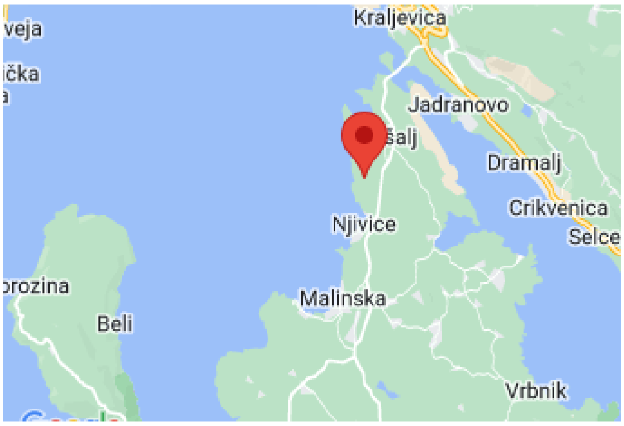
Promoting countries: Croatia, Serbia

Commissioning: Serbia (2028), Croatia (2024)

Croatia

7. Development of a LNG terminal in Krk (HR) up to 2.6 bcm/a– Phase I and II

Krk FSRU is a floating liquefied natural gas (FLNG) regasification terminal in Croatia. The project was originally planned to be an onshore regasification facility, but was switched to a FLNG proposal in 2015, being declared by the Croatian government as a Strategic Investment Project. The project is a part of the European Union's Projects of Common Interest (PCI), making it eligible for public funding. The project includes construction of an 18 km pipeline, part of the Omišalj-Zlobin-Bosiljevo-Sisak-Kozarac-Slobodnica LNG main evacuation pipeline, which will act as an extension of the existing Hungary-Croatia interconnection (Városföld – Slobodnica), providing 2.6 bcm/y from the LNG terminal to the Croatian gas transmission system. The maximum capacity will eventually be 7 billion cubic meters (bcm)/year. Commercial operations began on January 1, 2021



A Phase 2 expansion of the existing floating LNG terminal on Krk Island from 2.9 to 6.1 billion cubic metres (bcm) of gas per year, project is proposed. The focus should be on two aspects at the same time: the construction of additional pipelines and the installation of a new regasification module on board of the vessel.
Currently, there are three regasification modules on board of the vessel, so the plan is to build just an additional one. The terminal could already function up to 3.5 bcm so the increase is not from 2.9 to 6 bcm, but from 3.5.
There is no plan on receiving bigger vessels, the volume's increase is only in the regasification capacity. The plan is for the works to be completed in the next 2 years so to be ready for the gas season 2024-2025.

8. Omišalj-Zlobin-Bosiljevo-Sisak-Kozarac-Slobodnica LNG main evacuation pipeline

Omišalj-Zlobin-Bosiljevo-Sisak-Kozarac-Slobodnica LNG main evacuation pipeline is a proposed natural gas pipeline system in Croatia which will be built in 3 phases. The pipeline runs from Omišalj to Slobodnica, Croatia. The pipeline is also called "LNG evacuation pipeline Omišalj - Zlobin (Croatia)
Phase one of the project is known as the Omišalj-Zlobin Gas Pipeline.The pipeline will connect the Krk LNG Terminal to Phase 2. Phase 1 started in 2021.

Phase Two (A) of the project is known as the Bosiljevo-Sisak Pipeline. The pipeline route connects to Phase one at Bosiljevo, Croatia then runs to Sisak, Croatia. Its ENTSOG TYNDP code is "TRA-N-75". The Nov 5, 2019 TYNDP named TRA-N-75 as Zlobin-Bosiljevo-Sisak-Kozarac Pipeline.
Phase Two (B) of the project is known as the Kozarac-Slobodnica Pipeline. The pipeline route connects Phase Two(A) with Városföld–Slobodnica pipeline. Both sections of Phase Two have received a Connecting Europe Facility grant of EUR 2.25 million for pre-investment phase studies. Start year: 2027

Serbia

9. Gas Interconnector Serbia - Bulgaria

PECI: Gas_09
The realisation of this project ensures diversification of directions and sources of supply, while improving the security of supply of both the Republic of Serbia and Bulgaria and the entire region. The northern part of the gas pipeline system is significantly relieved, which increases the security of supply of transit routes for BA, as well as the future supply of Kosovo*, North Macedonia and Montenegro. In addition to improving the security of supply of the Serbian natural gas market and facilitating the further development of the distribution network of central, eastern and southern Serbia, the project

enables the integration of existing and future storage capacities of natural gas into a unified energy system.

The Gas Interconnection Bulgaria – Serbia is envisaged as a reverse connection which will connect the national gas transmission networks of the Republic of Bulgaria and the Republic of Serbia. The gas pipeline's total length is approximately 170 km from the town of Novi Iskar, Republic of Bulgaria, to the city of Niš, Republic of Serbia.

Promoting countries: Serbia and Bulgaria

Commissioning: 2023

Italy

10. TAP and TAP2 - Doubling of Trans-Adriatic Gas Pipeline Capacity

The Incremental Capacity Project concerns 5 (five) Interconnection Points (IPs) along the route of the Trans Adriatic Pipeline (TAP), being: Kipoi (TR-GR), Nea Mesimvria (GR), Korca (AL), Fier (AL), and Melendugno (IT).

In particular, the Incremental Capacity Project comprises the following:

- Incremental capacity offered jointly by TAP and SRG at the IP of Melendugno as a bundled capacity product.
- Incremental capacity offered jointly by TAP and DESFA at the IP of Nea Mesimvria as a bundled capacity product.
- Incremental capacity offered by TAP at the IPs of Kipoi, Korca, Fier as unbundled capacity products on the TAP side of the IP.

This Incremental Capacity Project is primarily driven by potential increases of the technical capacity at IPs along the TAP pipeline route. If infrastructure upgrades necessary for the Incremental Capacity Project are realised by the interconnected TSOs, then additional natural gas flows from the Greek-Turkish border will potentially reach the markets of Greece, Albania and Italy. Hence, this Incremental Capacity Project is conducted in close coordination by TAP, SRG and DESFA, to enable the offering of capacities at the IPs shared by the TSOs Concerned.

Promoting countries: Italy, Greece and Albania

Market tests are held at least every two years following the operation of TAP. The market tests are structured in two phases:

- non-binding phase
- binding phase.

On 12 July 2021, TAP invited stakeholders and interested parties to participate in the non-binding phase of the 2021 market test, by requesting specific documentation in a structured timeframe.

TAP accepted non-binding demand indications until 6 September 2021.
In January 2020, SRG, DESFA and TAP in accordance with the provisions set out in article 27 (3) of CAM NC, jointly launched a public consultation on the draft Project Proposal written with the purpose to meet the received indicative non-binding demand requests. The TSOs have received comments during the public consultation from 3 (three) respondents. These comments have been considered to the extent possible in the subsequent design phase of the Incremental Capacity Project. In line with the provisions of Article 28 CAM NC Project Proposal is submitted to the Italian, Greek and Albanian NRAs for their evaluations.

11. Floating Storage and Regasification Unit (FSRU) off the Port of Ravenna with Connection to the National Gas Network

The project involves the mooring of a floating storage and regasification vessel offshore (8.5 km) Ravenna: the BW Singapore, purchased by Snam at the beginning of July. It has a regasification capacity of about 5 billion cubic metres, equivalent to about one-sixth of the amount of natural gas currently imported from Russia, and a storage capacity of 170,000 cubic metres of liquefied natural gas. It will be supplied by other ships at regular intervals, once a week at the most. In order to convey the gas to the point of interconnection with the national gas pipeline network, located approximately 42 km from the mooring point, a connection will be built consisting of an approximately 8.5 km section of pipeline at sea and a completely buried section of approximately 34 km, minimising the use of land. The plant and operations on board the ship will have minimal impacts, which Snam has committed to containing within limits significantly lower than those required by law. The FSRU will be made available to Snam at the closing date of the deal, which is expected by the end of 2023.
Promoting country: Italy
Commissioning: 2023-2024

North Macedonia and neighboring countries

12. Interconnection between Gas Transmission Systems of Serbia and North Macedonia (PECI)

The project consists of an interconnection between the Serbian gas transmission system and Macedonian gas transmission system as a part of the Trans Balkan corridor.
The project would allow:

- Competitiveness of natural gas market
- Connecting of gas transmission of both countries with the region (market integration) which would lead to economic, financial and social benefit.
- Development of the region in terms of using the natural gas as energy source as well as security of energy supply in the economic development of the region- Introducing a higher level for achieving economic and social benefits
- Advancement and protection of the environment with higher utilization of natural gas as ecologically clean fuel, coal transition etc.
- Would ensure security of suppy
- The project can allow to JSC NOMAGAS to increase the utilisation of its infrastructure for transit, enabling, in this way, the reduction of the transportation tariff
- The project can allow to Transportgas Srbija faster development of gasification in South Serbia.

The TYNDP code of the Project is TRA-N-965.The project is on the proposed PECI list for 2020 by the ECS

A Technical grant has been secured within IPA Instrument Investment framework of the Western Balkans (Flagship 5 - Transition from coal) for the project Gas interconnection with Serbia in 2021. The project is currently in the phase of preparation of ToR for feasibility study and ESIA.

The two parts of the mentioned interconnector are going to be built and operated by the respective TSOs in the countries Transportgas Srbija and JSC.

The two parts of the mentioned interconnector are going to be built and operated by the respective TSOs in the countries Transportgas Srbija and NER JSC.

Promoting countries: North Macedonia and Serbia

Commissioning: 2026

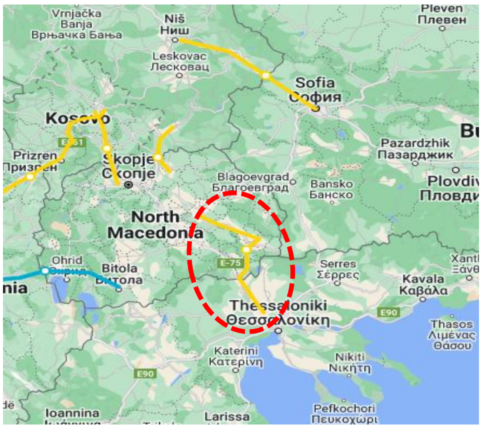
13. **Interconnection between the Natural Gas Transmission Systems of Greece and North Macedonia (PMI)**

This project aims at Diversification of natural gas supply in the gas market of North Macedonia, given that the only source of natural gas in the country comes from Gazprom, Russian Federation. The project will allow:

- Competitiveness of natural gas market – the construction of the gas interconnector allows access to various sources of natural gas which will increase the competitiveness of the natural gas market.
- Ensure market integration aiming at allowing the consumers to have gas prices like those of the neighbouring countries.
- Connecting the gas transmission system of North Macedonia with the region (market integration) would lead to economic, financial and social benefits.
- The implementation of the project for construction of gas interconnection between the two countries will bring economic and financial benefits to and the region as well.
- Development of the regional Gas Hub in terms of using the natural gas as energy source as well as security of energy supply in the economic development of the region.
- Support the gasification of the country, by providing an Interconnection Point that can supply large amount of gas to meet the expected growth in demand

Regional context

- The Project will contribute to the economic development of the region and energy regional cooperation. This project will boost cooperation with Greece in the field of energy, and will improve the diplomatic and economic relationships between the two countries, offering a concrete example of mutual trust in a strategic sector



- Contribution to the security of supply (reducing the risk of continuous supply of the country with natural gas, whereas the investment risk decreases also)

The environmental impact assessment study has been prepared and all related procedures have been completed. Also, a decision from the Ministry of environment and physical planning has been received. The basic design has been completed and revised. A financing loan agreement for construction has been signed with the European Investment Bank (50%). A part (20%) of the construction of the project will be financed with funds for co-financing infrastructure projects approved through IPA Instrument Investment framework of the Western Balkans and the other part of the loan will be secured from the EBRD. During 2023, tender documentation will be prepared for construction, construction supervision, inspection body and management in accordance with EIB rules. By the end of 2023, the contractors for construction are planned to be selected.

Most of the objectives of the Project are in line with the EU Regulation No. 347/2013 and the project code in the TYNDP is TRA-N-967 and TRA-N-980.

The Project is part of the Action Plan of the signed Memorandum of understanding on a Joint approach to address the natural gas diversification and security of supply challenges as part of the Central and South-Eastern European Gas Connectivity (CESEC) initiative.

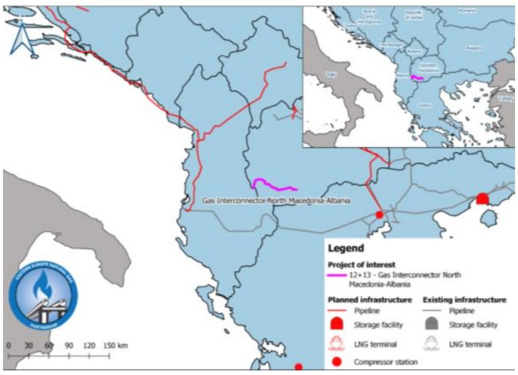
The project is also part of PMI list for 2020 by the ECS under the PMI code GAS-04B.

Promoting countries: North Macedonia and Greece

Construction phase & start of commercial operation: Q4 2023 – Q4 2025

14. Interconnection between the Albanian and Macedonian Natural Gas Transmission Systems

The main purpose of the construction of this main gas pipeline section arises from the strategic commitment of the Government in order to achieve higher level of overall functionality of the energy system in the country and to provide conditions for significantly greater infrastructural and economic integration with the neighbouring and the remaining European countries.



This project will ensure the diversification of natural gas sources and supply routes and the liberalization of South-eastern Europe's energy market.

Allowing access to energy fuel on the territory around City of Ohrid and possibility for interconnection with IAP on Albanian territory. This interconnection is also included in Albanian gas Master Plan and the project code in the TYNDP is TRA-N-998.

The two parts of the mentioned interconnector are going to be built and operated by the respective TSOs in the countries ALBGAZ and NOMAGAS.

Promoting countries: North Macedonia and Albania

Commissioning: 2026

15. Interconnection between the Kosovo* and Macedonian Natural Gas Transmission Systems (PECI)

This project will ensure the diversification of natural gas sources and supply routes and the liberalization of South-eastern Europe's energy market.

The main purpose of the construction of this main gas pipeline section arises from the strategic commitment of the Government of the Republic of N.Macedonia in order to achieve higher level of overall functionality of the energy system in the country and to provide conditions for significantly greater infrastructural and economic integration with the neighbouring and the remaining European countries. Also, there is option North Macedonia to become transit country.

The TYNDP code of the Project is TRA-N-966.The project is included in the PECI list for 2020 by the ECS, under the code GAS – 26.

For the realization of the project, a Technical assistance for infrastructure projects within IPA Instrument Investment framework of the Western Balkans, with its update was secured in 2019 for preparation of Feasibility Study with Basic Design and Environmental Impact Assessment Scope Study. The documents were finished in December 2022.

Greece

16. Eastern Mediterranean Pipeline (EastMed)

The EastMed Pipeline Project interconnects the available and already in production gas fields in the Levantine basin to the European markets via Cyprus and Greece. This project is currently assigned to transport up to 20 bcm/y up to the inlet point with Poseidon Pipeline Project, plus 1 bcm/y that will be delivered to Cyprus to satisfy its internal consumption.

In order to sustain the energy transition in the area, the Project Promoter is designing the Project as "hydrogen ready" and is considering a design that could allow the opportunity to interconnect the future hydrogen renewable production sites located along the route.

The Project Promoter completed the feasibility studies of the Project in 2019, expects to conclude the FEED phase in the first half of 2023 and complete the construction phase in in 4 years in order to have the commercial operating date in 2027.

Promoting countries: Greece, Italy and Cyprus
Commissioning: 1Q 2024 – 1H 2027/2H 2027

17. Poseidon Pipeline (Greece, GR – Italy, IT)

The Poseidon Pipeline Project consists of a multisource offshore pipeline that will connect the Greek and Italian natural gas systems and transport natural gas available by East Mediterranean and the Middle East sources and the low carbon gases imported by the Levantin area or produced in Greece by the future renewable installed sources. It will be connected with the EastMed pipeline in Florovouni.

The Project Promoter completed the FEED phase in 2019, performed the construction tenders and is planning to complete the hydrogen ready interconnector within the 2025.
Promoting country: Greece and Italy
Commissioning: 2H 2023 – 2H 2025/ 2H 2025

18. Marine LNG Refueling Points in the Adriatic and Ionian Sea

Construction of ssLNG infrastructure for bunkering in the Adriatic-Ionian Region ports. Refueling points would contribute to: sustainable shipping decarbonisation for tackling climate change, security of marine fuel supply (one of the main concerns of the shipping industry), air quality in urban areas and ports, and regional ports' competitiveness.
The project could build upon experience of a wide range of stakeholders from the Adriatic-Ionian Region, representing national, regional and local authorities, private sector, academia and deliverables of current EU co- financed projects such as Poseidon Med II (CEF, TEN-T) or Super LNG (Interreg-Adrion). A number of ssLNG infrastructure for bunkering through the European Union could be leading examples.
The project is proposed for the EUSAIR label and has been endorsed as a priority action by the TSG2 Sub-Group on Energy Networks.
The project responds to the Directive 2014/94 / EU "A central network of LNG refueling points in seaports and Inland ports should be available at least until the end of 2025 and 2030 respectively". It is in line with the transport, energy and climate policy of the European Commission.
The project may include survey of existing and planned infrastructure, estimated CAPEX and opportunities for EU funding. It can also include proposal for an ECA zone.
Promoting country: Greece
Commissioning: 2021-2025

19. Interconnection Greece – Bulgaria

Interconnection Greece – Bulgaria [currently known as "IGB"] between Komotini (EL) and Stara Zagora (BG) and compressor station at Kipi (EL)
The pipeline will begin in Stara Zagora, Bulgaria and will run to Komotini, Greece. The proposal includes approximately 31 km of pipeline in Greece and 151 km through Bulgaria.
The 182-kilometer pipeline will deliver gas from Azerbaijan via the Trans-Adriatic Gas Pipeline through Greece to Bulgaria and will maintain an initial capacity of 3 bcm per year, with potential to expand its capacity to 5 bcm per year. IGB pipeline will cost an estimated EUR 160 million ($170m), of which up to EUR 45 million ($48m) will be provided by the European Commission (EC) under the European Energy Program for Recovery. IGB will also be able to supply Bulgaria with gas sourced from Greek ports which are importing liquefied natural gas (LNG).

In April 2022, a senior AVAX official said that construction of the pipeline had been completed in early April, work and testing at two metering stations and software installation were in the final stages. Against a backdrop of the Russian invasion of Ukraine, final permits were fast-tracked and approved, with construction completed on the 1st of July, 2022. The pipeline officially began operations in October, 2022.

Promoting countries: Greece and Bulgaria

7.1.4 Other projects, relevant initiatives and measures either in the national programmes or supported by international and European financing institutions

Relevant initiatives and measures from National Energy and Climate Plans (NECPs) and Energy Development Plans here follows, listed by country.

Albania

The Master Plan of Natural Gas for Albania was approved by DCM No. 87 of 14.02.2018. This plan aims to develop a sustainable natural gas system that enables a balanced contribution to the energy system, ensuring gas supply through competition and environmental protection. A completely new gas transmission and distribution system is needed.

The Gas Master Plan defines the main lines for the development of the gas market and services in Albania based on natural gas:

- through the Trans Adriatic Pipeline (TAP Project), as well as potential gas sources discovered and concretized in the country;
- through natural gas pipelines such as the Ionian Adriatic Pipeline (IAP Project);
- the Albania – Kosovo* Pipeline (ALKOGAP Project);
- to develop an underground natural gas storage site in Dumre, near Elbasan (UGS Dumrea Project);
- the construction of the pipeline that will link the TAP project near the Fier Compressor Station area to the Vlora TPP and the entire Vlora region, will make it possible to restore the Vlora TPP by using natural gas as fuel.

Croatia

It is planned to integrate the Croatian gas transmission system with the gas transmission systems of all neighbouring countries.

Strategic projects to increase supply diversification and efficiency of the transmission system are:

- The Omišalj-Zlobin gas pipeline, which will connect the LNG terminal on the island of Krk to the existing transmission system, will enable the first gas volumes to be transported from the LNG terminal on the island of Krk to the market in Hungary and further in the east of Europe.
- Further development of the gas pipeline system from Zlobin to Slobodnica near Slavonski Brod (the Zlobin-Bosiljevo-Kozarac-Slobodnica gas pipeline) will increase the shipping capacity towards southeast Europe up to 7 billion cubic meters of gas annually.
- The development of the Lučko-Zabok-Sutla gas pipeline system will allow gas to be transported from the LNG terminal to Slovenia and further to Central and Western Europe, as well as the access of the terminal users and gas users in the Republic of Croatia to the liquid gas exchange in this part of Europe in Baumgarten, Austria.
- The Ionian Adriatic Pipeline (IAP) would allow the supply of gas from the Trans-Adriatic Pipeline to Croatia and countries in the region and possible transport to Hungary, Slovenia and Austria.

Greece

It is expected that new interconnections be developed and the existing interconnections with neighbouring systems be reinforced, and that new natural gas pipelines be developed, which will have regional interest and strong transmission capacity towards third countries.

According to the Natural Gas Market Roadmap, the most important projects of national and international interest concerning pipelines and gas storage units are:

- operation of the TAP pipeline;
- operation of Revithoussa after the construction of the 3rd tank (increase of LNG storage), and the completion of works to further increase the rate of gasification of the Terminal's drainage capacity;
- implementation of the gas interconnector Greece-Bulgaria (IGB);
- implementation of the Alexandroupolis Independent Natural Gas System Project (ASFA);
- design of the interconnector Turkey-Greece-Italy (ITGI);
- preparation works for the design and implementation of the East Med pipeline;
- implementation of the underground gas storage facility project in South Kavala;
- implementation of the Greece - Republic of North Macedonia interconnection;
- The East Med pipeline.

Italy

With regard to the objective of diversifying import capacity, work is in progress on the following aspects:

- optimising the use of LNG import capacity in existing terminals, maintaining the capacity of which will continue to play a strategic role, to promote Italy's participation in the Mediterranean and global LNG market, in competition with terminals in northern Europe;
- use of a number of small-scale liquefied natural gas (SSLNG) coastal storage facilities.

- operation of the southern corridor by way of the TAP (Trans Adriatic Pipeline), and dopubling of its capacity to 10 billion cubic meters/year (phase 2)
- EastMed project: although the project will allow further diversification of the current routes from 2025 onwards (throughout the EU, Italy is the country with the greatest diversification of its sources), it might not be a priority, given that the decarbonisation scenarios may be achieved through pre-existing infrastructure and the aforementioned TAP.

North Macedonia

Regarding the gas transmission infrastructure, Macedonia has only one interconnection gas pipeline, with the Republic of Bulgaria. The entry point is at Deve Bair on the border with Bulgaria and extends through Kriva Palanka, Kratovo and Kumanovo to Skopje. The installed capacity of the gas pipeline is 800 million cubic meters/year. The capacity can be increased to 1,200 million cubic meters/year by building a compressor station on the first section of the main gas pipeline. This pipeline is operated by the newly formed JSCNOMAGAS, which has a license for transmission of natural gas and operation of the natural gas transmission system. In 2021 the consumption of natural gas was at the highest level, since the beginning of natural gas consumption, reaching 426 million cubic meters.

Up to 2019 two additional transmission lines were constructed:

1. Klechovce-Valve station 5(Stip), with length of 61 km and diameter of 500mm, finished in 2016 Valve station 5(Stip)-Negotino, with length of 38 km and diameter of 500mm, finished in 2019 North Macedonia has an ambitious gasification plan and a detailed list of planned infrastructure project of the gas network.

1. Negotino (Kavadarci)-Bitola, with length of 92 km and diameter of 500mm, 99% realized by the end of 2021 (green line in Figure 1)

2. Skopje-Tetovo-Gostivar, with length of 76 km and diameter of 500mm, and additional branch to Tetovo with length of 10 km, 82% realized by the end of 2021 (yellow line in Figure 1).

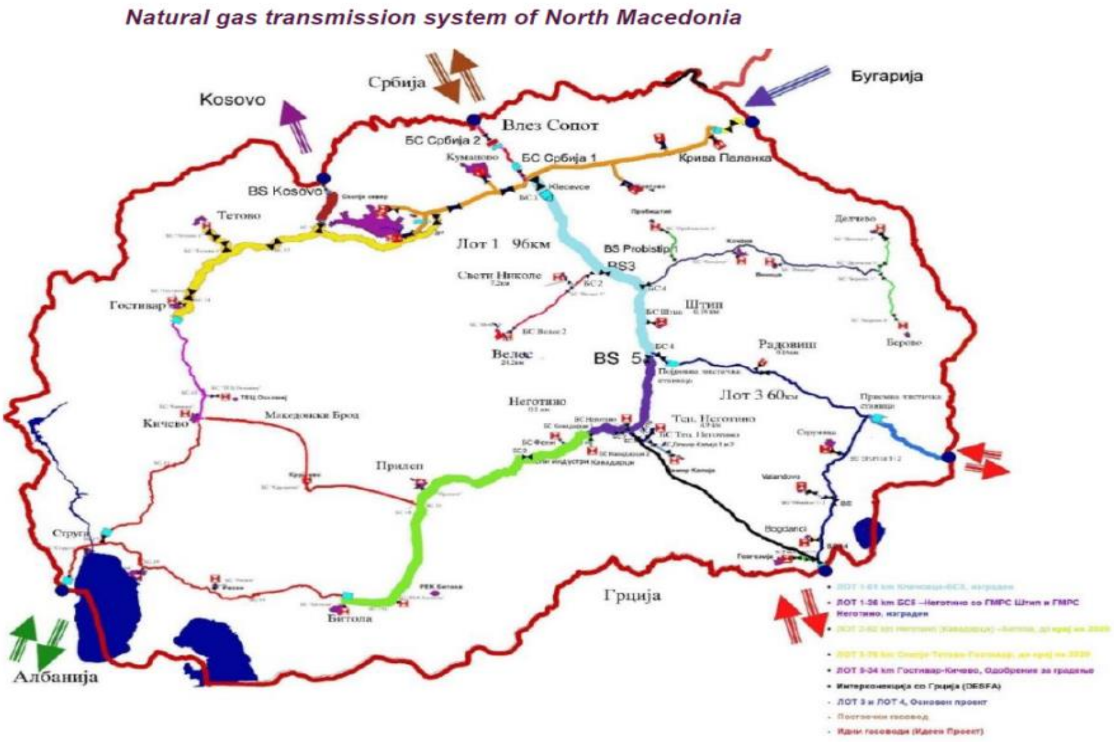


Figure 99 – Natural gas transmission system of North Macedonia

Source: Ministry of Economy North Macedonia

It is expected that in the near future the construction of additional main gas pipelines to be started.

Slovenia

The Slovenian transmission pipeline system is connected through the cross-border interconnection points to the transmission pipelines of neighbouring countries, which are managed by different TSOs. These are as follows:

- with the Austrian TSO, Gas Connect Austria, at the Ceršak interconnection point,
- with the Italian TSO, Snam Rete Gas, at the Šempeter interconnection point and
- with the Croatian TSO, Plinacro, at the Rogatec interconnection point;
- interconnection with the Hungarian TSO is also envisaged.

Slovenia faces the challenges in the area of gasification and production of synthetic gas. As the decarbonisation of the gas sector is expected in future in order to achieve climate targets and the integration of the electricity and gas sectors, and as the demand for storage of excess RES will increase, as well as the volumes of renewable gas in gas networks, further research and integration solutions are needed to incorporate gasification and methanation technologies into energy systems. These include the gas as well as the electricity sector ('power-to-gas' technologies), and, in particular, further research into the effects of the increasing proportion of hydrogen and synthetic natural gas (SNG) on parts of the gas pipeline network and on the related security of supply will be of vital importance.

NECPs of Bosnia and Herzegovina, Montenegro and Serbia are still in different phases of development and approvals, thus not available.

7.2 The natural gas supply and demand forecasts to the year 2030 for each EUSAIR Member State and the Adriatic-Ionian Region

7.2.1 Estimated total gas consumption and by different sectors (power generation, housing, industry, transport, services

7.2.1.1 Albania

The existing gas network in Albania is outdated and mostly non-operational. Its domestic natural gas production is marginal, of which the majority is consumed for own use in oil production and by the refining industry.

The Trans Adriatic Pipeline (TAP), which is entered in operational in late 2020, has opened the route for gas supplies from Azerbaijan and linked the country with the European gas market through connections with Greece and Italy.

The Master Plan of Natural Gas for Albania was approved by DCM No. 87 of 14.02.2018. This plan aims to develop a sustainable natural gas system that enables a balanced contribution to the energy system, ensuring gas supply through competition and environmental protection. A completely new gas transmission and distribution system is needed.

The Gas Master Plan defines the main lines for the development of the gas market and services in Albania based on natural gas supplied through the Trans Adriatic Pipeline (TAP), as well as potential gas sources discovered and concretized in the country, or even through natural gas pipelines such as the Ionian Adriatic Pipeline (IAP) and the Albania – Kosovo* Pipeline (ALKOGAP). Albania intends to develop an underground natural gas storage site in Dumre, near Elbasan (UGS Dumrea Project).

The construction of the pipeline that will link the TAP near the Fier Compressor Station area to the Vlora TPP and the entire Vlora region, will make it possible to restore the Vlora TPP by using natural gas as fuel.

According to this Master Plan, in 2040, the potential consumption of natural gas for electricity generation could be around 770 million cubic meters, while the projected consumption at the country's refineries could be around 89.2 million cubic meters.

In the NECP, however, the natural gas consumption is expected to be lower. Considering the exposure to renewable energy in the power generation sector, in the CPS is expected the refurbishment for natural gas usage of the thermal power plant in Vlora with 97 MW capacity. The consumption of natural gas in other sectors is not expected in CPS, except for energy sector (e.g. refinery own usage).

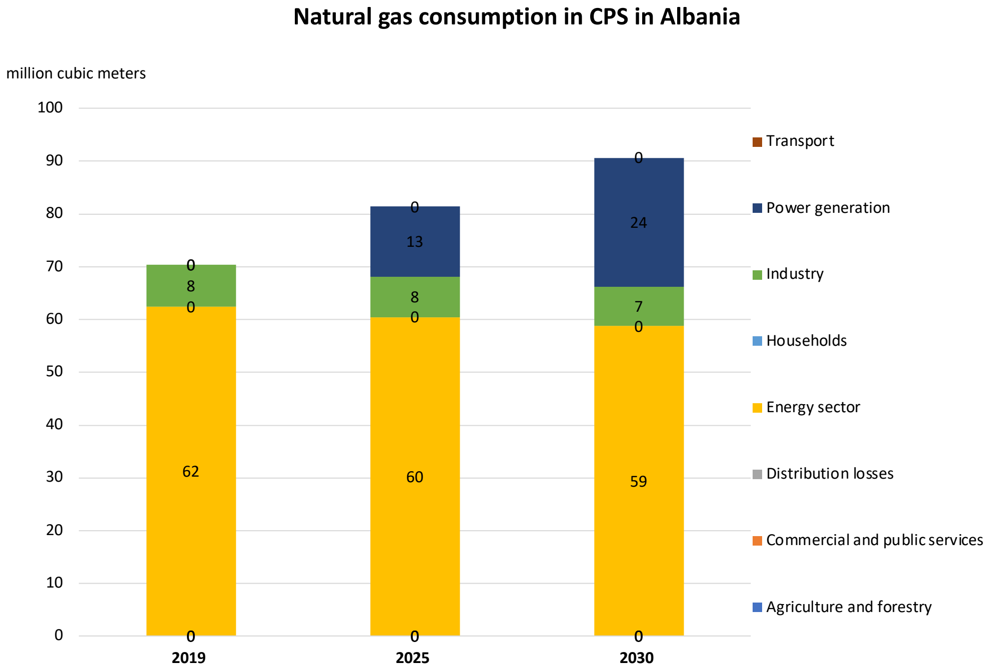


Figure 100 – Natural gas consumption in CPS in Albania

Source: Consultant's elaboration on NECP data

In the NPS is expected an increase in the demand for natural gas, which is imported through the TAP pipeline, and used for power generation, but also in the residential (1.5% of FEC in 2030) and services sector (8.0% of FEC in 2030), where it replaces the use of LPG. There is also a limited and declining use of natural gas in industry, where it is phased out for electricity.

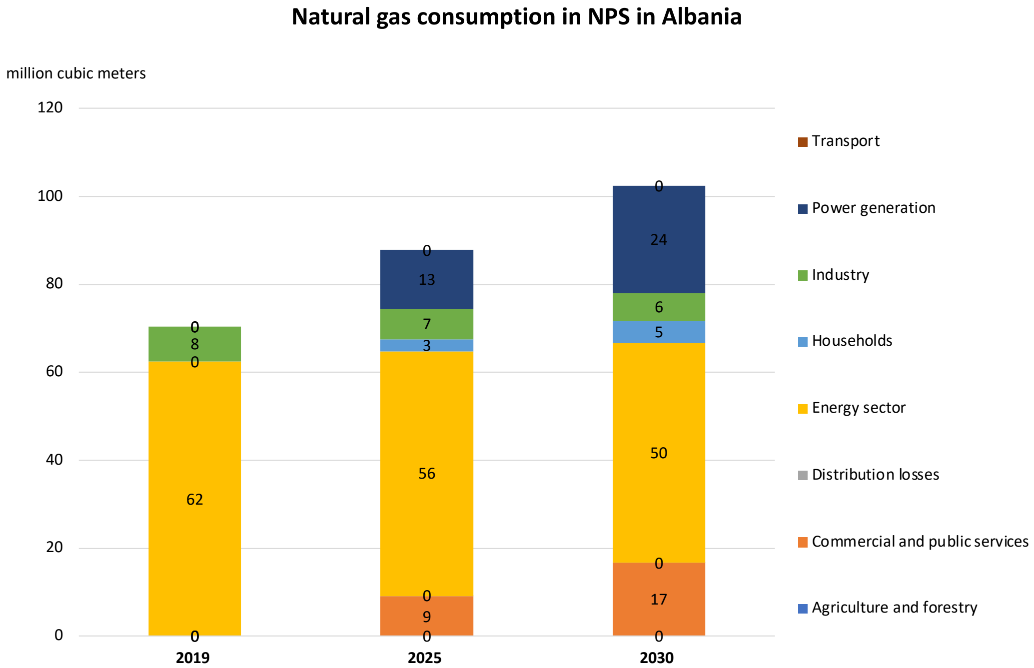


Figure 101 – Natural gas consumption in NPS in Albania

Source: Consultant's elaboration on NECP data

7.2.1.2 Bosnia and Herzegovina

At the moment, the NECP for Bosnia and Herzegovina is under preparation, therefore the CPS and NPS scenarios were built starting from those of the IEA.

In Bosnia and Herzegovina, gas is currently used in all sectors, including electricity generation, albeit at very low levels (about 230 million cubic meters in 2019).

According to the IEA scenarios, by 2030 the use of gas is expected to decrease in both the CPS and NPS scenarios, including its use in electricity generation.

If it were not used to replace coal-fired electricity generation, in the NPS scenario, in particular, gas consumption would fall below 200 million cubic meters (it would remain just above 200 million cubic meters in the CPS scenario).

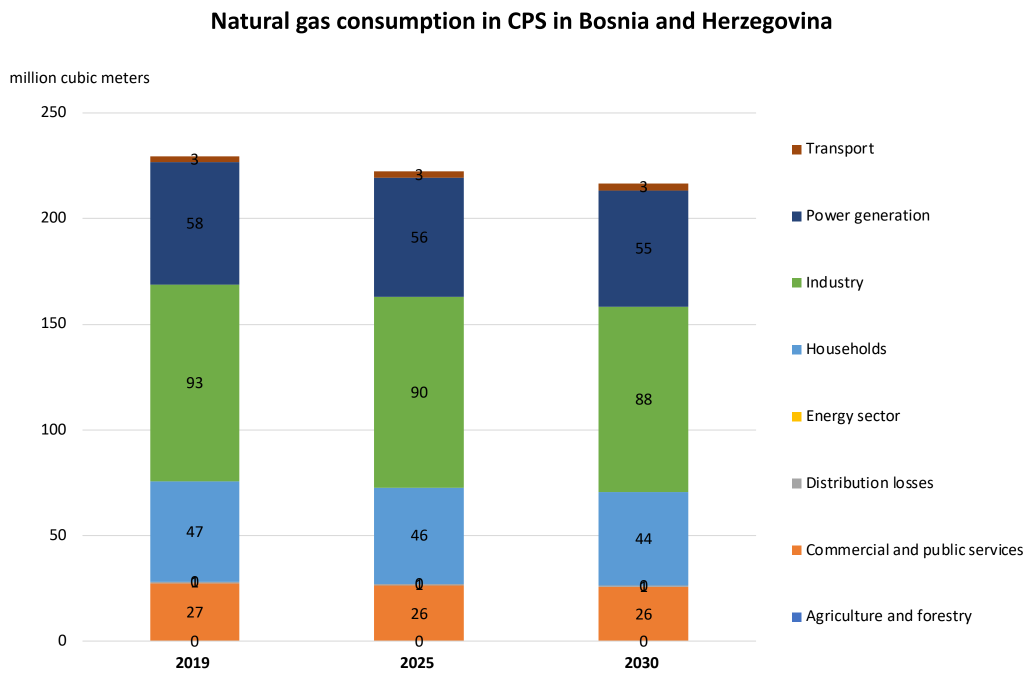


Figure 102 – Natural gas consumption in CPS in Bosnia and Herzegovina

Source: Consultant's elaboration on Eurostat and IEA data

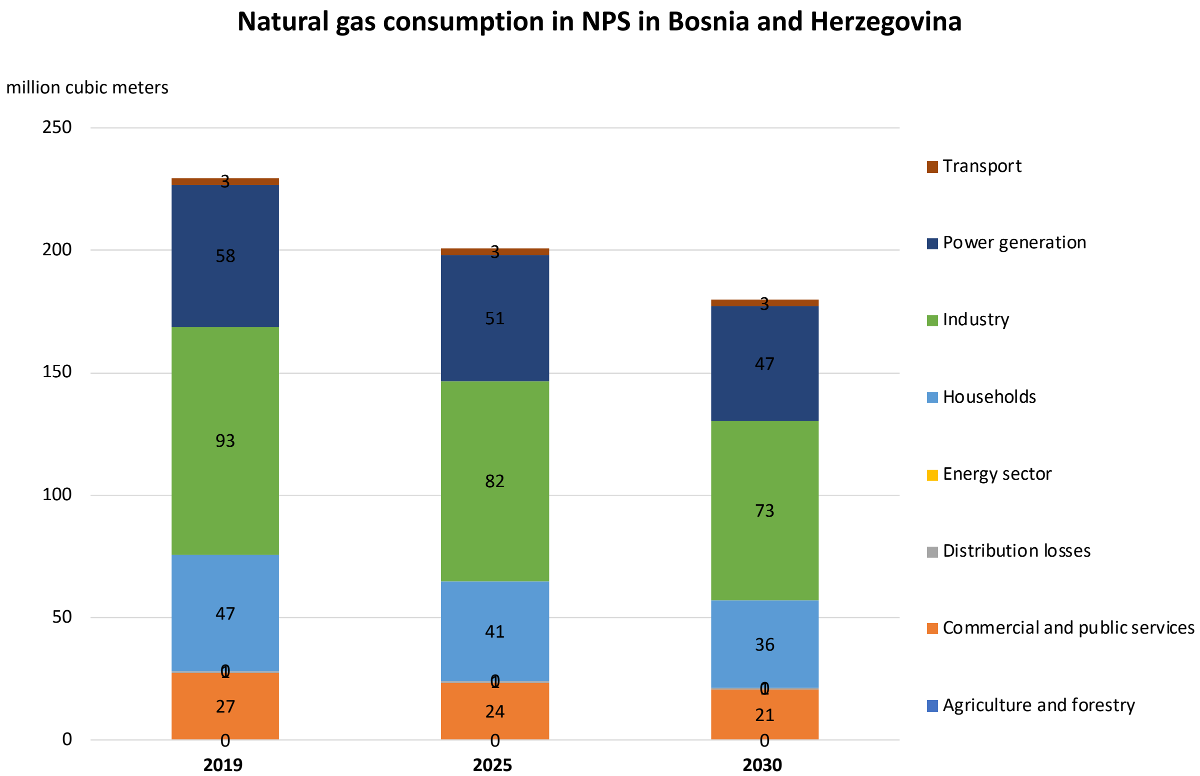


Figure 103 – Natural gas consumption in NPS in Bosnia and Herzegovina

Source: Consultant's elaboration on Eurostat and IEA data

7.2.1.3 Croatia

The gas transmission system in Croatia is composed of a total of 2.693 km of gas pipelines available to the transmission system operator (PLINACRO). Gas in the gas transmission system is withdrawn through nine connectors at input measuring stations, of which six connectors receive gas from the production fields located on the territory of the Republic of Croatia, two connectors receive gas from import supply routes and one connector serves to withdraw gas from the Okoli underground gas storage facility.

The transmission of gas from the transmission system is carried out through 194 connectors at 157 output measuring reduction stations. The gas transmission system of the Republic of Croatia reached a significant level of development regarding capacities and the distribution on almost 95% of the territory of the Republic of Croatia, as well as regarding the connection with gas systems of neighbouring countries, technological reliability and operational safety. The gas transmission system enables gas to be delivered to 19 counties.

Depending on the expected scenario of changes in gas consumption and the level of domestic production, in order to meet the infrastructure standard, according the NECP it is necessary to secure a new supply capacity of at least 3,5 million cubic meters/day in the shortest possible time, and an additional 4-8 million cubic meters/day should be built around 2030.

Strategic projects that meet the obligation under the infrastructure standard are projects that increase capacity at the entrance to the transport system, which can be: LNG terminal on the island of Krk, Ionian-Adriatic gas pipeline, Lučko-Sotla gas pipeline system interconnected with Slovenia and Slobodnica-Sotin towards Serbia.

However, leaving aside the need for gas supply security, the scenario envisaged by the NECP does not envisage a sharp increase in gas demand by 2030. In fact, gas demand should remain rather stable in 2030 in both scenarios, decreasing slightly in the CPS.

The consumption of gas in Croatia mainly concerns power generation, which, as seen, is expected to maintain a stable gas generation capacity up to 2030.

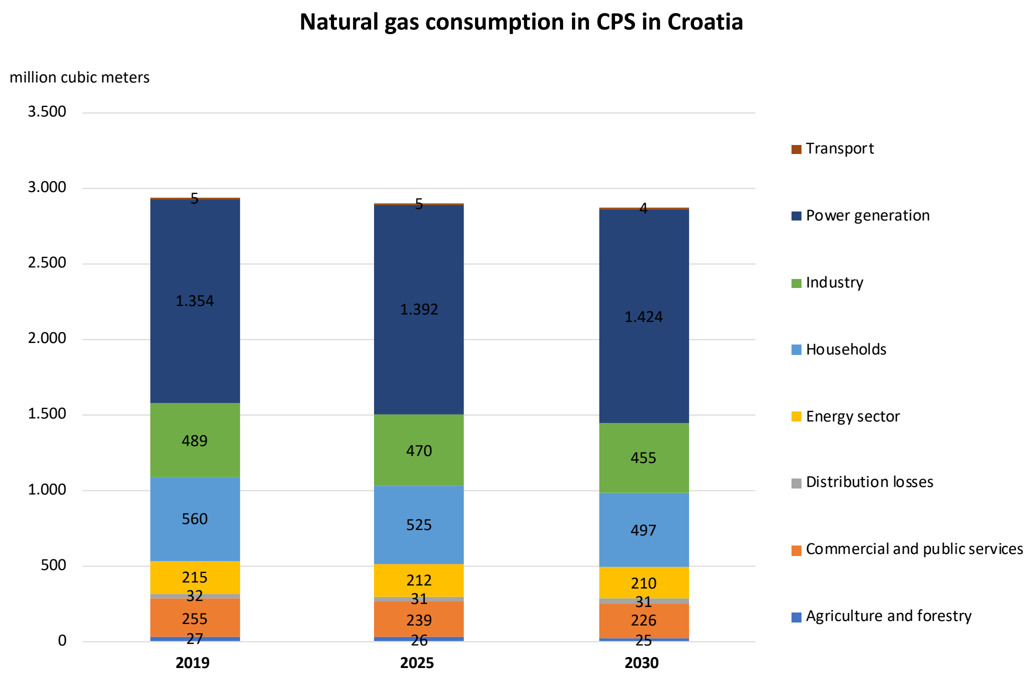


Figure 104 – Natural gas consumption in CPS in Croatia

Source: Consultant's elaboration on Eurostat and IEA data

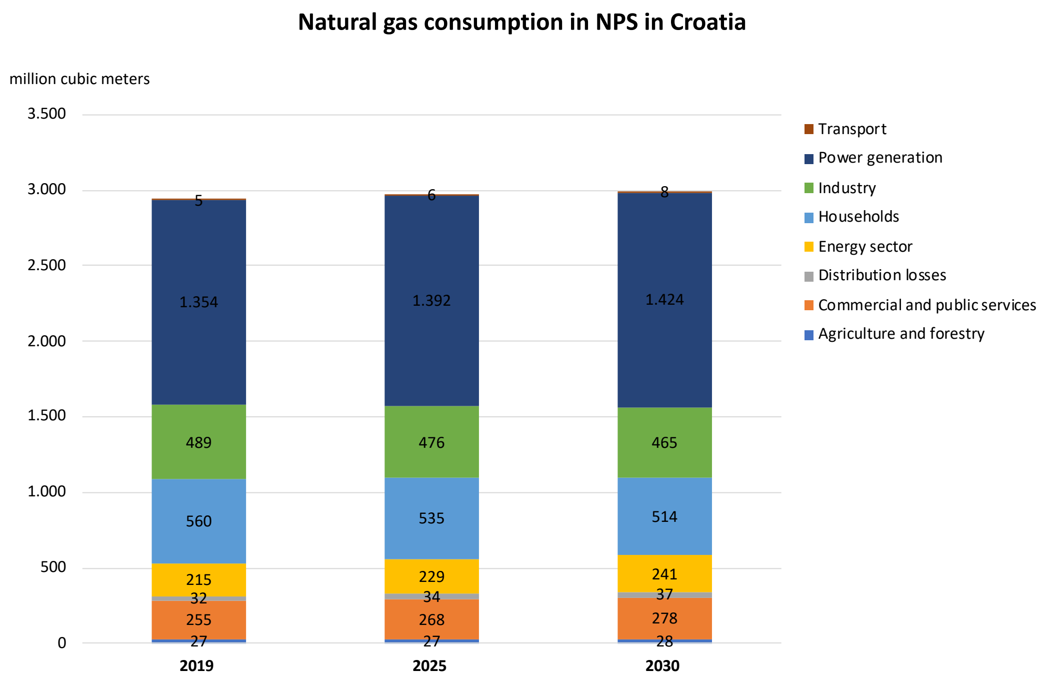


Figure 105 – Natural gas consumption in NPS in Croatia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

7.2.1.4 Greece

One the main aim of the Greek energy policy is to increase the use of natural gas in final consumption. More specifically, natural gas is expected to be the intermediate fuel for switching to a low GHG emissions model in all final consumption sectors, and may also lead to both improved energy efficiency and lower energy costs compared to other conventional technologies.

A key aim is to achieve a higher gas share in all final consumption sectors and, essentially, to ensure that its increased use replaces part of the current consumption of petroleum products in these sectors.

The development of the necessary transmission and distribution infrastructure to allow access to natural gas for higher percentages of end users in the building sector and the further increase in its use in industry and transport are priorities for the forthcoming period.

However, the increase in natural gas consumption in end uses is offset by a drop in gas-fired electricity production. The latter, in fact, although it has to make up for the phase-out of lignite, would be partially replaced by renewable production, which is on the increase.

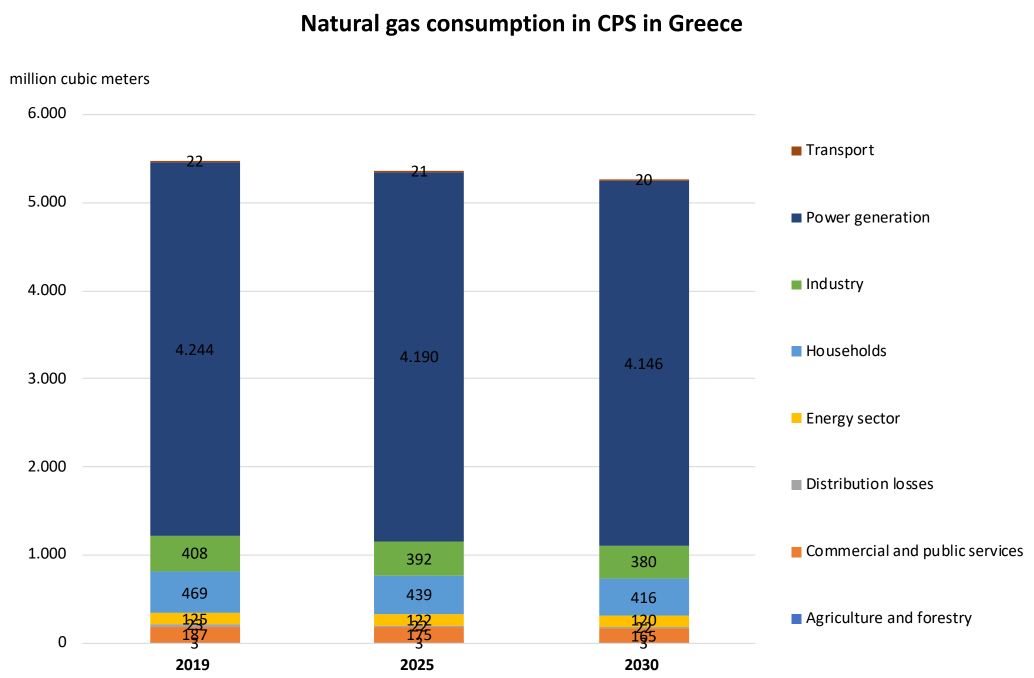


Figure 106 – Natural gas consumption in CPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

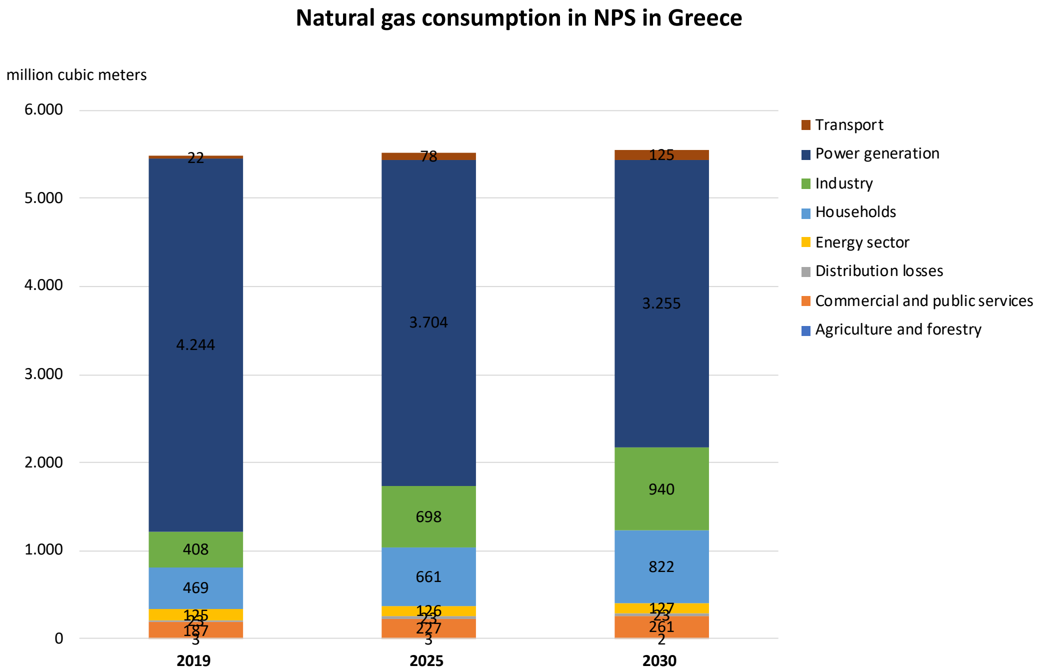


Figure 107 – Natural gas consumption in NPS in Greece

Source: Consultant's elaboration on NECP, Eurostat and IEA data

7.2.1.5 Italy

According to Italian energy policies, natural gas will continue to perform an essential function for industrial and domestic uses (in addition to transport) and, above all, for electricity generation, especially in the short and mid-term.

Without prejudice to the need to accelerate growth of renewable energies, in the context of the overall measures (storage, networks, flexible generation, other network operations) to be implemented by 2030, some infrastructure changes are linked in particular to the phasing out of carbon and, in particular, are to be launched in the period 2020-2025: above all, is provided new gas capacity for around 3 GW, of which around 50% is substantially linked to the phase-out.

The new capacity for gas-fueled generation (with a resulting temporary increase in gas consumption, with no associated infrastructural development envisaged for the time being) will help cover the needs and maintain the adequacy of the system in the next few years. More specifically, taking into account the phase-out of coal-fired power stations, in view of their intrinsic characteristics (potential to respond quickly and for prolonged periods to wide ranges of electrical load), gas-fueled power stations will ensure the flexibility the system needs, compensating for the significant increase in non-plannable renewable production and ensuring that the system maintains its levels of safety, security, adequacy, resilience and quality of service.

However, despite the role played in stabilizing electricity production, which will lead to a high consumption of gas especially in the first years of the coal phase-out, the overall consumption of natural gas is expected to decrease in the NPS, mainly thanks to the efficiency improvements end uses and its replacement by electricity and renewables.

Natural gas consumption in CPS in Italy (EUSAIR Region)

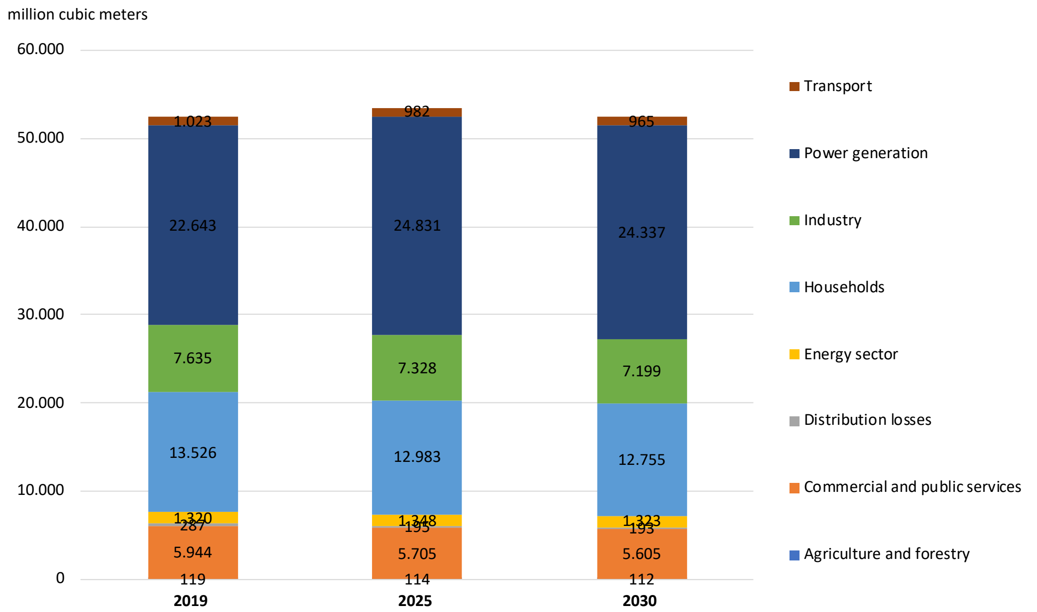


Figure 108 – Natural gas consumption in CPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Natural gas consumption in NPS in Italy (EUSAIR Region)

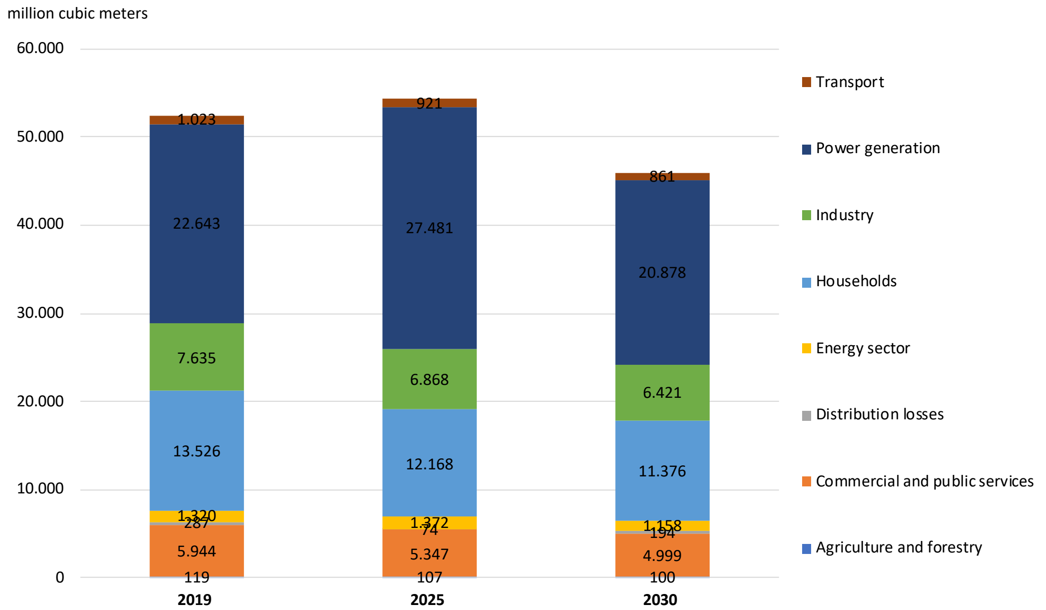


Figure 109 – Natural gas consumption in NPS in Italy (EUSAIR Region)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

7.2.1.6 Montenegro

At the moment, the NECP for Montenegro is under preparation, therefore the CPS and NPS scenarios were built starting from those of the IEA.

No natural gas is currently consumed in Montenegro.

In the CPS and NPS scenarios, similarly, gas is not expected to penetrate final consumption and electricity generation.

7.2.1.7 North Macedonia

North Macedonia has only one interconnection gas pipeline, with the Republic of Bulgaria. The entry point is at Deve Bair on the border with Bulgaria, and extends through Kriva Palanka, Kratovo and Kumanovo to Skopje. The installed capacity of the gas pipeline is 800 million cubic meters/year (that can be increased to 1,200 million cubic meters/year by building a compressor station on the first section of the main gas pipeline).

Although the annual capacity of the pipeline is used for around a third of the nominal capacity, there is a large imbalance in the monthly consumption of natural gas. In the winter months, when most of the natural gas is used to generate electricity and heat, the utilization of the pipeline reaches up to 80%.

The largest consumption of natural gas is in winter, which is expectable considering that natural gas is mostly exploited to produce district heating and electricity in CHPs. The highest influence on the profile of consumption is by the cogeneration plant located in Skopje. The months indicating minimum consumption of natural gas are due to the industrial consumers exploiting natural gas for self-requirements and are operable during the entire year.

The natural gas market in North Macedonia is liberalized starting from 2015. Depending on a single interconnector presents a high risk for security of supply. Therefore, it is essential that the country moves forwards with the construction of new interconnectors, especially the ones with Greece and Serbia, but also the ones with Kosovo* and Albania. This will create a diversification of supply sources, and reduce the risk of supply.

The new development of the natural gas market comprises the procedure of choosing a new natural gas distributor in the whole territory in the state. The Government of Republic of North Macedonia formed a commission for preparing a public call and tender documentation for allocating a public-private partnership, for financing, projection, construction, management, maintenance, and development of the natural gas distribution system in the Republic of North Macedonia.

During 2021, this commission has conducted the first phase of the procedure, by inviting two companies that shall compete for a future natural gas distributor in the territory of the Republic of North Macedonia. The second phase of the competitive dialog is ongoing, and the whole process is expected to be finalized in 3rd quarter of 2023 with signing PPP Agreement between the Public Partner and the Private bidder.

Both CPS and NPS foresee an increase in natural gas consumption for around 90-110 million cubic meters/year, mainly for electricity production in partial substitution of lignite production (while are provided lower changing in final gas consumption).

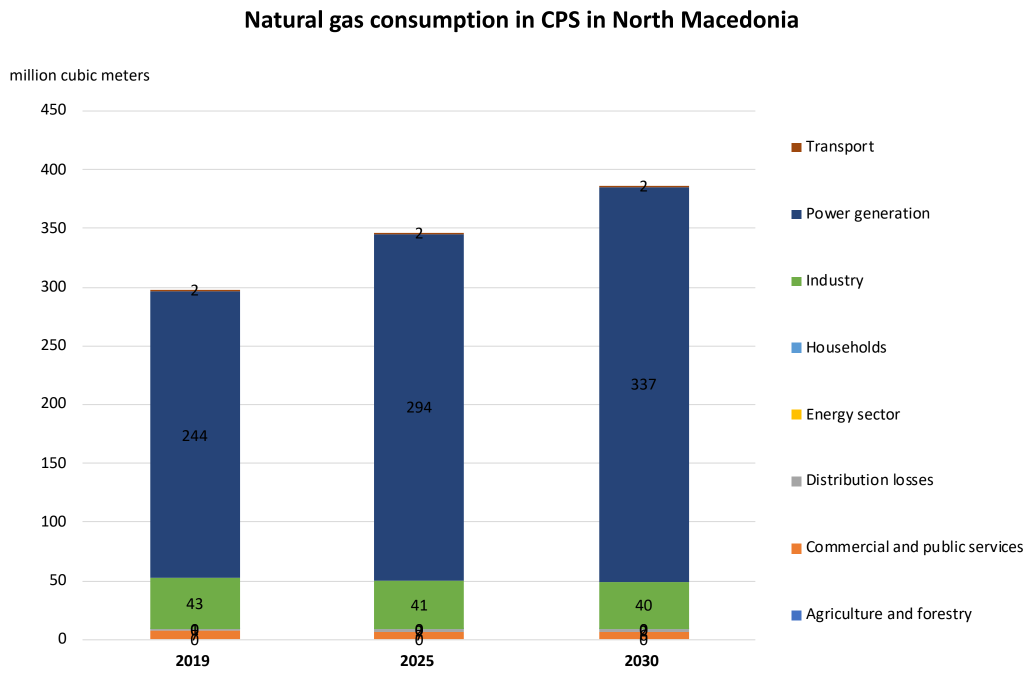


Figure 110 – Natural gas consumption in CPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

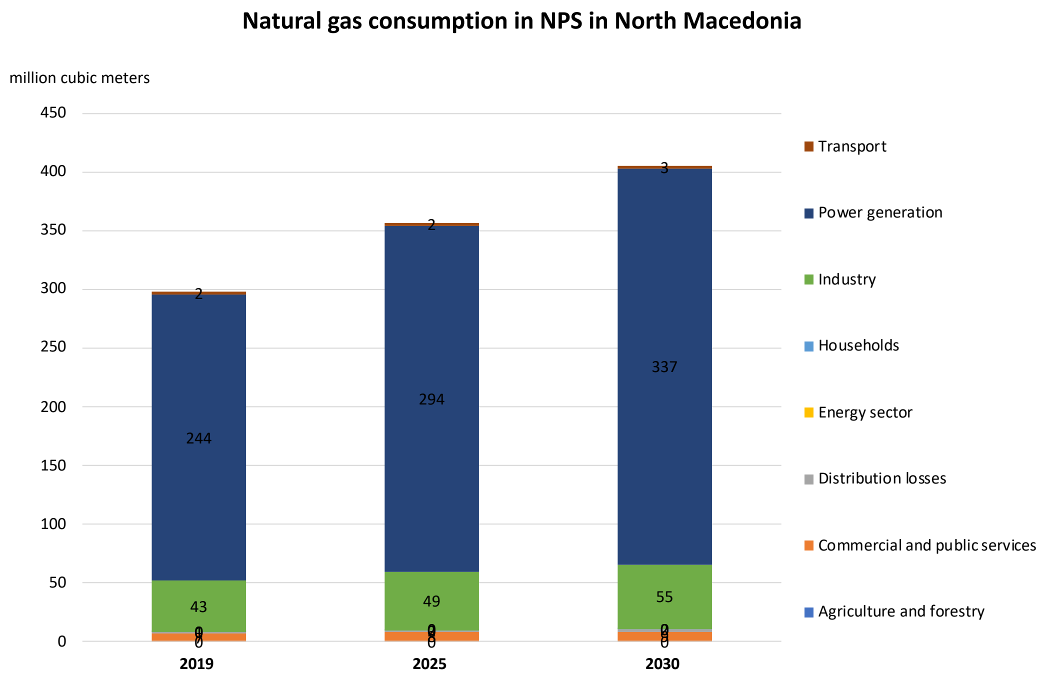


Figure 111 – Natural gas consumption in NPS in North Macedonia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

7.2.1.8 Serbia

At the moment, the NECP for Serbia is under preparation, therefore the CPS and NPS scenarios were built starting from those of the IEA.

In Serbia, gas is currently used in all sectors, including electricity generation, for a total 2.4 billion cubic meters in 2019 (of which 1.1 billion cubic meters for power generation).

According to the IEA scenarios, by 2030 the use of gas is expected to decrease in both the CPS and NPS scenarios, including its use in electricity generation.

If it were not used to replace coal-fired electricity generation, in the NPS scenario, in particular, gas consumption would fall below 2 billion cubic meters, while it would remain stable at 2.3 billion cubic meters in the CPS scenario.

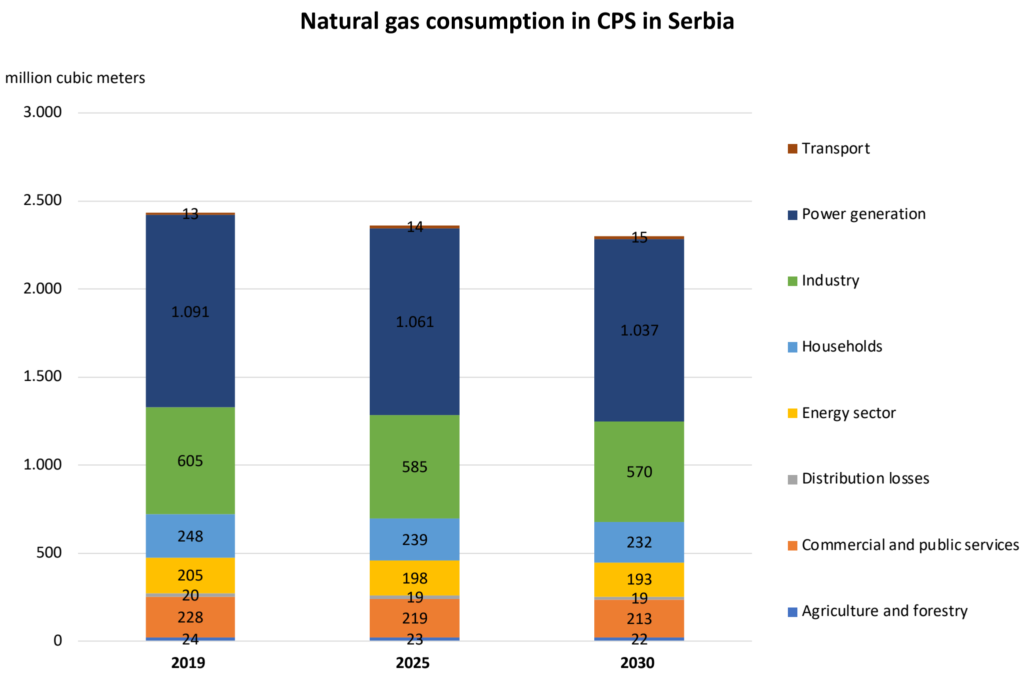


Figure 112 – Natural gas consumption in CPS in Serbia

Source: Consultant's elaboration on Eurostat and IEA data

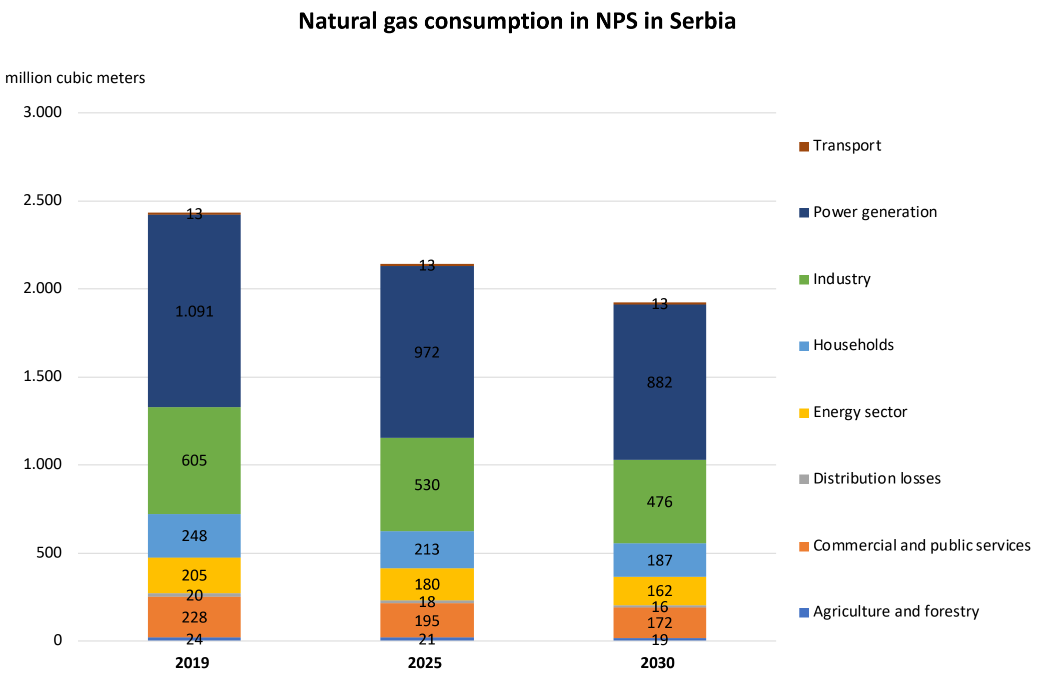


Figure 113 – Natural gas consumption in NPS in Serbia

Source: Consultant's elaboration on Eurostat and IEA data

7.2.1.9 Slovenia

The implementation of Slovenian energy policies and measures would achieve a gradual reduction of end-use of energy, included natural gas consumptions, in next years. Thus, with the implementation of the additional measures in transformations up to 2030, primary energy consumption is also significantly reduced.

Up to 2030, renewable electricity production (solar and hydro) contributes to an increase in production, while the decline in coal-fired electricity production is replaced by wood biomass and natural gas (and also the share of synthetic gas gradually increasing).

In power generation sector, indeed, natural gas in Slovenia is currently used to a lesser extent for the production of electricity in thermal power plants - Šoštanj (TEŠ) and Brestanica (TEB). It is expected to be used continuously and more extensively for the first time in the coming years for the production of heat and electricity at Energetika Ljubljana.

In final sectors, is expected an increase of around 140 million cubic meters in natural gas consumption in CPS up to 2030, especially due to the industry sector. In NPS, however, the gas consumptions are decreasing in 2030 of around 50 million cubic meters, partially due to the mixing of synthetic fuels in the gas distribution network. In this scenario (NPS), also the gas consumption for power generation is lower than in CPS.

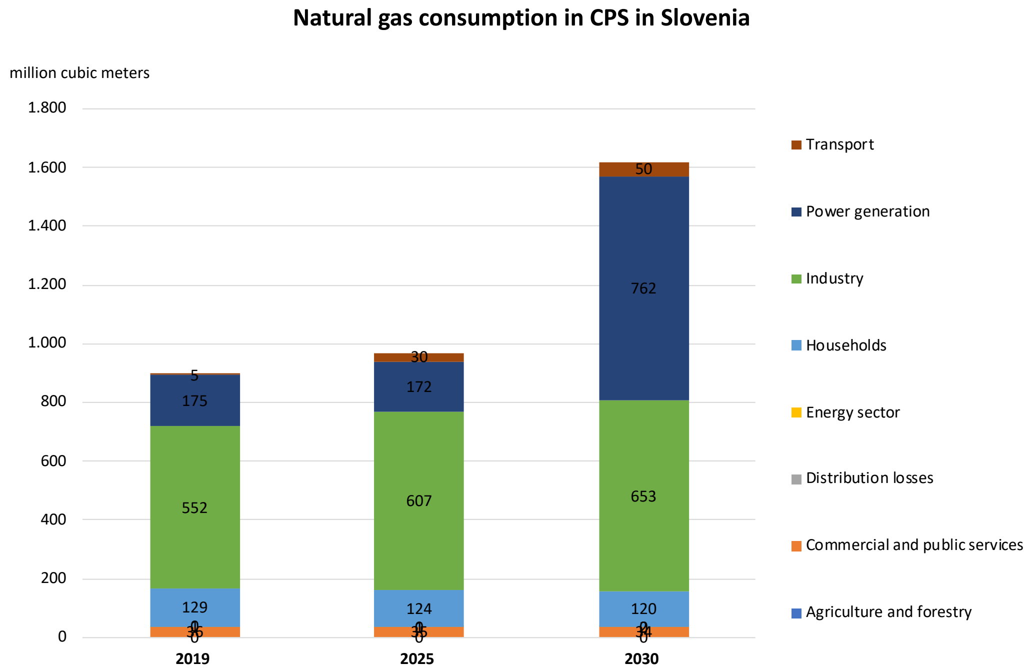


Figure 114 – Natural gas consumption in CPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

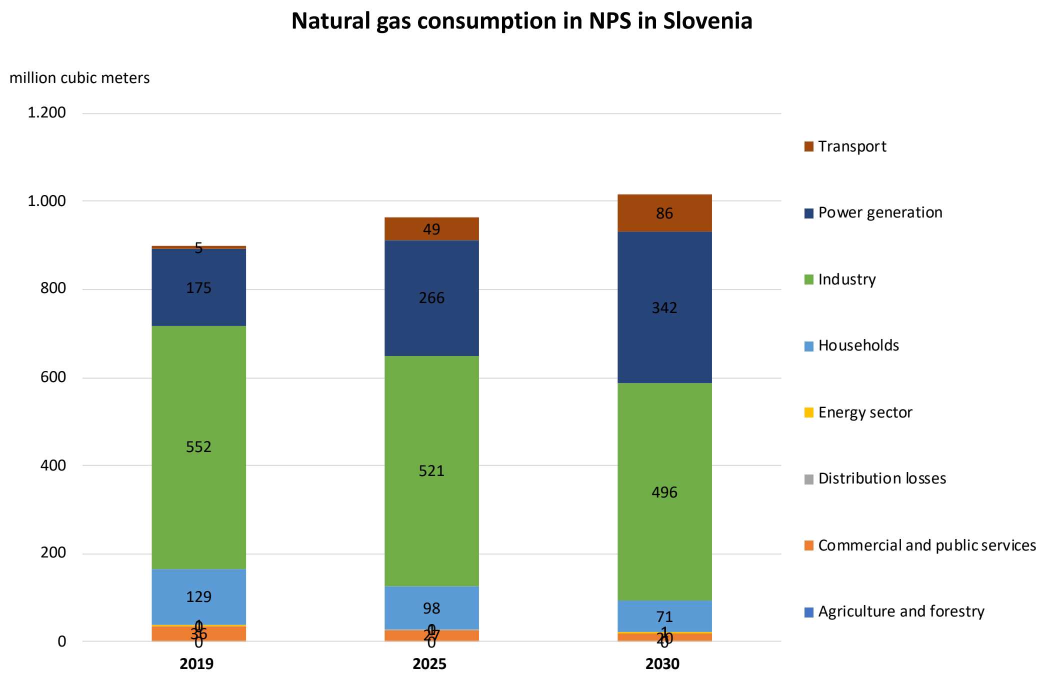


Figure 115 – Natural gas consumption in NPS in Slovenia

Source: Consultant's elaboration on NECP, Eurostat and IEA data

7.2.1.10 EUSAIR area

Starting from the scenario results reported in the previous paragraphs at the individual country level, a summary at the EUSAIR area level is provided below.

As regards natural gas consumption, based on the CPS and NPS scenarios, a significant drop in consumption is expected by 2030, falling from 65 billion cubic meters in 2019 to just over 58 billion cubic meters in the NPS scenario (while gas consumption remains substantially stable in the CPS scenario).

It is therefore a significant drop, equal to around 10% of consumption in the base year (2019), driven above all by Italy, which in the NPS scenario would lose around 6.5 billion cubic meters.

Natural gas consumption in CPS in EUSAIR

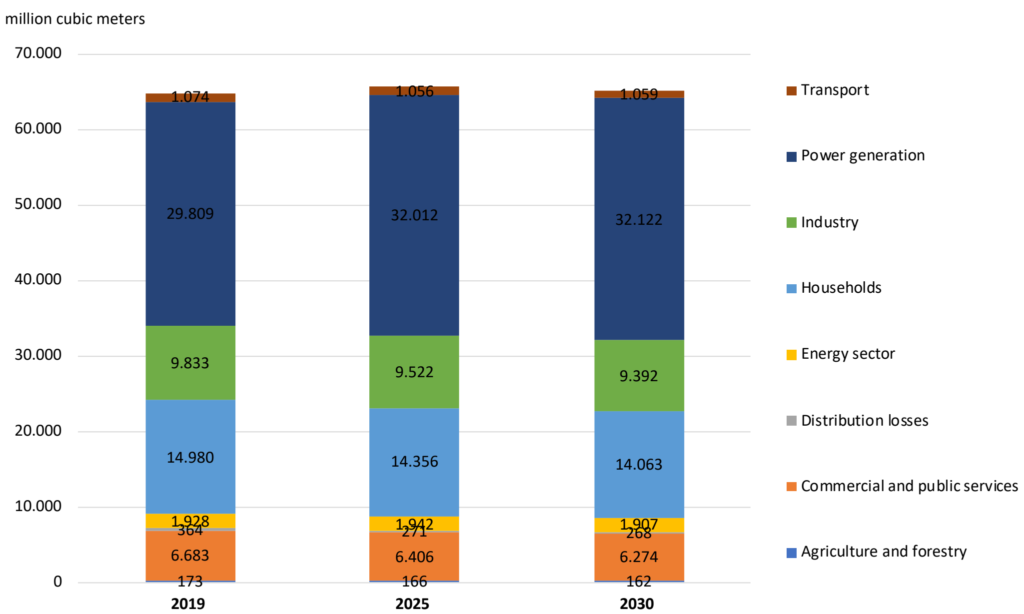


Figure 116 – Natural gas consumption in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Natural gas consumption in NPS in EUSAIR

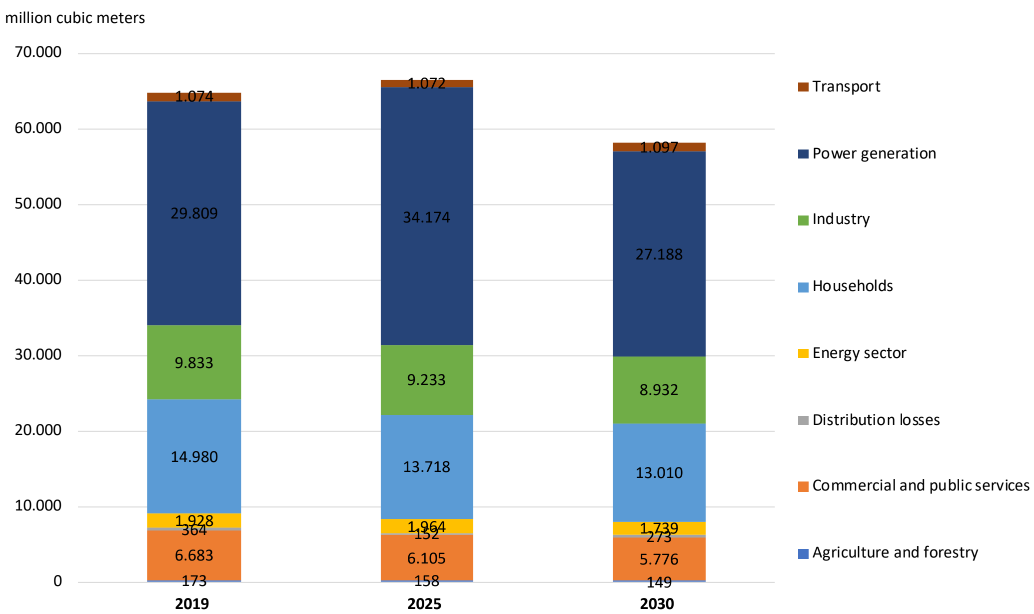


Figure 117 – Natural gas consumption in NPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

The comparison with the scenarios elaborated by the European Commission in 2020 (the "2020 EU Reference Scenario" and the "Fit for 55 Scenario") is also quite controversial: in the case of the

"Reference" scenario, in fact, a certain overall reduction in the gas consumption, albeit to a lesser extent than EUSAIR projections, but still driven by Italy; in the case of the "Fit for 55" scenario, on the other hand, the drop would be dramatic, bringing gas consumption to around 33 billion cubic meters for the Italian regions belonging to the EUSAIR area, compared to over 52 billion cubic meters for the year basis (2019). In the latter case, therefore, it would be a decrease of almost 40%.

EUSAIR Country	2019	EUSAIR Scenarios in 2030		EU Scenarios in 2030	
		CPS	NPS	2020 EU Reference Scenario	Fit for 55 Scenario (MIX)
Albania	70	91	102	n.a.	n.a.
Bosnia and Herzegovina	230	217	180	n.a.	n.a.
Croatia	2.937	2.871	2.994	2.499	1.995
Greece	5.481	5.271	5.554	6.187	6.733
Italy (EUSAIR Region)	52.497	52.489	45.987	49.484	33.203
Montenegro	0	0	0	n.a.	n.a.
North Macedonia	298	387	405	n.a.	n.a.
Serbia	2.433	2.301	1.925	n.a.	n.a.
Slovenia	898	1.621	1.016	1.702	1.286
Total	**64.845**	**65.247**	**58.164**	**n.a.**	**n.a.**

Table 16 - Summary of natural gas consumption scenarios in the EUSAIR area by 2030 (million cubic meters)

Source: Consultant's elaboration on NECP, Eurostat, IEA and European Commission data

The expected decrease in gas consumption in Italy is evident from the following figure, where Italy's leading role emerges with respect to consumption in other countries, expected to increase slightly in some cases and moderately decrease in other cases.

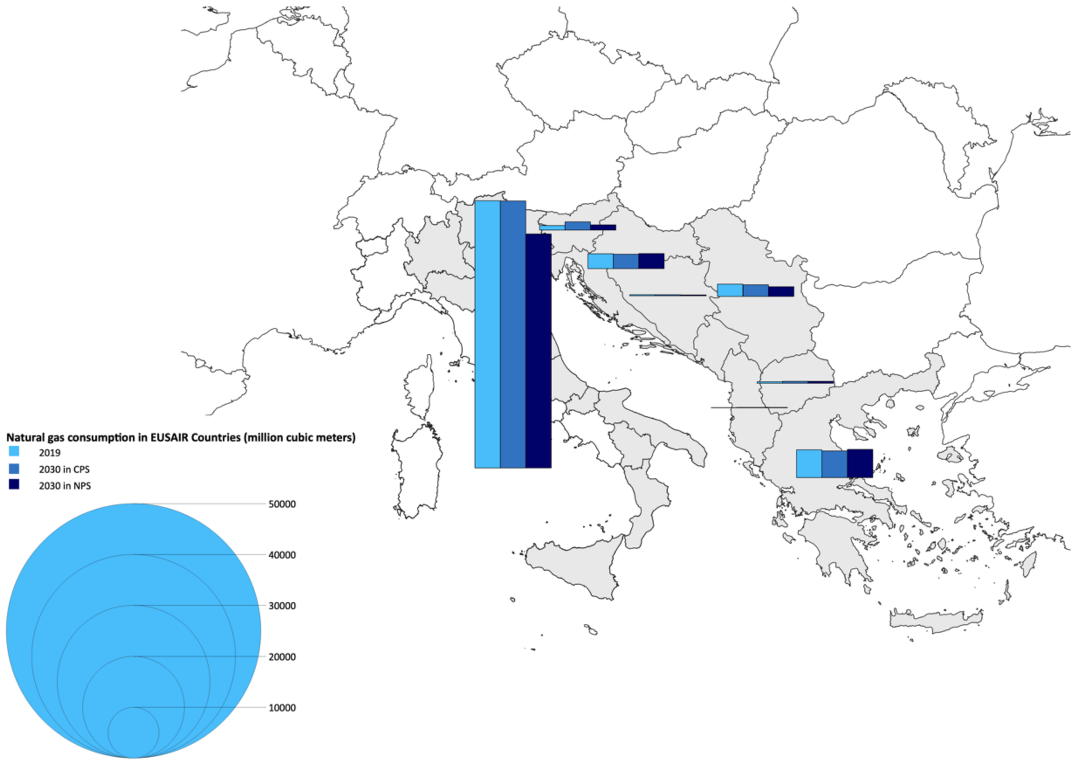


Figure 118 – Natural gas consumption in CPS and NPS EUSAIR Scenarios by 2030

7.2.2 New gas pipelines, LNG terminals and facilities for gas storage

Gas storage has an important role in ensuring security of supply and promoting decarbonisation, while also driving forward the energy transition. It is an integral technological and business activity of each gas system, and underground gas storage facilities are fundamental for security and flexibility of supply. While short-term gas supply disruptions have occurred in the past, several factors such as the Russian invasion of Ukraine since February 2022, price increases and the uncertainties related to future changes in the geopolitical situation can lead to further disruptions of gas supplies and damage the countries still dependent on external gas supplies. Underground gas storage facilities contribute to the security of gas supply by absorbing supply shocks in case of strong demand or supply disruptions.

The storage system makes it possible to compensate for the different requirements for gas supply and consumption: whilst supply - consisting of imports from overseas and domestic production - has a substantially constant flow throughout the year, the demand for gas is concentrated mainly in the winter period. Storage also ensures that quantities of strategic gas are available to compensate for any lack of or reduction in non-EU supply or crises in the gas system.

In June 2022, the European Parliament and the Council adopted the proposal of Regulation on Gas Storage by the European Commission providing that underground gas storage of EU countries' territory must by filled to at least 80% of their capacity before the winter of 2022/2023 and to 90% before the following winter periods. The Energy Community has also adopted the Gas Storage Regulation in October 2022. Its Contracting Parties that have storages, notably the EUSAIR country Serbia, have the obligation to fill them to at least 80% of capacity111. Contracting Parties and EU Member States without underground gas storage facilities should make arrangements and use underground gas storage facilities in other Member States with those facilities.

The efficient use of the existing infrastructure, including cross-border transmission capacities, underground gas storage facilities and LNG facilities, is important to safeguard the security of gas supply.

Here follows the description of the specific situation of the EUSAIR country concerned such as the size of the underground gas storage facilities, the importance of the underground gas storage facilities for security of gas supply in the region and any existing LNG storage facilities.

7.2.2.1 Underground Storage Gas Facilities (USG)

The following table and figure show the gas storage facilities across the EUSAIR countries.

[111] It is necessary to harmonize with: Energy Community Secretariat Decision 1/2022 according to Article 6a (7) of Regulation (EU) 2017/1938 as amended by Regulation of the European Parliament and of the Council (EU) 2022/1032 with regard to gas storage. Filling trajectory with intermediate targets for 2023 for Serbia - Adopts the filling trajectory with intermediate targets for 2023.

	operational				under construction				planned			
Country	**Operator**	**Facility location**	**City/Province**	**storage capacity million cubic meters**	**Operator**	**Facility location**	**City/Province**	**storage capacity million cubic meters**	**Operator**	**Facility location**	**City/Province**	**storage capacity million cubic meters**
Italy	**Stogit**	Bordolano	Cremona	1.650,0	**Stogit**	Sabbioncello (new facility)	Ferrara		**Edison Stoccaggio**	Palazzo Moroni on hold (Sant'Elpidio a Mare)	Fermo	50,0
		Brugherio	Milano			Bordolano (extension)	Cremona	226,7	**Gas Plus Storage**	San Benedetto (new facility)	Ascoli Piceno	503,7
		Cortemaggiore	Piacenza			Minerbio (extension)	Bologna	381,3		Poggiofiorito (new facility)	Chieti	160,2
		Fiume Treste	Chieti			Ripalta (extension)	Cremona			Sinarca (new facility)	Campobasso	312,6
		Minerbio	Bologna			Sergnano (extension)	Cremona	145,3	**Geogastock**	Cugno le Macine (Grottole-Ferrandina) (new facility)	Matera	771,9
		Ripalta	Cremona						**Stogit**	Alfonsine (new facility)	Ravenna	136,0
		Sabbioncello	Ferrara							Fiume Treste (new facility)	Chieti	181,4
		Sergnano	Cremona							Fiume Treste F (new facility)	Chieti	181,4
		Settala	Milano							Ripalta (extension)	Cremona	326,7
	Edison Stoccaggio	Cellino	Teramo	120,0						Settala (extension)	Milano	317,4
		Collalto	Treviso	600,0					**GDF Suez Italy**	Bagnolo Mella (on hold)	Brescia	633,3
		Cotignola & San Potito	Ravenna	350,0								
	Ital gas storage	Cornegliano	Lodi	1.300,0								
Croatia	**Podzemno skladiste plina**	Okoli	Zagreb	457,6					**Podzemno skladiste plina**	Grubisno Polje	Bjelovar	25,0
Greece									**DESFA**	South Kavala		338,6
Serbia	**Srbijagas/ Gazprom**	Banatski Dvor	Vojvodina	450,0					**Srbijagas/ Gazprom**	Banatski Dvor (extension)	Vojvodina	300,0

Table 17 – Underground storage gas facilities in EUSAIR countries (million cubic meters)

Source: Consultant's elaboration on GAS LNG Europe data

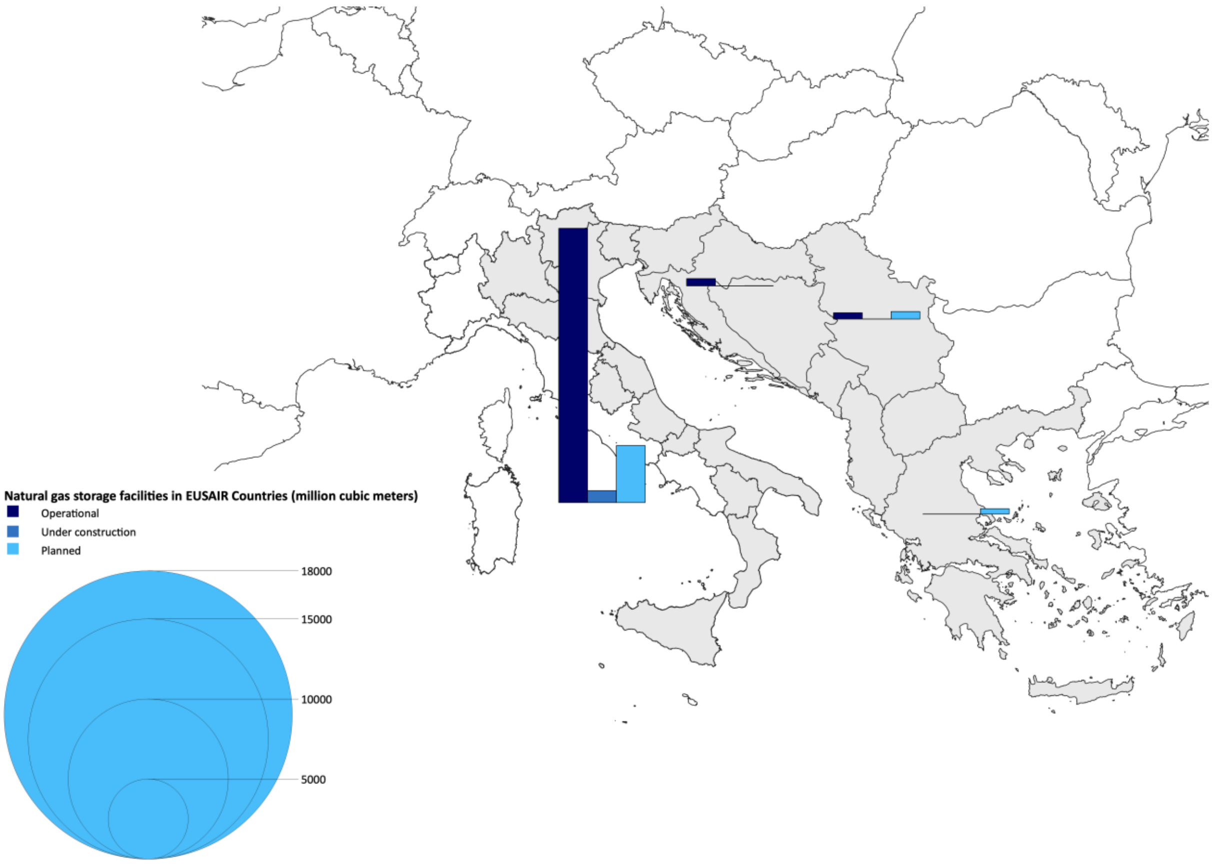


Figure 119 – Natural gas storage facilities in EUSAIR countries (million cubic meters)

Source: Consultant's elaboration on NECP, Eurostat and IEA data

Croatia has only one underground gas storage facility in Okoli, 50 km southeast of Zagreb, and it is currently managed by the national storage system operator - Plinacro's daughter company Podzemno skladište plina d.o.o.

Underground Gas Storage Okoli was put into trial run at the end of 1987, while in April 1988 the first cycle of gas injection began. After more than 20 years of doing business within INA, the Underground Gas Storage Okoli was organized as Podzemno skladište plina (PSP) d.o.o. at the start in early December 2008. On 30 January 2009, after signing the Agreement for the sale and purchase of business shares in Podzemno skladište plina d.o.o. with INA, Plinacro acquired a 100% share in the company, the main activity of which is natural gas storage.

Apart from its core business of natural gas storage, PSP d.o.o. is responsible for management, maintenance and development of a safe, reliable and efficient gas storage system, as well as for further development of storage capacities and storage operations. Croatia will improve the safety of the gas system of the country by carrying out development plans and new investment cycles of PSP, that is, by modernization and expansion of the compressor of the existing storage facility in Okoli and the construction of a peak gas storage facility in Grubišno Polje, as well as a future strategic underground gas storage facility.

Operating storage volume of PSP Okoli is **553 million cubic meters.**

Italy is the EUSAIR country with the largest storage capacity. There are 13 gas storage sites in Italy with storage capacity of around **16.5 bcm,** including 4.5 bcm of strategic reserves, mostly managed by Snam through its subsidiary Stogit. In addition, there are three sites owned by Edison, a subsidiary of the French company Edf, which are located in Collalto (Treviso), Cellino (Teramo), San Potito and Cotignola (Ravenna). Edison's three sites have a total capacity of about one billion cubic metres of gas. Finally, Ital Gas Storage operates a 1.6 billion cubic metre storage facility in Cornegliano (Lodi). By far the largest is the total capacity of Snam's nine facilities located in Fiume Treste (Chieti), Bordolano (Cremona), Sabbioncello (Ferrara), Minerbio (Bologna), Sergnano (Cremona), Ripalta (Cremona), Cortemaggiore (Piacenza), Brugherio (Milan) and Settala (Milan). The largest Italian site, among the largest in Europe, is Minerbio. The sites are usually located at considerable depths, around 1,000 metres below ground, in old deposits that are now depleted.

Increases in storage capacity are expected because of the expansions of the existing storage facilities in Fiume Treste, Minerbio, Ripalta, Sabbioncello, Sergnano and Settala. These expansions will add 1.4 billion cubic meters of storage capacity. In addition, the opening of six new facilities that are currently planned, add approximately 2.3 billion cubic meters of capacity. These are: San Potito and Cotignola, in Emilia Romagna, owned by Edison Stoccaggio, Salandra (Cugno Le Macine) in Basilicata, being developed by Geogastoc, San Benedetto, Poggiofiorito and Sinarca developed by Gas Plus Storage and Alfonsine owneb by Stogit that will be available by 2025/2026.

In addition to Russia, Italy's main suppliers are Norway, Algeria, Libya and Azerbaijan, which bring their gas to Italy through pipelines. Italy’s six pipeline entry points are: Tarvisio, Mazara del Vallo, Gries Pass, Gela, Melendugno and Gorizia. The Tarvisio and Mazara del Vallo interconnections are by far the most significant import points by capacity; Tarvisio receives Russian gas from Austria via the Trans Austria Gas pipeline while Algerian gas arrives at Mazara del Vallo via the sub-sea Transmed pipeline. The Gries Pass interconnection can be used to import gas originating in north-west Europe from Switzerland while the Gela interconnection can be used to import gas from Libya via the sub-sea Greenstream pipeline. The Gorizia interconnection with Slovenia has a relatively insignificant quantity of reverse flow capacity for imports to Italy, and is rarely used for imports.

Since late 2020, Italy has been able to import natural gas through the Melendugno interconnection in the south-east which facilitates Azeri gas imports via the Trans Adriatic Pipeline. The utilisation rate of the Melendugno interconnection remains relatively low but has been growing. In the past decade, Italy has invested in infrastructure facilitating the reverse flow of gas from Italy into northern Europe. All of Italy’s northern gas interconnectors now have reverse flow capacity for exports.

The Italian network is of a high standard and stretches 41,000 kilometres. Marginal quantities arrive by ship in the form of liquid natural gas (LNG) landing in the regasifiers of Rovigo, Panigaglia (La Spezia) and Livorno.

Greece has no gas storage facilities and it would need to store enough gas in other states to cover 15% of its annual use, which came in at about **7 billion cubic meters in 2021.**

The planned project of South Kavala assumes thus major importance.

The Underground Natural Gas Storage Facility in South Kavala is an energy infrastructure that will enhance the security of supply in the Greek market and will improve the management of the natural gas suppliers' portfolio. The project consists of exploiting the almost depleted underwater natural gas field of South Kavala as an underground natural gas storage (UGS). Natural gas field South Kavala is located in the southwestern part of the Prinos-Kavala basin, in 52 meters of water depth in the North Aegean Sea, about 6 kilometers off the west coast of Thassos. It will have a storage capacity of around 340 million cubic meters. The almost depleted field "South Kavala", due to its geology, size, proximity to the southern pipeline, the existing infrastructure and its uniqueness in Greece, is ideal for the proposed use. New gas entry points, besides Trans-Adriatic (TAP) pipeline, will be needed to secure sufficient gas quantities and flexibility during this transition, and the role played by the Kavala underground storage during this stage will be vital.

Serbia's only UGS facility at Banatski Dvor, partially owned owned by Russian state-controlled Gazprom and Serbian state-owned gas monopoly company Srbijagas plays an important role in providing reliable gas supplies throughout southeastern Europe. With a working gas capacity of **450 million cubic meters,** the facility has a maximum gas deliverability of 5 million cubic meters/day. The Banatski Dvor UGS facility, located in northwestern Serbia, was formally launched in November 2011.

In 2017, Russia and Serbia agreed on long-term cooperation to expand the Serbian gas transportation system and prepare a feasibility study for the Banatski Dvor underground gas storage expansion project. In 2019, Srbijagas and Gazprom signed a memorandum of understanding on a project for the expansion of Banatski Dvor's capacity by 300 million cubic metres to **750 million** cubic metres and doubling of the maximum withdrawal capacity up to 10 million cubic metres/day. Srbijagas is the main partner of Gazprom in Serbia. Transportgas Srbija is engaged in the transportation, storage and distribution of gas in the republic.

Banatski Dvor will be filled with Russian supply as Russian gas is much cheaper than spot prices. A new gas contract for 2.2 billion of cubic meters/year signed with Gazprom in late May 2022 covers 62% of Serbia's consumption, and the other 38% will be covered by storage withdrawals.

To ensure sufficient gas supply, Serbia in late May reached an agreement with Hungary to store up to 500 million of cubic meters of gas in its facilities.

Serbia plans to sign a gas supply contract with Azerbaijan for supply next year through the planned interconnector with Bulgaria, expected to be commissioned in September 2023, with a capacity of 1.8 billion of cubic meters/year. This would allow Serbia to procure at least 30-40% of its annual needs from non-Russian sources, against annual consumption of 3-3.2 billion of cubic meters/year.

Serbia is also preparing for the construction of an interconnection with North Macedonia, and is also considering interconnections with Bosnia and Herzegovina as well as Croatia.

Serbia plans the construction of another gas storage facility in Serbia in 2023, in Srpski Itebej, whose capacity would be between 800 million and 1 billion cubic meters.

The consumption of gas in the **Bosnia and Herzegovina** is **180 million cubic meters**, and the majority is in Sarajevo Canton, where 120-130 million cubic meters are consumed annually. The largest consumers are the population with around 60 million and the Public Institution “Toplane” (*Heating plant*), which heats the urban parts of Sarajevo, apartments in buildings, with 40 million. The rest falls on industry, institutions, etc.

BiH has no gas reserves and is completely dependent on Russian supplies. Only one branch of the gas pipeline “Turkish stream”, which goes from Russia through the Black Sea through Turkey and ends in BiH, supplies natural gas to two cities, Sarajevo and Zenica, and the surroundings of those cities. Work is underway to expand the gas pipeline network to other parts of the country, but this process is not going fast enough, and BiH has not been put on Russia’s list of “enemy countries” for now. Diversification of supply is planned with the construction of the “Southern Interconnection” gas pipeline, which would connect Bosnia and Herzegovina with Croatia. However, the project is still in the approval phase.

Slovenia uses approximately 0.8 billion cubic meters of natural gas/year, accounting for about 12% of the country’s energy consumption, most of which is based on a take-and-pay contract with Russia’s Gazprom. The state-owned gas company Geoplin signed a five-year natural gas supply contract with Gazprom in 2018 to import 600 million cubic meters of Russian natural gas per year. Russia’s February 2022 invasion of Ukraine, however, forced Slovenia to reconsider its energy policy and seek alternate sources. Slovenia does not have gas storage facilities, with companies dependent on infrastructure in Austria and Croatia. Slovenia has expressed interest in securing U.S. LNG sources via terminals in Krk, Croatia, or Rovigo, Italy, to diversify its supply away from Russia.

Slovenia’s natural gas infrastructure company Plinovodi hopes to work with Hungary’s FGSZ to construct a new gas interconnector to link Hungary and Slovenia, a project the EU has designated as a Project of Common Interest and which qualifies for funding through the Connecting Europe Facility. Investment plans in the transmission and distribution system also include the modernization of national dispatching and local distribution control centers, the renovation of the transmission grid, better control of reactive power in the system, and the completion and renovation of the east-west

400 kV transmission with Hungary. However, a lack of financial resources has postponed these projects.

Montenegro's state-owned power utility Elektroprivreda Crne Gore (EPCG) has started preparations for the construction of three gas power plants with a total installed capacity of 400 megawatts (MW). Natural gas supplies could be secured from gas deposits in the Adriatic Sea.

Elektroprivreda Crne Gore plans to build a hybrid power plant with a capacity of at least 50 MW near the city of Bar, based on a gas turbine and with the possibility to use renewable sources, as well as a combined gas power plant with a capacity of at least 150 MW within aluminium smelter KAP in Podgorica, also with a potential to utilize renewables. The third gas power plant, with a capacity of up to 200 MW, is envisaged to be installed near the city of Pljevlja.

The proposed power plant concept aims to enable long-term use of local resources for a period of at least 25 years and in full compliance with EU climate rules and regulations.

EPCG intends to prepare a strategy to integrate renewable energy sources with the gas power plant operations and also potentially convert them into facilities with net zero CO2 emissions.

Albania and Montenegro are the only countries in Europe that are not connected to interstate gas transmission systems. The gas sector in Albania has been steadily diminishing; domestic gas production has declined from 1 bcm in 1982 to 0.01 bcm in recent years. Generally, it can be concluded that the majority of the existing gas pipelines are old and/or in poor condition, which does not make it feasible to repair these pipelines and almost an entirely new or rebuilt gas transmission and distribution system is required. Except for the refurbished pipeline from Delvina gas field to the refinery in Ballsh, the gas infrastructure is non-operational and would require rehabilitation before coming operational.

Dumrea underground natural gas storage has the objective to contribute to the long-term development of Albania's gas system, improving the gas supply for the country, through the construction and operation of the underground natural 5 gas storage in Dumrea Area (UGS Dumrea). These investments will complement the gas supply originating from the Middle East and Caspian Region via the Trans Adriatic Pipeline (TAP). The Albanian power sector would benefit from the addition of an off-peak generation capacity that would be available on demand, in order to supplement hydro production in periods of unfavourable hydrological conditions.

According to the Gas Master Plan (GMP) for Albania, under a natural gas scenario for energy consumption, its full implementation will lead to a potential gas consumption in Albania by 2040 of total 927 million cubic meters in the residential, service and industrial sectors and 684 million cubic meters for anchor consumers. Implementing the Albanian GMP will increase the natural gas component in the Albanian TPES from 0.4% to 28%% in 2040 compared to the Base Line, or expressed in energy from 18 ktoe (210 GWh) in 2013 to 1,371 ktoe (15,950 GWh) in 2040.

The GMP ascertains that availability of known gas reserves is not the main upstream issue for gasification of Albania. The key issue is whether there will be sufficient investment in the infrastructure to bring the gas to market and the economic viability of such investments. Gas to pass through TAP and then an Albanian network and fill the storage capacity could come from the Caspian basin. However, given the both the TAP and IAP will have reverse flow capabilities, gas could virtually come from anywhere. In addition, while TAP's present capacity is fully booked, it could be doubled subject to the confirmation of additional demand following market tests. Actually, the projects TAP and IAP plan to lay down two major natural gas pipelines throughout Albania, transiting natural gas back and forth in the E-W direction via the Trans-Adriatic-Pipeline (TAP) and also in the N-S direction via Ionian-Adriatic Pipeline (IAP).

Bulgaria's gas transmission operator Bulgartransgaz signed an Interconnection Agreement with the gas transmission operator of **North Macedonia** GA-MA for the Kyustendil/Zhidilovo point.

The Agreement is of key importance for the diversification and enhancement of the security of the gas supply in North Macedonia as Kyustendil/Zhidilovo is the only entry point for the supply of natural gas to the country. The country has no gas fields nor a natural gas storage facility and to guarantee the gas quantities required for the country relies completely on the transport of gas through Bulgaria.

The interconnection point Kyustendil/Zhidilovo is not a new one, however, the Agreement provides for the increase of the technical transmission capacity to North Macedonia with 500,000 cubic meters/day or an increase of **182 million cubic meters/year**. The domestic yearly consumption amounts to about 300 mcm.

Thanks to the cooperation between Bulgartransgaz and GA-MA, North Macedonia is given the opportunity to diversify its gas supply. The prospect as well for access to a liquid, transparent and non-discriminatory market on the trading platform of Balkan Gas Hub is expected to elicit an interest amongst the market participants.

The market participants (traders and customers) in North Macedonia are also provided with access to significant gas quantities from alternative sources – the liquefied gas terminals in South East Europe as well as pipeline gas from Azerbaijan and other alternative suppliers. In addition, North Macedonia will have the opportunity to benefit from natural gas storage services in the Chiren underground gas storage facility, which is a prerequisite both for creating natural gas reserves and achieving optimal gas prices with flexible portfolio management of the supply.

7.2.2.2 LNG Storage Facilities (LNG)

Liquefied Natural Gas (LNG) facilities provide delivery capacity during peak periods when market demand exceeds pipeline deliverability. LNG storage tanks possess a number of advantages over underground storage. As a liquid at approximately −163 °C (−260 °F), it occupies about 600 times less space than gas stored underground, and it provides high deliverability at very short notice because

LNG storage facilities are generally located close to market and can be trucked to some customers avoiding pipeline tolls. There is no requirement for cushion gas and it allows access to a global supply. LNG facilities are, however, more expensive to build and maintain than developing new underground storage facilities.

FSRUs (Floating Storage and Regasification Units) are terminals capable of **storing and regasifying** natural gas. They are mounted on ships located in the vicinity of a port area, on the quayside or offshore, and receive liquefied natural gas (LNG) at a temperature of -160°C from other LNG carriers and regasify it (i.e. bring it to a gaseous state) in order to feed it into the national gas transmission network.

LNG storage capacity is between 160,000 and 180,000 cubic meters.

The following table and figure show the LNG facilities across the EUSAIR countries.

	Operational		Under construction		Planned	
Country	**FSRU Facility name**	**storage capacity cubic meters**	**FSRU Facility name**	**storage capacity cubic meters**	**FSRU Facility name**	**storage capacity cubic meters**
Albania					Vlora Terminal (new facility) 2023	n/a
Croatia	Krk LNG Terminal (LNG Croatia)	140.000			Krk FSRU (expansion)	140.000
Greece	Revithoussa LNG Terminal	255.000	Alexandroupolis LNG terminal	153.500	Revithoussa LNG Terminal (expansion)	380.000
					Argo FSRU (new facility) 2024	170.000
					Thessaloniki FSRU 2025	140.000-170.000
					Thrace LNG	170.000
					Dioriga GAS FSRU 2023	210.000
Italy	Panigaglia LNG Terminal	100.000	BW Singapore (Ravenna)	170.000	Golar Tundra (Piombino)	170.000
	OLT Offshore LNG Toscana FSRU	137.500			Porto Torres (Sardinia)	15.000
	Adriatic LNG	249.579			Portovesme (Sardinia)	140.000
					Porto Empedocle (Sicily)	320.000
					Gioia Tauro (Calabria)	n/a

Table 18 – LNG storage facilities in EUSAIR countries (cubic meters)
Source: Consultant's elaboration on GAS LNG Europe data

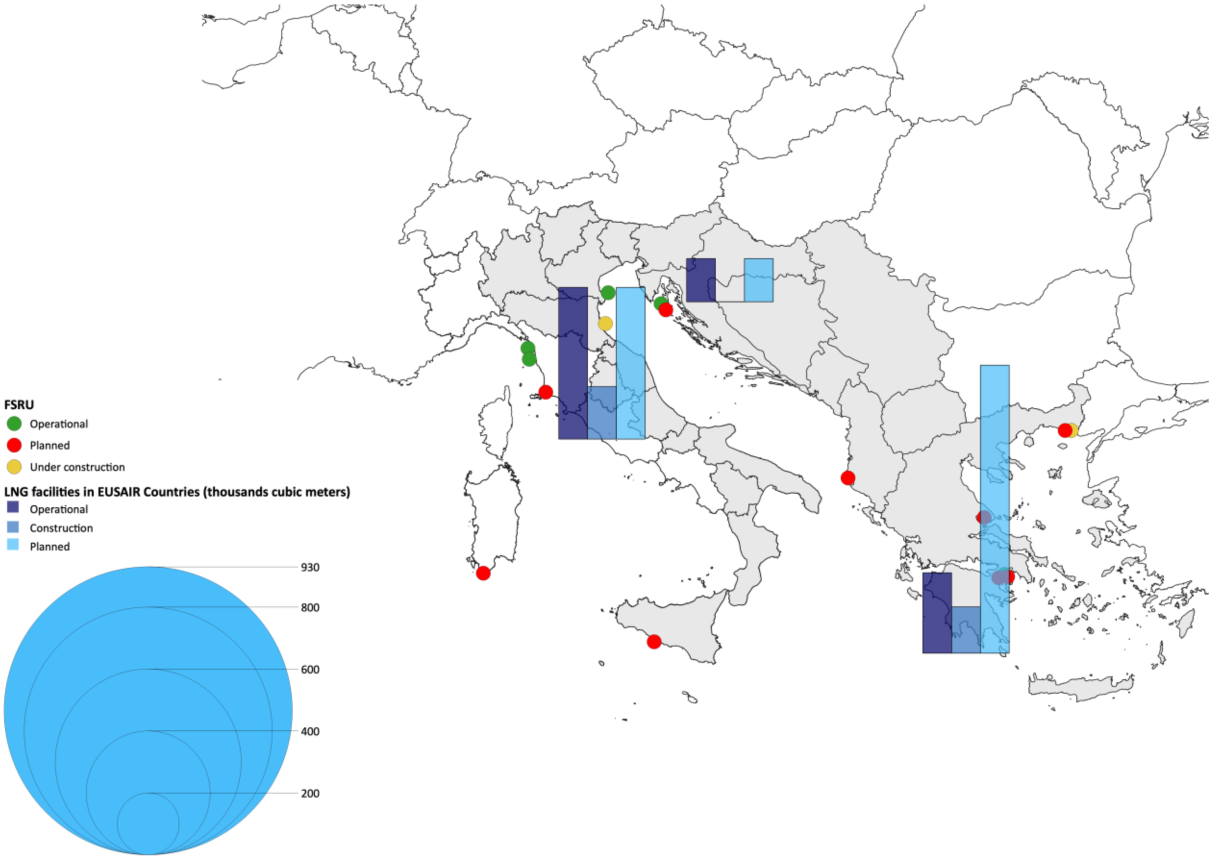


Figure 120 – LNG facilities in EUSAIR countries (thousand cubic meters)
Source: Consultant's elaboration on NECP, Eurostat and IEA data

Albania

Albania will see an FSRU installed at the planned Vlora LNG terminal on the Adriatic Sea, following a MOU between Excelerate, Snam and Albania's Albgaz. Excelerate will conduct a study to explore the potential of an integrated LNG-to-power solution that includes developing an LNG import terminal, converting and/or expanding the existing Vlora thermal power plant, and establishing small scale LNG distribution to Albania and the surrounding Balkans region. Storaga capacity is not known at the moment.

Croatia

Krk FSRU is an operating floating LNG terminal in Omisalj on the island of Krk in northern part of Croatia. It started operations on 1 January 2021 with full capacity of 2.6 billion cubic meters/year booked for the next three years. The FSRU vessel is equipped with four LNG storage tanks with a total capacity of 140,206 cubic meters.

A Phase 2 expansion of the existing floating LNG terminal on Krk Island from 2.9 to 6.1 bcm of gas per year, project is proposed. The focus should be on two aspects at the same time: the construction of additional pipelines and the installation of a new regasification module on board of the vessel. Currently, there are three regasification modules on board of the vessel, so the plan is to build just an additional one. The terminal could already function up to 3.5 bcm so the increase is not from 2.9 to 6 bcm, but from 3.5. There is no plan on receiving bigger vessels, the volume's increase is only in the regasification capacity. The plan is for the works to be completed in the next 2 years so to be ready for the gas season 2024-2025. The capacity of the expanded terminal will go beyond the needs of Croatia's industry and households allowing Croatia to play a more regional role and many countries in the neighbourhood such as Slovenia, Hungary or Bosnia and Herzegovina to benefit from diversified supplies.

Greece

The Revithoussa LNG Terminal is located on the island of Revithoussa, in the gulf of Pachi at Megara, 45 km west of Athens and is the only one operational regasification and storage terminal in Greece that receives LNG cargoes, temporarily stores and regasifies LNG and supplies the National Natural Gas Transmission System. It has played an important role in the country's strategy to diversify from Russian gas and secure the security of supplies.

It can store 225,000 cubic metres of gas and regasify 1,400 cubic metres per hour. It was completed in 1999 and is operated by DESFA SA. In 2022, DESFA started the upgrading of the terminal by adding a floating storage unit to the existing facilities in order to increase storage capacity to 380,000 cubic meters.

In Greece, the long-planned 153,500 cubic meters **Alexandroupolis FSRU** is expected to start up by end-2023 in the northeast, approximately 17.6 km south-west of Alexandroupolis in the Aegean Sea. The project is being developed by Gastrade. Alexandroupolis will include a floating storage and regasification unit (FSRU) with the ability to transport, store and convert LNG into natural gas. It will also be equipped with a subsea and onshore gas transmission system. The floating terminal will have an incoming LNG transfer rate of 10,000 cubic metres per hour, a storage capacity of 170,000 cubic meters and a maximum regasification capacity of 700,000 normal cubic metres per hour. Regasified LNG will be transported onshore via a gas transmission system consisting of a subsea pipeline and an onshore pipeline. The onshore pipeline will be laid on the coastline of the Apalos area, connecting to the Kipi-Komotini branch of the Greek National Natural Gas System (NNGS) near the Amphitriti village. A new entry station will be built by natural gas operator DESFA near the existing NNGS Alexandroupolis exit station, which is currently being operated by the company.

The new infrastructure is tied to other interconnection projects, such as the Gas Interconnector Greece-Bulgaria (IGB), but also the important gas links between Bulgaria, North Macedonia and Serbia. Through these recent and new projects, these countries will be able to reduce their dependence on Russian natural gas by diversifying their routes and sources of supply.

Apart from the project in Alexandroupolis, another investment to import LNG is scheduled by Greek refiner, Motor Oil, in Corinth, called "**Dioryga LNG**". The annual capacity is projected at 2.5 bcm. It will have a storage capacity of up to 210,000 cubic metres of gas which will be either regasified and exported through Greece's gas grid or sold as LNG via vessels and trucks.

Elpedison, a joint venture by Italy's Edison and Helleniq Energy, plans to build an FSRU off the northern city of Thessaloniki, **"Thessaloniki FSRU**", which is expected to become operational in 2025 and will also use a floating platform. It will have the capacity to store 170,000 cubic metres of gas and deliver up to 20 million cubic meters/day. It would connect to onshore and underwater pipelines with Elpedison's power plants in Thessaloniki, one existing and one under design, as well as with existing pipelines in the area.

Thrace FSRU Terminal is a proposed FSRU terminal for LNG import in the Aegean Sea, off the coast of Greece, promoted by the Greek company Gastrade like the Alexandroupolis LNG Terminal. It will have a storage capacity of 170,000 cubic metres of LNG. It will be able to deliver up to a maximum of 22.7 million cubic meters/day or 5.5 billion cubic meters of natural gas/year. The project will also include an offshore and onshore pipeline system. This will connect the FSRU to the existing gas transmission pipelines. Specifically, the project is to enhance energy security and diversification of gas supply sources and routes in Greece and the entire region of Southeastern Europe. This way it will materially reduce any risk for supply interruption.

Argo FSRU is a proposed FSRU terminal for LNG import in Greece, in the port of Volos promoted by Mediterranean Gas (MedGas) with potential import capacity of 4.6 billion cubic meters/year. It will have a storage capacity of 885,000 cubic meters of LNG. The facility will start operating probably in the first quarter of 2025.

Italy

2

In addition to the six pipeline entry points, natural gas can be imported through three LNG regasification terminals: the Adriatic (or Cavarzere) terminal off the Veneto coast in the north-east; the Panigaglia terminal near Liguria in the north-west; and the Offshore LNG Toscana (OLT) terminal near Livorno on the western coast in Tuscany. The three LNG terminals have a combined technical entry capacity of around 19 billion cubic meters/year.

The Adriatic LNG terminal is Italy's most significant LNG terminal by import capacity. With a regasification capacity of 9 billion cubic meters/year of natural gas (equal to more than half of the national LNG regasification capacity) the Adriatic LNG terminal ensures approximately 12% of national natural gas consumption The two modular LNG storage tanks have a capacity of 125,000 cubic metres each. 80% of the regasification capacity at the Adriatic LNG terminal (6.4 bcm) is reserved for the import of Qatari gas in accordance with a long-term supply contract. The terminal is owned by Adriatic LNG, in which ExxonMobil Italiana Gas has a 71% share, Qatar Terminal Company Limited has a 22% share, and Snam Group has a 7% share. The regasifier is connected to the national gas pipeline network through a pipeline that connects it to the station station in Cavarzere (Venice): from here the gas can be withdrawn by the user - and eventually sold on the market or consumed at its point of consumption - without further infrastructure investment.

The Panigaglia LNG terminal, owned by Snam, is the first LNG regasification facility built in Italy in 1971. It has an annual regasification capacity of 3.5 bcm. The terminal's storage capacity is 100 000 cubic metres. The terminal is limited by an inability to receive the largest LNG tankers, and mostly receives loads from smaller ships operating in the Mediterranean.

The OLT terminal has a 15 mcm/d import capacity, and an annual regasification capacity of 3.75 bcm. The terminal's storage capacity is 155 000 cubic metres. It is owned by Offshore LNG Toscana, in which Snam Group has a 49% shareholding with the remaining shares owned by asset management group, First Sentier Investors.

Italy plans to increase its LNG import capacity as it seeks to completely replace Russian gas supplies following Moscow's invasion of Ukraine. Italy has mandated gas grid operator Snam to buy and set up two additional floating storage and regasification units near the cities of Piombino and Ravenna.

Snam plans to secure a new **FSRU called "Golar Tundra"** in the port of **Piombino** for the next three years, before moving it offshore. The Golar Tundra can operate both as an LNG carrier and as an FSRU. The vessel, built in 2015, has a storage capacity of around 170,000 cubic metres of LNG and a continuous regasification capacity of 5 billion cubic meters/year. In order to maximise its regasification capacity, the vessel will be located in central-northern Italy, close to the areas with greatest gas consumption. The Golar Tundra is expected to start operations as an FSRU during the spring of 2023, subject to completion of authorisation, regulatory processes and the construction of the necessary infrastructure connecting the terminal to the existing gas transport network.

Snam plans to place a **FSRU called "BW Singapore**" some 8 km off the coast of **Ravenna** in the Adriatic Sea. The project involves the mooring of a floating storage and regasification vessel offshore (8.5 km) Ravenna: the BW Singapore, purchased by Snam at the beginning of July 2022. It has a regasification capacity of about 5 billion cubic metres, equivalent to about one-sixth of the amount of natural gas currently imported from Russia, and a storage capacity of 170,000 cubic metres of liquefied natural gas. It will be supplied by other ships at regular intervals, once a week at the most. In order to convey the gas to the point of interconnection with the national gas pipeline network, located approximately 42 km from the mooring point, a connection will be built consisting of an approximately 8.5 km section of pipeline at sea and a completely buried section of approximately 34 km, minimising the use of land. The plant and operations on board the ship will have minimal impacts, which Snam has committed to containing within limits significantly lower than those required by law.

In addition to Piombino and Ravenna, there are other two projects in Sardinia, in Porto Torres and Portovesme.

In November 2022, Snam Rete Gas submitted to Ministry for environmental impact assessment its project for a LNG regasification terminal in Porto Torres, the smaller of the two envisaged by the Virtual Pipeline design for the methanisation of Sardinia. The FSRU plant, with a nominal storage capacity of 25,000 cubic metres, will be installed inside the industrial port of **Porto Torres** and is expected to supply 203 million cubic metres of natural gas. In May 2022, Snam purchased a FSRU (**Golar Arctic**) with a storage capacity of 140,000 cubic metres of gas, which will be installed near the port area of **Portovesme** (in the province of Cagliari).

Plus, there are the two onshore terminals at **Gioia Tauro**, in Calabria, and **Porto Empedocle** in Sicily. These two are old projects that the Italian government is trying to get back into. In March 2022, the Italian energy groups Sorgenia and Iren revived plans to build a 12 billion cubic meters/year LNG import terminal in the southern Italian port of Gioia Tauro. The project was initially developed by LNG MedGas and proposed in 2005. It had received approvals but had remained suspended so far. If accelerated, the project could be commissioning as soon as in 2026. In addition, Enel proposed to revive the Porto Empedocle LNG import project in Sicily, which had also secured approvals but remained suspended. The project, which could have a capacity of 8 billion cubic meters/year, could be operational by 2025.

The framework of fossil projects fundable by the Italian recovery fund is completed with two pipelines. The expansion of Tap, the pipeline that brings gas from Azerbaijan to Europe and arrives in Puglia. And then a project - currently at the feasibility study stage - by Snam and Spain's Enagas to connect Spain to Livorno and bring to Europe the LNG arriving at the many Spanish terminals.

7.3 The electricity-natural gas interaction: power to gas, grid stability and optimization.

Introduction

The interactions of electricity and natural gas sectors across their value chains are widely explored by academics and researchers, but they gained full attention of the European policymakers in context of the transition towards climate neutral Europe in line with the obligations set by the Paris Agreement on Climate Change[112]. There is a wide consensus that climate objectives cannot be achieved if the energy systems continue to develop independently, in parallel vertical value chains, linking specific energy carriers (e.g. electricity, natural gas, coal) with specific end- use sectors (e.g. industry, transport, buildings), without tapping the full potential for optimization.

In its communication "An EU Strategy for Energy System Integration"[113,] the EC defined ***energy system integration*** as "coordinated planning and operation of the energy system 'as a whole', across multiple energy carriers, infrastructures, and consumption sectors" (Figure 121).

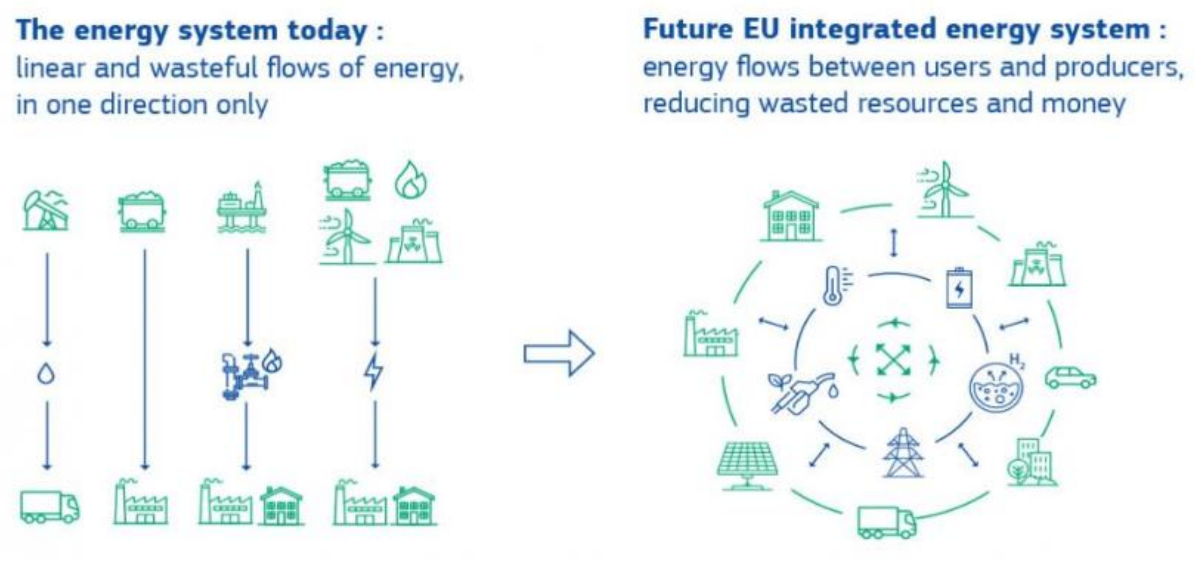


Figure 121 – Energy system integration

Source: European Commission

[112] https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

[113] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2020) 299 *"Powering a climate-neutral economy: An EU Strategy for Energy System Integration"* https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2020:299:FIN

Sector coupling (or sector integration) is defined by EC as *"closely linking the electricity and natural gas sectors, both in terms of their markets and infrastructure"*[114].

Finally, ***power- to- gas*** (P2G) is a subset of power- to- X (P2X[115]) technologies, converting electricity in either hydrogen or (after an additional conversion) synthetic methane (syngas) by electrolysis. Figure 7.3.2 shows the hierarchy of aforementioned integration levels.

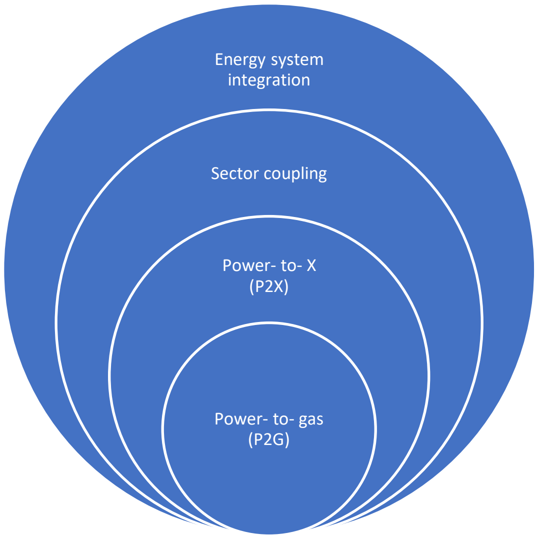


Figure 122 – Energy system integration hierarchy

Source: European Commission

P2G technologies provide an opportunity for multi-factor optimization between electricity, gas and end-use sectors, among others by:

- providing flexibility to electrical networks, by serving as a storage for electricity at times of high renewable generation, absorbing intermittent RES which would otherwise be curtailed
- increasing the share of renewable electricity, and thereby cutting the share of electricity generated by use of fossil fuels in the electricity supply mix
- providing ancillary services and contributing to more efficient congestion management.
- supporting decarbonisation of existing hydrogen end- user sectors by replacing fossil- based hydrogen with green hydrogen
- increasing the share of renewable gases in end- use sectors and replacing natural gas, contributing thereby to the efforts to replace Russian gas in mid-term and achieving net- zero economy until 2050.

P2G- strategic and regulatory framework in the Adriatic-Ionian Region

[114] Conclusions of the 31st Madrid Forum, https://commission.europa.eu/system/files/2018-10/31st_mf_conclusions_final.pdf

[115] P2X refers to technologies converting electricity in other forms of energy, such as heat (P2H), gas (P2G) etc.

A common driver for implementation of P2G technologies in Adriatic-Ionian Region (AIR) countries is the EU strategic and regulatory framework. Namely, four EUSAIR stakeholders (Croatia, Greece, Italy and Slovenia) are EU member states, while the remaining countries (Albania, Bosnia and Herzegovina, Montenegro, Serbia and North Macedonia are candidates for EU membership and Contracting Parties to the Energy Community, an international organization established with the ultimate goal to bring together its' EU and non-EU members in a Pan- European energy market based on EU acquis on energy.

P2G technologies are recognized as important contributor to EU climate objectives, and as such elaborated within the EU strategic and regulatory framework. Although sustainability has been one of the pillars of EU energy policy for decades, the EU Green Deal[116] of 2019 with its ambitious targets – cutting GHG emissions for 55% by 2030 and achieving climate neutrality by 2050 – was a decisive step of the EU towards Paris Agreement objectives. Based on the European Green Deal, the aforementioned EU Energy System Integration strategy and the EU Hydrogen Strategy[117] have been issued by the EC in 2020, supporting clean hydrogen production in Europe and its use as a feedstock (e.g. as an input for production of syngas), fuel or energy carrier and storage. Among others, the Strategy envisages introduction of 40 GW of renewable hydrogen electrolyser capacity, producing up to 5 Mt of renewable hydrogen by 2030[118], together with other EU wide hydrogen infrastructure, such as the EU hydrogen grid and EU hydrogen valleys). These initiatives have been followed by a proposal for larger legislative reform, covering the whole economy (climate, energy, transport, taxation etc), the so called "Fit for 55 Package", announced in the Commission's 2021 Communication "Fit for 55: delivering the EU's 2030 Climate Target on the way to climate neutrality"[119].

Among other legislative proposals, the "Fit for 55 Package" includes the "Hydrogen and gas markets decarbonization package", pursuing climate goals of the EU and simultaneously adapting the energy acquis to expected changes in the composition of gaseous energy carriers on the path towards net-zero economy in 2050 by means of facilitating access of renewable gases to existing gas networks, enabling development of dedicated hydrogen infrastructure and market, fostering planning of electricity, gas and hydrogen networks, promoting consumer protection and participation in renewable gas markets and reinforcing security of supply.

Another important milestone for P2G technologies was entering into force of the revised TEN-E Regulation120 in June 2022, introducing, among others, new infrastructure categories and reconfiguration of priority corridors and areas while strengthening cross- sectoral energy

[116] Communication COM (2019) 640 "The European Green Deal" https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN

[117] Communication COM (2020) 301 "A hydrogen strategy for a climate-neutral Europe" https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0301

[118] This includes an interim target of 6GW of electrolysers, i.e. production of up to 1 million ton of renewable hydrogen by 2024.

[119] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0550&from=EN

[120] Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2022.152.01.0045.01.ENG&toc=OJ%3AL%3A2022%3A152%3ATOC

infrastructure planning. For the first time natural gas projects are not eligible as candidates for projects of common interest (PCI) and Union financing, while hydrogen infrastructure (new and repurposed pipelines, storage etc) and electrolysers above 50 MW with a network related function121 are included among eligible project categories. In addition to that, revised TEN-E Regulation established three priority corridors for hydrogen and electrolysers, including the Hydrogen interconnection in Central Eastern and South Eastern Europe (HI East), involving all EU AIR countries. The regulation allows including into the Union list "projects of mutual interest", i.e. projects promoted by the Union in cooperation with third countries (this was designed with a view to support Energy Community Contracting Parties, including non-EU Adriatic- Ionian countries. It is envisaged that non- EU AIR Countries will implement the revised TEN-E regulation via mechanisms provided in the Energy Community Treaty at the end of 2023, while the first list of PCI/PMI might be adopted by the Energy Community Ministerial Council in mid-2024. Adoption of the revised TEN-E Regulation, and its transposition in the Energy Community acquis opens an opportunity for joint application of project promoters from Adriatic – Ionian countries for inclusion of projects of mutual interest (PMIs) in the Union list, and thereby obtain right for accelerated permit granting, regulatory incentive measures and EU financial assistance in line with the provisions of the revised TEN-E Regulation.

Finally, as a reaction to the Russian war against Ukraine and the global energy crisis, the EC issued communications **"REPowerEU: Joint European Action for more affordable, secure and sustainable energy"**[122] (March 2022) and **"REPowerEU Plan"**[123] (May 2022), proposing actions to *"make Europe independent from Russian fossil fuels well before 2030"* by means of *diversifying energy supplies* (i.e. replacing imports from Russia by commodities provided by other suppliers), *energy savings* and *accelerating clean energy transition*. Regarding P2G technologies, the acceleration of the energy transition is translated in revised targets in comparison to the "Fit for 55" objectives: the renewable hydrogen target is increased from 5.6 million tonnes to 20 million tonnes by 2030, divided in 10 million tonnes of domestic production, and 10 million tonnes of imports. Notably, renewable gases including hydrogen, considered as supplementary in "Fit for 55", are now among key contributors to the European decarbonization effort. Adoption of the "Fit for 55" legislative package, and especially the hydrogen and gas market decarbonization package (comprising of recast Directive on gas markets and hydrogen and the recast Regulation on gas markets and hydrogen) and the revised Renewable Energy Directive (including the revised targets in line with the RePowerEU plan) expected in 2023 will complete the regulatory framework supporting P2X technologies in the EU. Swift implementation of these acts in the Energy Community would create a level playing field also in the Adriatic – Ionian region (together with the already applicable revised TEN-E Regulation), whereby legislative preconditions for effective promotion of regional P2G projects of mutual interest would be met.

Hydrogen developments in the Adriatic – Ionian region (AIR)

Due to the fact that the strategic, legislative and financial framework in EU, supporting EU climate goals (including measures boosting deployment of P2G technologies) and adjusting to new geopolitical

[121] In terms of overall system flexibility and system efficiency of hydrogen and electricity networks.

[122] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN

[123] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN

reality after the conflict in Ukraine is not finalized yet (although in the final phase of preparation before launch in early 2023), planning and implementation of P2G technologies in the region are limited.

EU member states of the AIR have provided their National Energy and Climate Plans (NECP) for the period 2021-2030 in 2019[124] (meaning that Fit for 55 or RePowerEU targets have not been taken into account while developing the NECPs), while only Albania[125] and North Macedonia[126] of the non-EU EUSAIR countries have adopted NECPs within the Energy Community framework. North Macedonia's NECP was adopted in May 2022, but was prepared during 2020 and 2021, therefore Fit for 55 and RePowerEU targets have not been taken into account while developing it. The regional NECPs and other strategic documents do not provide targets on P2G technologies, with the exception of Italy and Croatia.

The Italian "Guidelines for the National Hydrogen Strategy" (2020) forecasts coverage of 2% demand by 2030 with green hydrogen, requiring app. 5GW of electrolysers to be installed. Until 2050 this target shall rise to 20%. The Guidelines also envision the deployment of hydrogen valleys, industrial clusters of concentrated production and consumption, with the view to reduce electricity and hydrogen transportation.

"Hydrogen Strategy of the Republic of Croatia until 2050"[127] has been published in March 2022, taking into consideration the EU Hydrogen Strategy and National Development Strategy of the Republic of Croatia. The Strategy forecasts coverage of 0.2% of demand by 2030 with green hydrogen, requiring app. 70 MW of electrolysers to be installed. Until 2050 this target shall rise to 11%, corresponding to 2.75 GW of electrolysers capacity. Another scenario (accelerated development of a hydrogen-based economy) explores the possibility to install electrolyzers with a capacity of 1.27 GW by 2030 and 7.33 GW by 2050, corresponding to the share of hydrogen in energy consumption of 3.75% by 2030 and 15% by 2050.

There is no information on plans of non-EU EUSAIR states for deploying P2X technologies, or for developing transport and end – use applications; moreover, partial or even non-existing (e.g. Montenegro) gasification in these countries limits the possibility of blending renewable gases into existing networks or repurposing the networks for hydrogen- only use. The hydrogen transport infrastructure map (Figure 123), developed by ENTSOG, GIE, CEDEC, Eurogas, GEODE, GD4S in cooperation with European Hydrogen Backbone with a view to gather all relevant hydrogen infrastructure projects, shows a grey area in the part of AIR comprising of non-EU states.

The new plans for designing and constructing interconnectors for natural gas, connecting North Macedonia with the neighboring countries, including developing gas distribution network take into consideration the necessity to repurpose the gas pipelines for blending hydrogen.

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[124] The EU member states' NECPs of 2019 incorporate targets set by the European Green Deal (updated NECPs, adjusted to more ambitious targets set by the Fit for 55/ RePowerEU, shall be submitted to the Commission by 30th June 2023).

[125] Final NECP published in December 2021

[126] Draft NECP submitted to the Energy Community Secretariat in June 2020

[127] https://mingor.gov.hr/UserDocsImages//UPRAVA%20ZA%20ENERGETIKU//Croatian%20Hydrogen%20Strategy%20ENG%20FIN%2022%208.pdf

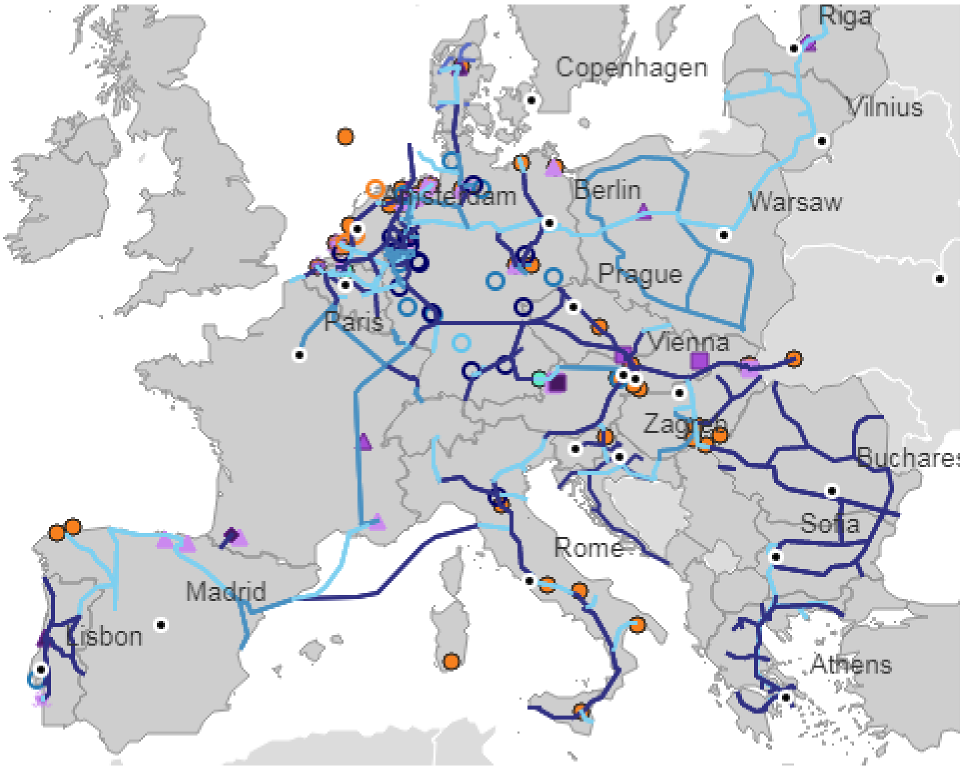

Figure 123 – Hydrogen infrastructure map

Source: ENTSO-E[128]

On the positive side, in December 2022 the Energy Community Ministerial Council adopted targets for 2030 for renewables, energy efficiency and greenhouse gas emissions, aiming to achieve climate neutrality by 2050. This will trigger adjustments in national and regional planning (such as NECPs, TYNDPs, hydrogen strategies, revised TEN-E mechanisms) and legislation and consequently contribute to reducing the gap between the EU and non-EU AIR countries frameworks regarding P2X applications. By establishing a level playing field on the Energy Community level, in mid- term prerequisites will be met for including regional Adriatic – Ionian P2X project in the hydrogen infrastructure map.

Few considerations on P2G impact on the power networks

As per the EU Hydrogen Strategy, *"renewable hydrogen will start playing a role in balancing a renewables-based electricity system by transforming electricity into hydrogen when renewable electricity is abundant and cheap and by providing flexibility. Hydrogen will also be used for daily or seasonal storage, as a backup and provide buffering functions, enhancing security of supply in the medium term."* According to ENTSO-E recent study[129], electrolysers *"can provide a wide range of*

[128] https://www.h2inframap.eu/

[129] "Potential of P2H2 technologies to provide system services"(June 2022), https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-

frequency and non-frequency ancillary services as well as congestion management" and *"accommodate expected VRES curtailment by 2030, thus providing longer-term flexibility to power networks"*. Electrolysers convert electricity in hydrogen (or syngas) providing simultaneously flexibility to the electricity transmission network they are connected to, while produced gaseous fuels can provide further flexibility to the energy system, either on the supply side for peak generation[130] or on the demand side for various end-uses, in particular heat supply, industry and transport.

Deployment of significant capacity of electrolysers (40 GW until 2030) will impact the electric and gas networks in Europe, adding complexity to the efforts to optimize the system as a whole, across several energy vectors. It is clear that such optimization requires finalization and operationalization of the envisaged cross- sectoral planning and financing tools on the EU and Energy Community level (e.g. revised TEN-E, Union – wide TYNDP), regional level (e.g. Gas and Electricity Regional Investment Plans) and national level (e.g. TYNDP, NECPs, national strategies).

documents/Publications/Position%20papers%20and%20reports/ENTSO-E_Study_on_Flexibility_from_Power-to-Hydrogen__P2H2_.pdf

130 Due to a double energy transformation (P2G and afterwards G2P) there are concerns on related efficiency losses

8 Section 8 – Clean fuels for transport to the year 2030

8.1 Overview and description of the EUSAIR countries of the New Policies Scenario and its commitments as compared with the Current Policies Scenario

Present situation and prospects, for biofuels in different countries of Adriatic and Ionian region, will be explored below. Examination of current consumption of biofuels will be complemented with that of the objectives programmed for 2030 by various states, in their official document.

8.1.1 National commitments as reflected in the National energy and Climate Plans (NECPs)

This section will display NCPS transport sector[131] results, as presented by the respective countries in their documents. Presentations and data in various national documents, vary considerably. When both are present, results and commitment of New Policy Scenarios and Current Policy Scenarios, will be presented together.

8.1.1.1 Albania

A draft of the NECP for Albania has been prepared and submitted to the Secretariat of the Energy Community in July 2021. Following the comments and recommendations from the Secretariat of the Energy Community, Albania adopted the NECP for the period 2021-2030 in December 2021.

In the WEM (“with existing measures”) scenario, the NECP foresees the share of RES in overall final energy consumption (FEC) to reach 33.5% in the year 2030. On the other hand, in the WAM (“with additional measures”) scenario, this share would reach 54.9%. For reference, the share of renewables in FEC in Albania, per NECP, in the year 2018 was 37.9%. Considering the transport sector only, RES share in the sector is projected to be 34.6% in the year 2030 (WAM scenario)[132].

In absolute figures, overall FEC in Albania recorded in the recent period, per national energy balance, is presented in the following table. A decrease in overall FEC in 2020, which can be attributed to the start of COVID-19 pandemic, is directly linked to the decrease of FEC in the transport sector.

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[131] In the various NECPs, transport sector refers to the land sector, ie road and rail for passengers and goods.

[132] Source: National Energy and Climate Plan of Albania, https://www.energy-community.org/dam/jcr:a0c2b8a8-96c8-4423-993a-537cf51daa65/Draft_NECP_AL_%202021.pdf.

Final energy consumption in Albania, in ktoe

Final energy consumption / Year	2016	2017	2018	2019	2020
Industry	318.3	413.4	415.7	378.4	387.9
Transport	827.0	828.2	832.1	859.8	627.4
Households, commerce, public authority, etc.	668.9	689.4	710.9	710.4	717.8
of which, households	498.7	484.9	500.2	492.1	527.7
Agriculture	74.0	74.1	80.3	78.6	74.9
Fisheries	29.1	38.5	38.2	40.3	41.3
Other	0.0	22.5	0.0	0.0	0.0
Total	**1,917.2**	**2,069.7**	**2,077.1**	**2,067.1**	**1,848.0**

Table 19 – Final energy consumption in Albania

Source: National energy balance of Albania[133]

The NECP foresees the following developments with FEC in the transport sector until the year 2030.

The distribution of energy sources, i.e. their shares in the transport sector, in the recent years as well as projected until the year 2030 (WEM scenario), is presented in the following table. The share of biodiesel in the energy mix, current as well as projected, is equal to zero according to this scenario.

Shares of energy sources in the transport sector, in % (WEM scenario)

Fuel / Year	2016	2017	2018	2020	2025	2030
Electricity	0.0%	0.0%	0.0%	0.5%	1.7%	4.0%
Gasoline	16.4%	16.4%	16.3%	16.5%	17.4%	18.4%
Diesel	81.6%	81.5%	81.6%	79.7%	75.8%	70.9%
LPG	2.1%	2.1%	2.1%	3.2%	5.1%	6.8%
Hydrogen	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Biodiesel	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 20 – Shares of energy sources in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

The target share of RES in FEC in the transport sector until the year 2030 is summarized in the following table.

Share of RES in FEC in the transport sector, in % (WEM scenario)

Share / Year	2016	2017	2018	2020	2025	2030
RES T	0.1%	0.1%	0.1%	2.5%	8.6%	19.8%

Table 21 – Share of RES in FEC in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

The share of the transport sector in overall FEC, projected until the year 2030 per WEM scenario, is presented below.

[133] Source: Institute of Statistics of Albania, https://www.instat.gov.al/en/themes/environment-and-energy/energy/.

Share of the transport sector in overall FEC, in % (WEM scenario)						
Share / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Transport sector	40.2%	39.3%	39.1%	40.5%	41.9%	43.3%

Table 22 – Share of the transport sector in overall FEC, Albadia

Source: National Energy and Climate Plan (NECP) of Albania

The WEM scenario results in the following projections for FEC until 2030.

Final energy consumption, in ktoe (WEM scenario)						
FEC / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Transport sector	819.4	829.8	822.7	840.2	969.2	1,098.6
Total FEC	**2,039.4**	**2,109.7**	**2,102.1**	**2,076.1**	**2,313.6**	**2,540.0**

Table 23 – Final energy consumption, Albania

Source: National Energy and Climate Plan (NECP) of Albania

Final energy consumption in the transport sector (in the WEM scenario) is further broken down in the NECP, as follows.

Final energy consumption in the transport sector, in ktoe (WEM scenario)						
FEC / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Passenger transport	**558.7**	**568.4**	**560.8**	**593.5**	**663.1**	**740.8**
Rail	0.4	0.3	0.3	0.0	6.2	42.4
Navigation	20.5	20.5	20.5	21.7	24.8	28.3
Motorcycle	2.0	2.0	2.0	2.1	2.4	2.7
Car	501.3	513.0	505.5	535.2	585.2	612.0
Bus	34.5	32.7	32.6	34.5	44.5	55.3
Freight transport	**260.8**	**261.4**	**261.9**	**246.7**	**306.1**	**357.9**
Rail	0.8	1.2	1.2	1.1	1.4	1.7
Navigation	14.9	15.8	16.7	15.8	19.8	23.4
Truck	245.1	244.5	244.0	229.8	284.9	332.8
Total	**819.5**	**829.8**	**822.7**	**840.2**	**969.2**	**1,098.7**

Table 24 – Final energy consumption in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

By applying the WAM (“with additional measures”) scenario, the following shares of energy sources in the transport sector in Albania, in the recent period (2016-2018) as well as projected until the year 2030, are obtained.

Shares of energy sources in the transport sector, in % (WAM scenario)						
Fuel / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Electricity	0.0%	0.0%	0.0%	0.5%	2.2%	5.7%
Gasoline	16.4%	16.4%	16.3%	16.5%	17.4%	18.4%
Diesel	81.6%	81.5%	81.6%	79.7%	71.6%	62.6%
LPG	2.1%	2.1%	2.1%	3.2%	5.3%	7.3%
Hydrogen	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Biodiesel	0.0%	0.0%	0.0%	0.0%	3.5%	6.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 25 – Shares of energy sources in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

Additional measures result in the following evolution of RES share in FEC in the transport sector.

Share of RES in FEC in the transport sector, in % (WAM scenario)						
Share / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
RES T	0.1%	0.1%	0.1%	2.5%	14.4%	34.6%

Table 26 – Share of RES in FEC in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

The share of the transport sector in overall FEC, as well as final energy consumptions in the transport sector and in Albania as a whole, according to WMA scenario, are presented in the following tables.

Share of the transport sector in overall FEC, in % (WAM scenario)						
Share / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Transport sector	40.2%	39.3%	39.1%	40.5%	41.7%	43.1%

Table 27 – Share of the transport sector in overall FEC, Albania

Source: National Energy and Climate Plan (NECP) of Albania

Final energy consumption, in ktoe (WAM scenario)						
FEC / Year	**2016**	**2017**	**2018**	**2020**	**2025**	**2030**
Transport sector	819.4	829.8	822.7	840.2	923.8	1,003.4
Total FEC	**2,039.4**	**2,109.7**	**2,102.1**	**2,072.5**	**2,213.8**	**2,326.9**

Table 28 – Final energy consumption, Albania

Source: National Energy and Climate Plan (NECP) of Albania

The breakdown of FEC in the transport sector, per WMA scenario in the NECP, is presented in the following table.

Final energy consumption in the transport sector, in ktoe (WAM scenario)

FEC / Year	2016	2017	2018	2020	2025	2030
Passenger transport	**558.7**	**568.4**	**560.8**	**593.5**	**645.3**	**688.9**
Rail	0.4	0.3	0.3	0.0	6.2	42.4
Navigation	20.5	20.5	20.5	21.7	24.8	28.3
Motorcycle	2.0	2.0	2.0	2.1	2.3	2.4
Car	501.3	513.0	505.5	535.3	574.2	573.2
Bus	34.5	32.7	32.6	34.5	37.7	42.5
Freight transport	**260.8**	**261.4**	**261.9**	**246.7**	**278.5**	**314.5**
Rail	0.8	1.2	1.2	1.1	1.4	1.7
Navigation	14.9	15.8	16.7	15.8	19.8	23.4
Truck	245.1	244.5	244.0	229.8	257.3	289.4
Total	**819.5**	**829.8**	**822.7**	**840.2**	**923.8**	**1,003.4**

Table 29 – Final energy consumption in the transport sector, Albania

Source: National Energy and Climate Plan (NECP) of Albania

Main actions and commitments of Albania to achieve objectives on RES in transport sector

As of 2020[134], Albania was not compliant with the EU Renewable Energy Directive (RED), in terms that consumed biofuels were not certified for sustainability requirements, and the RED target of 10% for the share of RES energy in gross FEC was not achieved. Other legal documents[135] define the share of RES/biofuels blending in the transport sector of 10%, until the year 2030, but these documents neither provide measures for enforcing the stipulations of the law (e.g. for fuel blending), nor sustainability criteria, nor support mechanisms in the area. In order to achieve compliance with the RED targets by 2030 as well as the targets set by the National Energy Strategy and national legislation in the field, compliance with sustainability requirements has to be secured, and other measures can also contribute to the goal.

Important legislation which is currently in place, regulating the field of transport, is the following:

- National Energy Strategy for the period 2018-2030;
- National Action Plan for Energy Efficiency for the period 2010-2018 (NEEAP);
- 2nd and 3rd NEEAPs for the period 2017- 2020;
- Decision 580/2019 on the Approval of the National Consolidated Action Plan (NCAP) for the RES for the period 2019-2020;

[134] Modalities to foster use of renewable energy sources in the transport sector by the Energy Community Contracting Parties, https://www.energy-community.org/dam/jcr:ab72cdbe-4900-4b8f-906c-3c61e0e7b728/LSBT_RES_transport_122020.pdf.

[135] National Energy Strategy of Albania (2018-2030), https://www.climate-laws.org/documents/national-energy-strategy-2018_7bd0; Law No. 9876 for Production, Transportation and Trade of Biofuels and Other Renewable Fuels for Transport (2008).

- The NECP, adopted in December 2021, complementing the Energy Strategy (2018-2030) and replacing the NEEAP and setting EE/RE targets and measures;
- Albanian Intended Nationally Determined Contribution (INDC) under the Paris Agreement[136]. The Nationally Determined Contribution (NDC) has been drafted in 2021;
- Law No. 9876/2008 for Production, Transportation and Trade of Biofuels and Other Renewable Fuels for Transport, adopted in 2008 and amended in 2014. In May 2023, Albanian government has opened the public consultation process on a drafted new law to promote the production and use of RES for the Transport sector through the use of biofuels for internal combustion engines as a part of the process of aligning with the EU acquis as a part of its path to EU membership[137]. The new law provides more precise guidance on RES targets, including biofuels in the transport sector. Sustainability criteria are also defined in the draft law, as well as the responsible body and methodology for fulfilment of the criteria;
- Law No. 9975/2008 On National Taxes, defining turnover and carbon taxes for gasoline, as well as annual tax on used vehicles and luxury vehicle tax;
- Law no. 61/2012 on Excises (amended several times since), defining excise taxes for various fuel types, including biofuel;
- Law No. 43/2015 on the Power Sector;
- Law No. 124/2015 on Energy Efficiency amended by Law No. 5/2019;
- Law No 7/2017 on the Promotion of the Use of Energy from Renewable Sources; and
- Law No. 155/2020 on Climate Change.

The NECP of Albania for the period 2021-2030, adopted in December 2021, provides a list of policies and measures, both for WEM and WAM scenarios, for the energy sector in Albania as a whole. The target to be reached in the transport sector of Albania in the year 2030 is 14% of RES. Policies and measures in the transport sector in order to reach the target include:

- WEM scenario:
    - Efficiency-based car fees and incentives for fleet renewal (2020-ongoing);
    - Support mechanisms for EE and clean vehicles (2023-ongoing);
    - Increasing the share of public transport for passengers and freight (roads, railways and waterways), (2021-ongoing);
- WAM scenario:
    - Improvement of extra-urban bus network (2020-ongoing);
    - Integrated freight management (2020-2025);
    - Electrification of the transport sector (2021-2030);
    - Sustainable / Advanced biofuels (2021-2030);
    - Energy labelling of new cars (2022-2030); and
    - Increasing the share of Electrical Vehicles in the national car fleet (2023-2030).

[136] https://unfccc.int/sites/default/files/NDC/2022-06/Albania%20First.pdf.

[137] https://www.euractiv.com/section/politics/news/albania-puts-biofuels-law-up-for-public-consultation/.

The NECP provides a detailed description of objectives, expected results, costs, the activities up to date, as well as activities yet to be implemented, for each of the measures listed above.

8.1.1.2 Bosnia and Herzegovina

The NECP for Bosnia and Herzegovina is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the NECP[138]. The development of the draft NECP focused on the refinement of the policy and the reference scenarios, in part to reflect the negotiations on the Energy Community 2030 targets for Bosnia and Herzegovina[139]. The legal basis for the NECP, i.e. climate law and accompanying by-laws, as well as the adoption of the entity energy and climate plans, are still pending.

In April 2023, the NECP for Bosnia and Herzegovina (BiH) for the period until 2030 was publicly presented for the first time at the Energy Summit in Neum (BiH)[140]. In accordance with the undertaken obligations towards the Energy Community, the draft NECP is planned to be submitted to the Energy Community Secretariat by the end of June 2023.

The NECP foresees reaching the share of RES in FEC of 43.62%, with FEC of BiH of 4,340 ktoe.

The NECP also envisages decommissioning of coal-fired TPPs with installed overall capacity of 410 MW, ceasing construction of new coal-fired TPP units and switching of some existing capacities to biomass.

Putting into RES power plants with overall capacity of 2,000 MW is foreseen (1,500 MW of solar PV power plants, and the remaining capacities covered by wind, HPPs and biomass).

Policies and measures listed in the NECP include establishing of organized electricity and natural gas markets, introduction of an emission trading scheme (ETS) in accordance with EU ETS, as well as introduction of guarantees of origin. With the Energy Community Secretariat's support, Bosnia and Herzegovina drafted a roadmap for introducing carbon pricing by the end of 2025.

On the basis of the Decision on the implementation of the Directive 2009/28/EZ, an obligatory target for RES share in FEC of 40% in the year 2020 was set for Bosnia and Herzegovina[141]. In this regard, both entities in Bosnia and Herzegovina (Federation of Bosnia and Herzegovina, and Republika Srpska) have drafted their own Renewable Energy Action Plans, and on this basis together with evaluating the situation in the Brcko District, the RE Action Plan on national level (National Renewable Energy Action

[138] Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

[139] Energy Community – Bosnia and Herzegovina Annual Implementation Report (November 2022), https://www.energy-community.org/dam/jcr:90f246f0-0e7e-469e-8895-d2bc4538ec58/IR2022_Bosnia_Herzegovina.pdf.

[140]https://balkangreenenergynews.com/rs/predstavljen-nekp-za-bih-gase-se-termoelektrane-a-otvaraju-elektrane-na-obnovljivu-energiju-snage-2-000-mw/.

[141] https://www.vladars.net/sr-SP-Cyrl/Vlada/Ministarstva/mper/std/Documents/StrategijaEnergetike2035Latinica.pdf.

Plan – NREAP) was drafted and released in 2016[142]. The data from the NREAP give the following gross FEC, in the transport sector as well as in the energy sector of BIH as a whole.

Final energy consumption in BiH, in ktoe, reference scenario (NREAP, 2016)

Final energy consumption / Year	2016	2017	2018	2019	2020
Transport	985.0	1,017.0	1,048.7	1,090.3	1,129.1
Total	**4,503.0**	**4,588.9**	**4,675.6**	**4,763.0**	**4,851.3**

Table 30 – Final energy consumption, Bosnia and Herzegovina

Source: elaboration on data of Energy Community

Final energy consumption in BiH, in ktoe, scenario with additional EE measures (NREAP, 2016)

Final energy consumption / Year	2016	2017	2018	2019	2020
Transport	947.9	975.9	1,004.4	1,042.8	1,081.2
Total	**4,248.8**	**4,290.1**	**4,331.7**	**4,372.3**	**4,407.7**

Table 31 – Final energy consumption, Bosnia and Herzegovina

Source: elaboration on data of Energy Community

In the above tables, the reference scenario considers the current situation, and application of additional EE measures results in decreased energy demand.

Analyses performed in the scope of the study for the Energy Community[143] (2020), based on data collected during the preparation of the study and data from the preliminary draft of the NECP, released the following FEC in the transport sector and in the country as a whole. Both the data from the recent years as well as projection until 2030 is included.

Final energy consumption in BiH, in ktoe (EC Study, 2020)

Final energy consumption / Year	2016	2017	2018	2020	2030
Transport	1,196.9	1,248.9	1,248.9	1,187.3	1,244.8
Total	**3,543.9**	**3,498.2**	**4,211.9**	**4,265.0**	**4,388.0**

Table 32 – Final energy consumption, Bosnia and Herzegovina

Source: elaboration on data of Energy Community

The trajectories of the share of the transport sector in FEC are presented in the following table.

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142 https://www.energy-community.org/dam/jcr:ef59bc5d-a6c3-48a8-9653-2a40e5721d58/NREAP_2016_BH.pdf.

143 Modalities to foster use of renewable energy sources in the transport sector by the Energy Community Contracting Parties, https://www.energy-community.org/dam/jcr:ab72cdbe-4900-4b8f-906c-3c61e0e7b728/LSBT_RES_transport_122020.pdf

Share of the transport sector in overall FEC, in %

Share / Year	2016	2017	2018	2020	2030
EC Study, 2020	33.8%	35.7%	29.7%	27.8%	28.4%
NREAP (2016)	21.9%	22.2%	22.4%	23.3%	n/a

Table 33 – Share of the transport sector in overall FEC, BIH

Source: elaboration on data of Energy Community

The Fourth Annual Report under the EE Directive[144], prepared by the Ministry of Foreign Trade and Economic Relations of BiH in August 2020, provides the following trajectories for FEC until the year 2030. The reference scenario is the scenario with existing measures, while the remaining scenarios refer to application of sets of additional measures.

Final energy consumption in BiH, in ktoe (Fourth Annual Report under the EED, 2020)

Final energy consumption / Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Reference scenario	4,445.0	4,505.0	4,565.0	4,626.0	4,687.0	4,747.0	4,807.0	4,866.0	4,927.0	4,987.0	5,046.0
Light scenario	4,311.0	4,343.0	4,374.0	4,406.0	4,438.0	4,468.0	4,498.0	4,528.0	4,557.0	4,587.0	4,615.0
Moderate scenario	4,249.0	4,264.0	4,280.0	4,295.0	4,311.0	4,324.0	4,338.0	4,351.0	4,364.0	4,377.0	4,388.0
Ambitious scenario	4,188.0	4,193.0	4,198.0	4,202.0	4,207.0	4,210.0	4,212.0	4,214.0	4,216.0	4,218.0	4,218.0

Table 34 – Final energy consumption, BIH

Source: elaboration on data of Energy Community

The share of the transport sector in total FEC, projected to the period until 2030, is presented in the following table.

Final energy consumption in BiH, moderate scenario, in ktoe (Fourth Annual Report under the EED, 2020)

Final energy consumption / Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Transport sector	1,184.0	1,197.0	1,211.0	1,225.0	1,239.0	1,251.0	1,264.0	1,276.0	1,288.0	1,301.0	1,312.0
Overall FEC	4,249.0	4,264.0	4,280.0	4,295.0	4,311.0	4,324.0	4,338.0	4,351.0	4,364.0	4,377.0	4,388.0
Share of transport sector in overall FEC	27.9%	28.1%	28.3%	28.5%	28.7%	28.9%	29.1%	29.3%	29.5%	29.7%	29.9%

Table 35 – Final energy consumption, BIH

Source: elaboration on data of Energy Community

The shares of different fuels in the transport sector of BiH are summarized below. The contribution of RES, i.e. biodiesel, in the sector is negligible, far below the target for 2020 of 10%, set by the NREAP and the obligations towards the Energy Community[145].

[144] https://www.energy-community.org/dam/jcr:85df90e4-fcb0-45a5-a1c8-bbaef35e2aed/BiH_4thEED%20_AR_082020.pdf.

[145] https://www.energy-community.org/dam/jcr:3706068e-9a3d-47d5-ae22-f7af0bbd1097/EnC_IR2022.pdf.

Shares of energy sources in the transport sector, in % (EC Study, 2020)

Fuel / Year	2016	2017	2018	2020	2030
Electricity	0.5%	0.5%	0.5%	1.0%	6.4%
Gasoline	17.6%	16.0%	22.1%	21.1%	17.1%
Diesel	77.6%	78.2%	76.0%	76.1%	69.4%
LPG	4.3%	5.2%	1.5%	1.2%	n/a
Biodiesel	0.0%	0.0%	0.0%	0.6%	7.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 36 – Shares of energy sources in the transport sector, BIH

Source: elaboration on data of Energy Community

The breakdown of FEC in the transport sector is presented in the following table.

Final energy consumption in the transport sector, in ktoe

FEC / Year	2016	2017	2018	2020	2030
Rail	6.3	6.5	5.1	55.6	111.0
Navigation	0.0	0.0	0.0	0.0	0.0
Car	803.8	787.5	771.6	790.4	752.6
Bus	17.1	18.3	19.4	22.1	31.9
Freight transport	315.0	315.4	316.1	319.2	349.3
Other	54.7	121.2	136.8	0.0	0.0
Total	**1,196.9**	**1,248.9**	**1,248.9**	**1,187.3**	**1,244.8**

Table 37 – Final energy consumption in the transport sector, BIH

Source: elaboration on data of Energy Community

Main actions and commitments of Bosnia and Herzegovina to achieve objectives on RES in transport sector

As per Energy Community's Annual Implementation Report (November 2022)[146], provisions of the RED related to the sustainability of biofuels are still not transposed into BiH legislation, and the legal framework remains completely non-compliant with Directive 2009/28/EC. As already indicated above, the share of RES in transport is far below the objective for 2020 of 10%. The EC report recommends the following measures on the legislative and strategic levels to be applied:

- Adoption of amendments to the renewables law to transpose and implement Directive (EU) 2018/2001, in the Federation of Bosnia and Herzegovina;
- Proceeding with adoption of secondary legislation and implementation of first renewables auctions in the Republika Srpska;
- Simplification of permitting procedures in both entities;

[146] https://www.energy-community.org/dam/jcr:90f246f0-0e7e-469e-8895-d2bc4538ec58/IR2022_Bosnia_Herzegovina.pdf.

- Entity bodies designated to issue guarantees of origin should sign direct agreements with the service provider and start using the electronic registries;
- Adoption of the law on climate;
- Adoption of entity level NECPs and the draft national NECP by June 2023, which seems to be following the schedule.

Important legislation which is currently in place, regulating the field of transport and energy, is the following:

- Entity/district level:
    - Federation of BiH (FBiH):
        - Law on energy efficiency in FBiH (Official Gazette of FBiH – OG FBiH – 22/17),
        - Law on the Use of Renewable Energy Sources and Efficient Cogeneration (OG FBiH 70/13, 5/14),
        - Law on Petroleum Products of FBiH (OG FBiH 52/14),
        - Framework Energy Strategy of FBiH until 2035 (2018),
        - Energy Efficiency Action Plan (EEAP FBiH) for the period 2019-2021;
        - Action Plan for RES utilization (2014);
    - Republika Srpska (RS):
        - Law on Energy (49/09, amendments 16/23),
        - Law on Energy Efficiency (59/13),
        - Law on RES (16/22),
        - Law on fuel oil and petroleum products (36/09, amendments 102/12),
        - Energy Strategy of RS until 2035 (2018),
        - Action Plan for RES utilization (2014),
        - Energy Efficiency Action Plan until 2018 (2013);
        - Energy Efficiency Action Plan (EEAP RS) for the period 2019-2021;
    - Brčko district (BD):
        - Law on RES and efficient cogeneration of BD in BiH (OG BD 22/22), and
        - Law on energy efficiency in BD in BiH (OG BD 25/22).
- National level:
    - Framework Energy Strategy until 2035 (2018),
    - National Energy Efficiency Action Plan 2016-2018 (NEEAP) – adopted in 2017, and
    - NEEAP for the period 2019-2021.

The NECP is being drafted, and its submission to the EC Secretariat is expected in June 2023.

Currently, in BiH there are no incentive programs for using RES in the transport sector. The NREAP (2016) envisaged establishing of the Program of promotion of utilizing biofuels on the national (BiH) level, through supporting imports of source material for biofuels, as well as through tax exemptions.

In FBiH, the „Decree on types, content and quality of biofuels in motor vehicle fuels“ has been in place since 2008. This Decree stipulates biofuel types and their parameters, as well as the portion of biofuels and monitoring, as well as suppliers' obligations. The Law on the Use of RES and Efficient Cogeneration has announced amendments to the Decree to cover lacking elements.

Currently in FBiH there aren't any subsidizing/incentive schemes for biofuels which satisfy the RED criteria.

In RS, the Decree on types, content and quality of biofuels in moto vehicle fuels has been in place since 2007. This Decree defines the average annual content of biofuels in all motor vehicle fuels which circulate in RS, throughout the years.

Considering that the defined goals in the field have not been achieved with the Decree, in accordance with the Law on RES and efficient cogeneration, a new Decree on the types, content, quality and portion of biofuel in transport has been adopted in 2016.

Currently in RS there are no incentive schemes in accordance with the RED criteria.

Further steps in the field may include amendments to the national laws on excise and duty taxes and their harmonization with the RES utilization policies.

Finally, further measures on national level in BiH may include:

- Introducing obligations (and their enforcement) for renewable fuels in transport,
- Establishing sustainability framework for all RES fuels,
- Increasing RES in electricity and transport sectors,
- Developing strategies for moving towards electric and hydrogen-based transport, and gradual increasing of these types of transport,
- Developing the infrastructure for electric charging and refuelling of vehicles with hydrogen, and
- Introducing financial support mechanisms to fuel producers and vehicle fleet operators towards increasing the share of RES in the transport sector

8.1.1.3 Croatia

Croatia's NECP expects, by 2030, an increase to 13.2% of weight RES on energy consumption in transport sector, compared to 5.2% in 2020.

In absolute terms, final target would be 156 ktoe: 85% from biofuels and 15% from RES electricity for transport.

Estimated contribution of RES in transport sector, kTOE	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Final RES NECP target	**68,4**	**70,9**	**74,5**	**78,6**	**84,00**	**91,2**	**98,5**	**107,7**	**119,6**	**135,2**	**156,00**
Biofuels	56,9	58,3	60,6	63,6	67,8	73,8	79,9	88,0	98,7	113,1	132,7
Electricity from RES	11,4	12,6	13,8	15,0	16,2	17,4	18,6	19,7	20,9	22,1	23,3
RES Target Share in transport NECEP %	5,2%	5,4%	5,7%	6,0%	6,5%	7,1%	7,7%	8,6%	9,7%	11,2%	13,2%
Final RES Existing measures	**68,4**	**70,8**	**72,8**	**75,7**	**78,8**	**52,1**	**85,6**	**89,2**	**93,1**	**97,3**	**101,8**
Biofuels	56,9	58,3	59,2	61,1	63,2	65,5	67,9	70,5	73,3	76,4	79,9
Electricity from RES	11,4	12,5	13,5	14,6	15,6	16,7	17,7	18,8	19,8	20,9	21,9
RES Target Share in transport with existing measures %	5,2%	5,3%	5,5%	5,7%	5,8%	6,0%	6,2%	6,4%	6,7%	7,0%	7,3%

Table 38 – Estimated contribution of RES in transport sector, Croatia

Source: Consultant's elaboration on NECP data

Forecast based on existing policies foresee an incidence of RES to 7.3% on the total consumption of the transport sector by 2030, for a total of 102 ktoe. In this case, 78% of the contribution could come from biofuels and 22% from RES electricity.

Between 2020 and 2030, in NECP Scenario, consumption of RES for transport will rise by 2.3-fold in absolute terms, while with the existing measures it will rise by 1.5-fold.

Main actions and commitments of Croatia to achieve objectives on RES in transport sector

These are initiatives that government will develop in the sectors concerned, to achieve the desired goals for RES in transport sector in 2030.

Croatia will stimulate use of additional renewable energy production, and will develop of framework for production of RES.

Promote clean and energy efficient vehicles in road, in particular electrics cars and electric commercial vehicles. Amendments to the Building Act are currently underway to address the adoption and implementation of the new Long-Term Strategy of Renovation of the National Building Stock by 2050, promoting **electromobility** through the installation of infrastructure for charging electric vehicles in buildings and on parking lots adjacent to buildings and others public stations.

Will be carried out an analysis and exploration of scenario for meeting share of **advanced biofuels** by 2030 through development of technological capacities that have the highest value added and multiplier effect on the domestic economy. The aim is to identify possible capacities with **domestic production** sites, based on availability of raw materials and technological capabilities (existing and possible) and to identify stakeholders, needs and barriers to development of the advanced fuel market.

Development of Plan for production and use of **biofuels in transport**. The plan will set out a policy to promote the production and use of advanced biofuels in transport in the Republic of Croatia. Plan will include a review of state of biofuels market, new business models, stakeholders, measures to promote increased production and use of advanced biofuels in transport, and a trajectory to achieve the goal of advanced fuels in transport by 2030.

The measures prescribed by the plan will include measures aimed at the production of **advanced biofuels** from raw materials under Part A of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, measures for the use of advanced biofuels, R&D measures, market strengthening, administrative measures. The plan will help attract the announced investments for a zero-pollution Europe.

Establishment of a model for the promotion and development of the advanced biofuel transport market by the Ministry, including the establishment of financial support through existing programmes (e.g. Rural Development Programme, HAMAG-BICRO, BBI JU) for advanced biofuel projects. These programs will be coordinated and financed by the ministers of agriculture, economy and finance

8.1.1.4 Greece

According to National Energy and Climate Plan, Greece will record relatively stable energy consumption for transport sector, between 2020 and 2030: from 6997 ktoe in 2020 to 7066 ktoe in 2030 (+1%)

Regarding transport sector, NECP reports a target of 19%[147] in 2030 for the contribution of RES, on total energy consumption of same sector. This means that in 2030, 1343 ktoe of RES would be consumed in Greece by transport: that is 19% of 7066 ktoe.

Greece, Final Energy Consumption in Transport Sector by 2030 based on the objectives achievement Scenario, kTOE

	2020	2022	2025	2027	2030
Transport Total Energy Consumption	**6.997**	**7.108**	**7.163**	**7.121**	**7.066**
Petroleum Products	6.723	6.810	6.780	6.691	6.439
Bioenergy	228	238	283	287	371
Natural Gas	28	32	42	57	102
Electricity	18	28	58	86	154
RES target Share in final consumption for transport %	**6,6%**	**7,0%**	**10,0%**	**12,0%**	**19,0%**
RES target Share in final consumption for transport kTOE	**462**	**498**	**716**	**855**	**1.343**

Table 39 – Final energy consumption in transport sector, Greece

Source: Consultant's elaboration on NECP data

Then is given a substantial stability in consumption in Grecian transport sector between 2020 and 2030, as indeed in most European countries, while contribution of biofuels and renewable electricity for transport should increase considerably, in this decade.

[147] Calculation criteria of RED II directive (UE 2018/2001)

Those just described are the objectives to be achieved by Greece. But in Greece NECEP itself there are different forecasts with respect to objectives. In these data, contribution of bioenergy is expected to substantially double, from 233 ktoe in 2020 to 465 ktoe in 2030: 80% biofuels and 20% Electricity from RES.

It should be noted that only in event that in 2030 all transport biofuels will be of advanced kind (thus benefiting of multiplier 2) objective of 19% of renewables in transport consumption will be (substantially) respected. Of course, remembering too that RES multiplier of electricity from transport is 4.

In this forecast, biofuels are expected to rise 63% to 371 ktoe. This quantity includes part of advanced biofuels, in accordance to EU directive 2018/2001, of 197 ktoe in 2030.

Consumption of RES in electricity for transport will greatly increase: from 5 ktoe in 2020 to 94 TOE in 2030, thanks to the expected increase in electric cars (PHEV and BEV): from 315 EV in 2018 to forecast of 270 thousnd-340 thousand electric cars in use in 2030, estimated on Greek NECEP data on annual car purchased from 2018 to 2030.

Greece, RES contribution in the transport sector, kTOE

	2020	2022	2025	2027	2030
Biofuels	228	238	283	287	371
Electricity from RES	5	11	27	46	94
Biofuels + Electricity from RES	233	249	310	333	465
Consumption advanced Biofuels (in accordance with Directive EU 2018/2001	81	94	127	127	197

Table 40 – RES contribution in the transport sector, Greece

Source: Consultant's elaboration on NECP data

Main actions of Greece to achieve objectives on RES in transport sector

These are initiatives that government will develop in the sectors concerned, to achieve desired goals in 2030.

Electrification of private mobility sector will contribute to higher RES in energy transport consumption and very strong reduction of pollutant emissions, in intentions of government. Greece NECEP considers most important problem for electric cars diffusion the high initial cost of EV and then the cost of charging infrastructure. But regarding this question, Greece NECEP says that in period up to 2025 the cost of purchasing of EV will reduce, forecast based on estimates of global automotive industry. Greek NECEP forecast for 2030, a 24%-30% share of electric passenger vehicles in new registration. This objective is judged by NECEP "ambitious but also realistic".

Naturally, complementary to electrification of transport, will be the objective to cover domestic electricity production mainly from RES.

Expansion of electric mobility will be sustained by an efficient package of measures and policies to increase number of EV purchased. Greek NECEP reminds generous incentives from Great Britain, Sweden, Norway and the Netherlands, which make EV less expensive for consumer; these incentives are seen as benchmarking for policies that Greece could implement. A combination of these initiative could be applied in Greece too.

Economic Incentives could be realized in market price subsidy, reduced registration and use costs by tax exemptions, special pricing in in insurance, reduced tolls.

Use Related Incentives are instead: free entry in major cities, free parking everywhere, state supporting for set up electricity recharging network, etc.

General national policy for promoting electromobility is initially drawn up in five directions: expanding 'purchase base' of Greek market by modifying consumer identity (profile); facilitate the replacing older vehicles with clean BEVs and PHEVs; increasing existing 0.33% share of electric vehicles in the Greek market to at least 8.7% of new registrations in 5 years (2020-2024); developing a new user environment in terms of infrastructure and benefits (incentives); providing general public with information by organising communication programmes.

Greece will promote use of Greek raw materials for **biofuel production** and support domestic biodiesel producers. The use of advanced biofuels will be promoted, while that of traditional biofuels will be limited. Regulatory framework needs to be revised, to render further exploitation of biodiesel compatible with promotion of advanced biofuel and reduction of conventional biofuels, in line with EU directives. Domestic production of advanced biofuel will be supported through development of support scheme and specific financing tools.

Will be also implemented **biomethane** production from organic waste, for feeding in gas network or used in motor vehicles in natural gas replacement or mixed to natural gas. Licensing process should be instituted in order to allow implementation of bio-methane production plants, with aim of achieving the greatest possible substitution of natural gas from domestically produced and renewable biomethane. As biomethane is produced using low-cost materials and organic waste for the purpose of producing high-value gas fuel, this priority will contribute to more efficient waste management.

Greece needs the creation of domestic **bioethanol** market, by enhancing conventional bioethanol (derived from agricultural food items as corn, wheat, beet, according to sustainability criteria), and support the **advanced bioethanol** from residual of biomass and waste as well as non-food crops. Relevant support measures concern bioethanol or bioethers blending with conventional transport gasoline, and also a provision to introduce cellular (advanced) bioethanol with specific low blending rates.

8.1.1.5 Italy (EUSAIR Regions)

Italy (EUSAIR Regions) NCPS, regarding biofuels and electricity related to transport sector, provides as a contribution from renewable energies for transport sector of 3775 ktoe in 2030, from 1039 ktoe in 2017. This contribution will be provided by biofuels and renewable electricity for cars and trains.

This share is obtained according to calculation criteria of RED II directive (UE 2018/2001), ie by applying multipliers to the physical entities of different types of biofuels or to different destinations of electricity from renewable sources for transport.

Italy (EUSAIR Regions), RES in transport sector by 2030 New Policy Scenario, kTOE

	Multiplicative coefficient	2016	2017	2022	2025	2030
Numerator		**1.283**	**1.039**	**2.100**	**2.591**	**3.776**
Advanced Biofuel	2	6	4	246	434	660
- of which Biomethane	2	0	0	173	319	495
- of which Others Biofuels	2	6	4	73	115	165
Biofuels double counting not advanced	2	477	218	419	393	356
Biofuels single countig	1	165	439	443	409	443
Renewable share of electricity on the road	4	1	1	34	79	252
Renewable share of rail electricity	1,5	97	99	127	142	195
Denominator (Total Transport Energy Consumption)		**19.793**	**18.940**	**19.129**	**18.003**	**17.143**
Share RES % RED II		**6,5%**	**5,5%**	**11,0%**	**14,4%**	**22,0%**

Table 41 – RES in transport sector, Italy (EUSAIR Regions)

Source: Consultant's elaboration on NECP data

In New Policy Scenario, first generation biofuels would physically weigh 23% in 2030; application of coefficients (to other fuels) reduces their weight to 12% on total RES (legal) consumption of transport sector (3776 ktoe). RES component of electricity for road transport would physically weigh 13%, but with application of multiplicative coefficient (4), its legal contribution rises to 27%.

NECP legal target of 3776 ktoe (22%) is almost double that of Current Policy Scenario (CPS) of 2110 ktoe (11,3%), recalled by NECP itself. Most important difference concerns the renewable share of electricity on the road, which in the NECP is about 10 times higher than that of CPS: 1008 ktoe in front of 100 ktoe.

Italy (EUSAIR Regions), RES in transport sector by 2030 Current Policy Scenario, kTOE

	Multiplicative coefficient	2020	2025	2030
Numerator		**1.773**	**2.026**	**2.110**
Advanced Biofuel	2	120	184	202
Biofuels double counting not advanced	2	437	418	406
Biofuels single countig	1	466	604	570
Renewable share of electricity on the road	4	4	6	25
Renewable share of rail electricity	1,5	117	130	151
Denominator		**19.880**	**19.254**	**18.654**
Share RES % RED II		**8,9%**	**10,5%**	**11,3%**

Table 42 – RES in transport sector, Italy (EUSAIR Regions)

Source: Consultant's elaboration on NECP data

It should be noted that the scenario with current policies foresees a higher consumption of energy by the transport sector (18654 ktoe against 17143 ktoe of the scenario with new policies), against a lower use of RES.

Main actions and commitments of Italy to achieve objectives on RES in transport sector

These are direct initiatives that government will develop in the sectors concerned, to achieve the desired goals for biofuels in 2030.

Setting **targets for biofuels** in blending for petrol, diesel and possibly methane; introduction of hydrogen from renewable sources and possibly recycled carbon fuels in the list of biofuels and fuels that can be used for the purpose of the obligation; setting maximum limits for first generation biofuels; facilitate the use of pure advanced biofuels.

For **first generation biofuels**, a decreasing contribution must be foreseen, up to around 3%; possibility of introducing lower limits for some types of biofuels will be evaluated, with particular reference to those that could generate an impact of indirect land use change. Starting from 2023, this sub-target will have to be distinguished between petrol and diesel, even with different contributions, and possibly methane.

For **advanced biofuels**: it is expected to exceed the specific target set by the Directive, equal to 3.5% by 2030, until a sub-target of around 8% is reached. Advanced bioethanol supply chain will be promoted. Objective of advanced biofuels will be reached, as a guide, for 75% through advanced biomethane (0.8 Mtoe) and for 25% through other advanced biofuels (0.26 Mtoe), without prejudice to any changes in distribution resulting from the actual availability and affordability of different types of advanced biofuel.

The production increase of advanced **biomethane** will be possible above all due to the greater availability of raw materials, such as industrial and agricultural waste and residues, algae and other non-food crops. Agricultural production efficiency will be improved, reducing costs across the entire supply chain and recovering and fertilizing currently uncultivated areas: reducing supply chain costs is essential to make advanced biofuels more competitive. In addition, research and development activities in the algae sector and in all technologies for converting biomass into advanced biofuels will be strengthened. The construction and operation of biomethane production plants will be encouraged, promoting investments in this field. Biomethane advanced by Forsu and agricultural waste confirms the target of 1.1 billion m3 by 2030 for the road transport sector. It is also planned to implement measures to promote the use of biofuels in the railway, aviation and maritime sectors, which also include the use of renewable gases (to tend hydrogen).

With regard to biofuels deriving from **used vegetable oils and animal fats**: an increase of up to a maximum of 2.5% is proposed, with a final contribution of up to 5% (with double counting); the objective will be achieved with used vegetable oils and must foresee priorities for UCO collected on the national territory, respecting the principle of circular economy and in line with the new objectives of the waste package. UCOs have great potential in the production of biodiesel and HVO (hydrotreated vegetable oil) for blending with fossil diesel. Measures will therefore be adopted to facilitate the collection of UCOs and their transformation into biofuels.

Electricity from RES in the road sector: foresee a progressive increase, of new registrations of pure electric cars to reach the cumulative goal of about 4 million pure electric cars (BEV) [148] on the road by 2030 and 2 million of PHEV, for 6 million total of EV. Purchase of electric vehicles will be supported with incentives to the purchase price and non-economic facilitations such as the possibility of freely circulating the areas and in periods forbidden to heat engines, ease of parking, national and local policies for the spread of recharging networks, etc.

A realistic contribution is expected for **hydrogen** by 2030, around 1% of the RES-Transport target, through direct use in cars and buses as well as in hydrogen trains (for some non-electrified routes) or through injection in the methane network, as, within certain mixing thresholds (according to some studies 5-15%), it is possible to exploit the existing infrastructures without particular interventions. The promotion of the production and use of hydrogen produced from renewable electricity is envisaged, which reduces emissions and allows the storage of excess renewable electricity generated when supply exceeds demand.

Recycled fossil (example: plastics collected separately or fuel obtained from recovery of CO2 from steel mills). The refining industry is developing alternative solutions for the landfill and incineration of waste and plastic residues. One of the technologies under development is anaerobic thermal pyrolysis for the production of thermal cracking oil to be used in refineries as a partial replacement for crude oil. Regulatory tools will be explored to promote synergies between the refining industry and the treatment of waste from a circular economy perspective.

The NECP provides for the introduction or strengthening of indirect existing initiatives to support clean fuels. More important initiatives are: progressive ban on circulation for more polluting cars, obligation to purchase alternative fuel vehicles for the Public Administration, incentives to purchase more efficient vehicles with lower climate-altering emissions, in particular promoting electric vehicles and recharge infrastructures, which in turn strengthen the electricity produced from renewable sources

8.1.1.6 Montenegro

The NECP for Montenegro is under preparation. By July 2021, the Secretariat of the Energy Community had provided informal comments to the preliminary draft of the NECP[149]. As per obligation towards the Energy Community, the draft NECP should be submitted by 30/06/2023. Preparation of the NECP is incorporated into Montenegrin legislation, through the Energy Law[150]. In accordance with the Energy

[148] Plug In Hybrid Electric Vehicles (PHEV); Battery Electric Vehicle (BEV).

[149] Energy Community website (https://www.energy-community.org/implementation/package/NECP.html).

[150] Official Gazette of Montenegro (OG ME) 5/2016, 51/2017 and 82/2020.

Law, monitoring of NECP implementation is performed by the line Ministry[151], which prepares biennial progress reports.

Prior to the NECP, Montenegro has prepared the following strategic documents in the field of RES:

- Energy Sector Development Strategy of Montenegro until the year 2030[152] (issued in 2014), and
- National Renewable Energy Action Plan until 2020[153] (also delivered in 2014).

The Energy Sector Development Strategy of Montenegro until the year 2030 envisages the following FEC, in the transport sector, as well as overall.

Final energy consumption, in ktoe (Energy Sector Development Strategy of Montenegro until 2030), in ktoe

FEC / Year	**2015**	**2020**	**2025**	**2030**
Transport sector	224.8	270.6	314.3	342.1
Total FEC	**768.7**	**874.9**	**1,005.7**	**1,107.8**

Table 43 – Final energy consumption, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

The figures in the table below refer to the reference scenario, with measures as they have been defined at the time of preparation of the Energy Strategy.

The share of the transport sector in overall FEC is summarized below.

Share of the transport sector in overall FEC, in % (Energy Sector Development Strategy of Montegro until 2030)

Share / Year	**2015**	**2020**	**2025**	**2030**
Transport sector	29.2%	30.9%	31.3%	30.9%

Table 44 – Share of the transport sector in overall FEC, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

The national RES target (RES share in total gross FEC) of 33% (in the year 2020) has been determined for Montenegro in accordance with the Decision 2012/04/MC-EnC of the Energy Community Ministerial Council (18/10/2012). The Decision obliged Montenegro to transpose the RED into Montenegrin legislation. The target set for the RES share in FEC in the transport sector is 10.2% in the year 2020.

[151] Ministry of Capital Investments – Energy Directorate.

[152] https://wapi.gov.me/download/eac811f8-4b13-46ce-97c4-412b8d1ebb8a?version=1.0

[153] https://wapi.gov.me/download/6d8db09e-a2b1-4e4a-bf98-42c39a0b3299?version=1.0.

Final energy consumption figures in Montenegro, per data presented in the NREAP, are summarized in the following tables.

Final energy consumption in Montenegro, in ktoe (NREAP, 2014 - Reference scenario)

Final energy consumption / Year	2016	2017	2018	2019	2020
Transport	217.8	229.1	236.1	308.0	239.6
Total	**949.8**	**979.8**	**1,008.8**	**1,052.6**	**1,080.1**

Final energy consumption in Montenegro, in ktoe (NREAP, 2014 - With additional measures)

Final energy consumption / Year	2016	2017	2018	2019	2020
Transport	199.0	206.4	209.8	213.5	215.7
Total	**907.6**	**929.6**	**950.7**	**984.3**	**1,002.5**

Table 45 – Final energy consumption, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

In the above tables, the reference scenario considers the current situation, and application of additional EE measures results in decreased energy demand.

The share of the transport sector in overall FEC, as stated in the NREAP, is presented in the following table.

Share of the transport sector in overall FEC, in %

Share / Year	2016	2017	2018	2019	2020
NREAP - reference scenario	22.9%	23.4%	23.4%	29.3%	22.2%
NREAP - with additional measures	21.9%	22.2%	22.1%	21.7%	21.5%

Table 46 – Share of the transport sector in overall FEC, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

The data on FEC and RES shares from the NREAP, presented above, are merely projections/forecasts. The Fourth Progress Report on the implementation of the NREAP[154] for the period 2018-2019 (issued in 2021) states that, while the overall RES share in FEC is around 39% (39.75% in the year 2018, 38.69% in 2019), the RES share in FEC in transport (RES-T) remains very low (1.66% in 2018, 1.71% in 2019), well below the target of 10.2%. The actual contributions of RES in the transport sector (RES-T) were 3.96 ktoe in 2018, and 4.27 ktoe in 2019, all of it referring to renewable electricity in non-road transport.

The shares of different fuels in the transport sector of Montenegro in the recent years are summarized below[155]. In 2018, the contribution of RES, i.e. biodiesel, was zero.

[154] https://www.energy-community.org/dam/jcr:0afbaf84-7d13-4ac3-9cc8-72f529514135/MO_RES_PR_2018-2019_072021.pdf

[155] Modalities to foster use of renewable energy sources in the transport sector by the Energy Community Contracting Parties, https://www.energy-community.org/dam/jcr:ab72cdbe-4900-4b8f-906c-3c61e0e7b728/LSBT_RES_transport_122020.pdf.

Shares of energy sources in the transport sector, in % (EC Study, 2020)			
Fuel / Year	**2016**	**2017**	**2018**
Electricity	0.8%	0.7%	0.7%
Gasoline	17.1%	16.0%	14.3%
Diesel	78.0%	79.3%	81.4%
LPG	4.1%	3.9%	3.7%
Hydrogen	0.0%	0.0%	0.0%
Biodiesel	0.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**

Table 47 – Shares of energy resources in the transport sector, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

The breakdown of FEC in the transport sector is presented in the following table.

Final energy consumption in the transport sector, in ktoe			
FEC / Year	**2016**	**2017**	**2018**
Rail	1.8	1.7	1.7
Road	214.6	233.8	250.9
Navigation	3.1	0.0	0.0
Total	**219.5**	**235.5**	**252.6**

Table 48 – Final energy consumption in the transport sector, Montenegro

Source: elaboration on data of Energy Sector Development Strategy of Montenegro

Main actions and commitments of Montenegro to achieve objectives on RES in transport sector

As per Energy Community's Annual Implementation Report (November 2022)[156], the sustainability of bioliquids and biofuels have been transposed into Montenegrin legislation. However, the verification body prescribed by the Energy Law is yet to be established. As already noted, the share of renewables in the transport sector remained below 1% in 2020.

The EC report recommends the following measures on the legislative and strategic levels to be applied:

- Proceeding with adoption of the renewable energy law to transpose and implement Directive (EU) 2018/2001 and implement first auctions in line with market principles,
- Simplification and streamlining of permitting procedures,
- The market operator, as the designated issuing body for guarantees of origin, should sign a direct agreement with the service provider and start using the national electronic registry.

156 https://www.energy-community.org/dam/jcr:90f246f0-0e7e-469e-8895-d2bc4538ec58/IR2022_Bosnia_Herzegovina.pdf.

Important legislation which is currently in place, regulating the field of transport and energy, is the following:

- Energy Law (OG ME 5/2016, 51/2017, 82/2020).
- Law on energy efficiency (OG ME 29/2010),
- Law on efficient use of energy (OG ME 57/2014, 3/2015, 25/2019),
- Law on protection from negative impacts of climate change (OG 73/2019),
- Energy Sector Development Strategy (2014),
- 4th Energy Efficiency Action Plan (EEAP) for the period 2019-2021; and
- National Action Plan for RES energy utilization until the year 2020 (NREAP - 2014).

The Law on amendments and additions to the Energy Law has been drafted, and is going through the public consultations process. These amendments mostly deal with marking of liquid fuels, both those originating from fuel oil as well as biofuels.

The Law on protection from negative impacts of climate change has been drafted and adopted in 2019[157]. On this basis, in February 2020 the government adopted the Decree on the activities producing greenhouse gases for which the state issues permit, thus introducing carbon tax in Montenegro. Impact of these measures is expected in the transport sector in the following years. A new Law on protection from negative impacts of climate change and protection of the ozone layer has been drafted in March 2023, and is currently subject of public consultations.

The Decree on the mandatory share of biofuel in the transport sector has been adopted in 2018[158]. In accordance with the Decree, wholesale and retail traders with oil and petroleum products, which put the biofuel into the market, are obliges of the system of putting biofuels into the transport sector. An obligee which in the previous year introduced a smaller amount of biofuel than what was prescribed, has to increase the amount to be put into the market during the current year. Similarly, with the approval of the authorities, if an obligee introduced a larger amount of biofuel than prescribed in the previous year, it is possible to decrease the amount to be put into the market in the current year. Each obligee has to provide a plan of introducing biofuels into the transport sector for the following year by December 01st of the current year. Obligees also have to keep track of the amounts, types and origin of the biofuel put into the market, and report to the authorities on fulfilment of annual plans for the previous year, by the end of February of the current year.

[157] OG ME 73/2019.

[158] OG ME 51/2018.

Other decrees of importance include Decree on the quality and methods for the control of biofuels[159] and Decree on closer sustainability criteria for biofuels and bioliquids for achieving the required share of energy in total final energy consumption[160].

The NECP is being drafted, and Montenegro, as well as other countries in the Energy Community which still haven't done so, is obliged to submit it to the EC Secretariat in June 2023. The NECP is expected to include the RES targets, policies and measures for 2030.

Currently, in Montenegro there are no support measures available to purchasers of alternative-fuelled vehicles. Further, there are no laws regulating the market of electric vehicles and needed infrastructure for these vehicles. There are no incentives or simplified procedures for the construction of electricity charging stations or hydrogen re-fuelling stations for road vehicles.

Also, the sector of public transport is not regulated in Montenegro, hence there are neither incentives for the use of electricity or renewable fuel in public transport, nor limitations on the subject.

Further measures in Montenegro, in order to achieve the planned RES-T target, may include:

- Introducing obligations (and their enforcement) for renewable fuels in transport,
- Adjusting the RES-T target for 2030 to RED II,
- Increasing RES in electricity and transport sectors,
- Developing a transport strategy that would include electric and hydrogen-fuelled transport,
- Increasing electric and hydrogen-fuelled transport,
- Developing the infrastructure for electric charging and refuelling of vehicles with hydrogen, and
- Introducing financial support mechanisms to fuel producers and vehicle fleet operators towards increasing the share of RES in the transport sector.

8.1.1.7 North Macedonia

North Macedonia has prepared the draft NECP, and submitted it to the EC Secretariat on 31/07/2020[161]. Upon reviewing the document, in November 2020 the EC Secretariat provided recommendations on the draft of the NECP[162]. The final version of the NECP was adopted by the Government in May 2022[163].

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[159] OG ME 43/2018.

[160] OG ME 51/2018.

[161] Energy Community website (https://www.energy-community.org/dam/jcr:bbb63b32-6446-4df8-adc6-c90613daf309/Draft_NECP_NM_%202020.pdf)

[162] Energy Community website (https://www.energy-community.org/dam/jcr:ad73687c-12d3-48ff-a48f-faed18760ce5/ECS_RE01_MK_NECP_112020.pdf).

[163]Energy Community website (https://www.energy-community.org/news/Energy-Community-News/2022/06/01.html)

The NECP defines the target RES share in gross FEC in the year 2030 of 38%, while the RES share target in the transport sector is 10%. Further, 19% savings of FEC in the transport sector, compared to the Business-as-usual scenario, are expected to be achieved by applying energy efficiency improvements.

Biofuels are the main reason why North Macedonia did not meet the RES target in 2020 – as of 2018, the achieved share of RES in the transport sector was about 0.1%. Further, verification of the biofuels in line with sustainability criteria as required by Directive 2009/28/EC is needed. Failure to meet the RES target in GFEC may be attributed to this. The country has prepared a GAP analysis defining the needs for further transposition of the EU acquis in the national legislation. The next step is to define the scope of national legislation which will define the energy sector, and the biofuels, and to transpose the requirements from the Directive 2009/28/EC.

The Renewable Energy Action Plan for North Macedonia until 2025 with vision until 2030 (NREAP)[164] set the RES-T target to 10%, both for the year 2025 and for 2030. The NREAP was amended in 2017165. In the amended NREAP, the RES-T share in the year 2020 remained at 10% (which was unattainable), however for the years 2020 and 2025 the amended NREAP defines the amounts of RES energy in the transport sector to be 53.9 ktoe (in 2020) and 62.3 ktoe (in 2025), lower than the values in the original NREAP.

The targets for RES-T (RES share in FEC in the transport sector) were also defined in the Energy Development Strategy of North Macedonia[166], according to which the RES-T (biofuels) share was projected to increase from 1.25% in the year 2020 to 10% in the year 2030.

In the following table, FEC in North Macedonia, both overall and in the transport sector, for the recent years as well as projected until 2030, are presented.

Final energy consumption, in ktoe (EC study, 2020; Energy Strategy until 2040) - Business as usual

FEC / Year	2016	2017	2018	2020	2025	2030
Transport sector	680.0	705.7	703.5	601.0	n/a	648.0
Total FEC	**1,847.7**	**1,859.0**	**1,829.9**	**1,900.0**	**2,300.0**	**2,600.0**

Table 49 – Final energy consumption, North Macedonia

Source: elaboration on data of NECP North Macedonia

The vast majority of FEC in the transport sector (more than 99%) refers to road transport. Out of the transport sector FEC in the table above, only a negligible amount refers to blended biofuels (for the recent years). The projections include bioethanol and biodiesel, and no blends.

164 https://www.energy-community.org/dam/jcr:04a15cad-b128-4bb5-80b1-62e2a03e2b21/NREAP_2016_MA.pdf.

165 https://www.energy-community.org/dam/jcr:119a6bd9-39f1-4ebf-8db9-4580ad0099e2/NREAP_MA_amend.pdf.

166 https://economy.gov.mk/Upload/Documents/Adopted%20Energy%20Development%20Strategy_EN.pdf.

Shares of energy sources in the transport sector, in ktoe (reference scenario - business as usual)

Fuel / Year	2016	2017	2018	2020	2030
Electricity	1.2	1.2	1.0	4.0	18.0
Gasoline	109.3	108.6	104.2	82.0	127.0
Diesel	509.9	537.5	537.2	486.0	396.0
LPG	59.3	58.1	60.2	n/a	n/a
Natural gas	0.2	0.2	0.7	n/a	n/a
Blended biofuels	0.1	0.1	0.1	n/a	n/a
Bioethanol	n/a	n/a	n/a	7.0	20.0
Biodiesel	n/a	n/a	n/a	0.0	39.0
Total	**680.0**	**705.7**	**703.4**	**579.0**	**600.0**

Table 50 – Shares of energy sources in the transport sector, North Macedonia

Source: EC Study

The Energy Development Strategy of North Macedonia until the year 2040 provides the following shares of energy sources in the transport sector:

Shares of energy sources in the transport sector, in % (reference scenario - business as usu

Fuel / Year	2017	2020	2025	2030
Electricity	0.0%	1.0%	1.0%	3.0%
Gasoline	19.0%	14.0%	14.0%	20.0%
Diesel	77.0%	81.0%	76.0%	61.0%
Biodiesel	0.0%	0.0%	3.0%	6.0%
Other (LPG, CNG, ethanol, aviation fuel)	4.0%	4.0%	6.0%	10.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 51 - Shares of energy sources in the transport sector (in %), North Macedonia

Source: EC Study, Energy Development Strategy until 2040

The NECP on the other hand provides the following projections for the RES contribution (in Mtoe) and share (in %) in the gross FEC for the period 2021-2030.

RES share in overall FEC (NECP)

Share / year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES [Mtoe]	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.9
FEC [Mtoe]	**2.0**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.3**
RES share in overall FEC [%]	23%	24%	26%	26%	29%	30%	31%	31%	34%	38%

Table 52 – RES share in overall FEC

Source: elaboration on data of NECP North Macedonia

The percentages in the above table originate from the NECP, and the discrepancy between the calculated shares in % and percentages in the table is a consequence of the fact that the data on RES and FEC have been given rounded off in Mtoe in the NECP.

The following data provides the estimated trajectories for RES-T, with or without electric vehicles.

RES share in FEC in the transport sector - RES-T, in % (NECP)

Share / year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES-T, without electric vehicles	2%	3%	3%	4%	5%	5%	6%	7%	8%	9%
RES-T, with electric vehicles	4%	4%	5%	6%	8%	13%	14%	15%	16%	17%

Table 53 – RES share in FEC in the transport sector, North Macedonia

Source: elaboration on data of NECP North Macedonia

The projected shares of RES technologies in the transport sector, in the period 2021-2030, are summarized in the following table.

RES technologies in FEC in the transport sector, in % (NECP)

Share / year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES electricity	34%	34%	34%	34%	44%	58%	56%	54%	51%	48%
Biofuels	66%	66%	66%	66%	56%	42%	44%	46%	49%	52%

Table 54 – RES technologies in FEC in the transport sector, North Macedonia

Source: elaboration on data of NECP North Macedonia

The NECP data presented above all refer to the Business-as-usual, or WEM, scenario. However, in the WAM scenario, applying policies and measures as proposed in the NECP results in a higher RES share in the transport sector (RES-T) in the year 2030 by 5 percentage points. This is a consequence of increased RES electrification in the sector.

Main actions and commitments of North Macedonia to achieve objectives on RES in transport sector

As of 2020[167], North Macedonia was not compliant with RED in the transport sector, since the provisions of RED were not transposed into the national regulatory framework. Further, North Macedonia was not on track of achieving the RES-T target of 10% by 2020, as determined in the Action Plan for Renewable Energy Sources of the Republic of Macedonia until 2025 with a vision up to 2030 (NREAP)

The country has prepared a draft Law on Biofuels, and additionally a draft Climate Law. The Climate Law will introduce a methodology for calculation of GHG from the transport sector. This Law, after its adoption, will set a legal basis for adoption of a Decree for GHG emissions.

The Energy Law sets a legal basis for an energy activity blending of fuels. The blending process is further defined in the Rulebook on quality of liquid fuels. Currently, in the country the transport sector can use biofuels.

Important legislation which is currently in place, regulating the field of energy and transport, is the following:

- Energy Law (2018), and its amendments from 2019 and 2022

[167] Modalities to foster use of renewable energy sources in the transport sector by the Energy Community Contracting Parties, https://www.energy-community.org/dam/jcr:ab72cdbe-4900-4b8f-906c-3c61e0e7b728/LSBT_RES_transport_122020.pdf.

- Energy Efficiency Law (OG NM 31/2020, amendments in OG NM 110/2021 and OG NM 236/2022),
- Law on Biofuels (draft version of July 2021),
- Law on Vehicles (OG NM 140/08. latest amendments in OG NM 161/2019),
- Climate Law (draft version of 2022)
- National Energy and Climate Plan – NECP (2022),
- 4th National Energy Efficiency Action Plan for the period 2020-2022 – NEEAP (2021),
- Energy Development Strategy until the year 2040 (2019), and
- National Renewable Energy Action Plan until the year 2025 with the vision until 2030 – NREAP (2015, amendments in 2017).

The NECP of North Macedonia for the period 2021-2030 provides a list of policies and measures, both for WEM and WAM scenarios, for the energy sector in the country as a whole. The target to be reached in the transport sector of North Macedonia in the year 2030 is 10% of RES. Policies and measures in the transport sector in order to reach the target include:

- Development of the biofuels market (2020-2040),
- Increased use of the railway (2020-2040),
- Renewing of the national car fleet (2020-2040),
- Renewing of other national road fleet (2020-2040),
- Advanced mobility (2020-2040),
- Construction of the railway to Republic of Bulgaria (2023-2040), and
- Electrification of the transport (2020-2040).

Further, North Macedonia has submitted its NDC to the UNFCCC in April 2021[168].

8.1.1.8 Serbia

The National Energy and Climate Plan for the period 2021-2030 with the vision until 2050 (NECP) for Serbia is currently being prepared. In April 2021, a set of laws in the energy sector has been adopted, including

- The Law on RES Utilization,
- The Law on Energy Efficiency and Rational Utilization of Energy, and
- Amendments to the Energy Law,

which have prescribed the obligation of preparing the NECP, as well as monitoring and reporting on its implementation, in accordance with the Energy Community regulations[169].

Prior to NECP, the following strategic documents in the energy sector had been adopted:

[168] https://climatepromise.undp.org/what-we-do/where-we-work/north-macedonia

[169] https://www.energy-community.org/implementation/package/NECP.html.

- The National Renewable Energy Action Plan until 2020 (NREAP), adopted in June 2013[170], which determined the goals/targets of using RES until 2020 as well as of the means of reaching these targets. The NREAP set the share of RES in final energy consumption in Serbia to increase (from 21.2% in the year 2009) to 27% in the year 2020. At the same time, the final energy consumption has been projected to increase from 9.1497 Mtoe (in the year 2009) to 10.3306 Mtoe in the year 2020 (an increase of 12.9%), without additional EE measures, i.e. to 9.495 Mtoe in the year 2020 with applied EE measures. Apart from RES target in the overall FEC, Serbia undertook the obligation to ensure the share of energy from RES in all forms of transport (RES-T) in 2020 to be at least 10 % of the FEC in transport on state/country level.
- The Energy Sector Development Strategy of the Republic of Serbia for the Period until 2025 with Projections by 2030[171] (the Strategy) has been developed in 2015. This document has provided projections of FEC in Serbia, which will be presented in this chapter. The Strategy is followed by the Program for Implementation of the Strategy.
- National Energy Efficiency Action Plans (NEEAP):
    - First NEEAP for the period 2010-2012[172],
    - Second NEEAP for the period 2013-2015[173],
    - Third NEEAP for the period until 2018[174], and
    - Fourth NEEAP for the period until 31/12/2021[175].

The validity of NREAP and NEEAP has expired, while the Program for the implementation of the Energy Strategy is valid until 2023. The NECP which is being prepared should replace the strategic documents which have expired.

The key task in the process of preparing the NECP, as stated by the Ministry of Mining and Energy, is defining the scenarios from which new goals will be determined in the fields of energy efficiency, RES and GHG emissions. In preparing the NECP, numerous alternatives were analysed through 33 proposed scenarios, which have been presented to the Working Group (WG)[176]. Through further work, the

[170] Conclusion of the Government of the Republic of Serbia of 04/06/2013 - OG RS 53/13; https://www.mre.gov.rs/dokumenta/sektor-za-zelenu-energiju/izvestaji/akcioni-plan-za-obnovljive-izvore-energije

[171] Official Gazette of the Republic of Serbia (OG RS) 101/2015, https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/sgrs/skupstina/ostalo/2015/101/1/r.

[172] Adopted in June 2010.

[173] Adopted in October 2013 - OG RS 98/13.

[174] Adopted in December 2016 - OG RS 1/17),

https://arhiva.mre.gov.rs/doc/efikasnost-izvori/efikasnost/Treci_akcioni_plan_za_energetsku_efikasnost_Republike_Srbije_za_period_do_2018_godine.pdf

[175] https://www.mre.gov.rs/dokumenta/sektor-za-energetsku-efikasnost-i-toplane/ostalo/cetvrti-akcioni-plan-za-energetsku-efikasnost-republike-srbije-za-period-do-31-decembra-2021-godine

[176] Representatives of Ministries, institutions, public and private companies, civil society organizations etc.

number of scenarios to be considered was lowered. At the WG meeting on 04/02/2022, the results of modelling of eight scenarios in total were presented. A tool for multi-criterion analysis has been developed in order to evaluate the results of scenarios and prioritize among the scenarios, which would help in choosing the scenarios which the NECP would be based on. This tool and analysis were presented at a WG meeting, and 3 additional scenarios are being considered which will be presented to the WG in the following period.

So far, preliminary public consultations were held on the analyses of shortlisted scenarios[177]. Further public consultations are expected upon completion of the draft NECP, which in accordance with obligations towards the Energy Community should be done by the end of June 2023.

The Annual Implementation Report of the EC Secretariat[178] reported that Serbia registered a 26.3% RES share of in 2020, thus fulfilling the set target. Sectorial target for transport (RES-T) of 10% was not met. Provisions of Directive 2009/28/EC, including sustainability criteria, have been transposed by primary and secondary legislation. Since RES-T remains far below the target of 10%, a decree is being prepared on the mandatory share of RES in transport sector fuels in line with RED II requirements.

The Energy Sector Development Strategy summarizes the projected final energy consumption in Serbia in two scenarios, reference scenario (with existing measures) and the scenario with application of EE measures. The results are presented in the following tables.

Final energy consumption in Serbia, in ktoe (Energy Development Strategy, 2015 - Reference scenario)

Final energy consumption / Year	**2015**	**2020**	**2025**	**2030**
Transport	2,329.2	2,388.1	2,448.4	2,510.2
Total	**10,137.4**	**10,676.9**	**11,497.9**	**12,435.1**

Table 55 – Final energy consumption, Serbia

Source: elaboration on data of Energy Sector Development Strategy of Serbia

Final energy consumption in Serbia, in ktoe (Energy Development Strategy, 2015 - Scenario with application of EE measures)

Final energy consumption / Year	**2015**	**2020**	**2025**	**2030**
Transport	2,206.7	2,143.4	2,081.9	2,022.2
Total	**9,695.8**	**9,756.1**	**10,360.8**	**11,076.2**

Table 56 – Final energy consumption, Serbia

Source: elaboration on data of Energy Sector Development Strategy of Serbia

177 https://www.mre.gov.rs/en/node/1429.

178 https://www.energy-community.org/dam/jcr:a2ee5af3-ab4d-4573-9e08-7702ffd810c8/IR2022_Serbia.pdf, November 2022.

The share of the transport sector in overall FEC, for both scenarios, is presented in the following table.

Share of the transport sector in overall FEC, in %				
Share / Year	**2015**	**2020**	**2025**	**2030**
Reference scenario	23.0%	22.4%	21.3%	20.2%
Scenario with application of EE measures	22.8%	22.0%	20.1%	18.3%

Table 57 – Share of the transport sector in overall FEC

Source: elaboration on data of Energy Sector Development Strategy of Serbia

As an indication of the measure of reality of the Energy Strategy data, the Energy Balance of Serbia for the year 2022 records the FEC in Serbia of 10,274 ktoe, which is closer to the scenario with application of EE measures. FEC in the transport sector in the year 2022 amounted to 2,718 ktoe, or 26.5% of overall FEC, well above the projected trajectory.

The shares of different fuels/energy sources in Serbia as a whole are summarized below.

FEC according to energy source, in ktoe (Energy Development Strategy, 2015 - Reference scenario)				
Fuel / Year	**2015**	**2020**	**2025**	**2030**
Biofuels	0.2%	2.2%	2.1%	2.0%
Petroleum products	33.6%	31.6%	31.7%	31.0%
Coal	9.8%	9.3%	8.9%	8.4%
Electricity	24.5%	23.5%	23.3%	22.5%
Natural gas	13.0%	14.4%	15.8%	16.8%
Heat	8.3%	8.1%	7.6%	8.5%
RES for heating needs	0.2%	0.6%	0.8%	0.6%
Biomass	10.2%	10.3%	9.7%	10.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 58 – FEC according to energy source, Serbia

Source: elaboration on data of Energy Sector Development Strategy of Serbia

As an indication of the RES share in FEC in the transport sector, the data on the shares of different energy sources for the recent years from the EC Study (2020) may serve.

Shares of energy sources in the transport sector, in % (EC Study, 2020)			
Fuel / Year	**2016**	**2017**	**2018**
Electricity	1.5%	1.5%	1.5%
Gasoline	21.8%	21.2%	21.1%
Diesel	68.2%	70.8%	73.2%
LPG	8.2%	6.3%	3.8%
Natural gas	0.2%	0.2%	0.4%
Hydrogen	0.0%	0.0%	0.0%
Biodiesel	0.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**

Table 59 – Shares of energy sources in the transport sector, Serbia

Source: elaboration on data of Energy Sector Development Strategy of Serbia

The breakdown of FEC in the transport sector is presented in the following table.

Final energy consumption in the transport sector, in ktoe			
FEC / Year	**2016**	**2017**	**2018**
Rail	40.5	42.5	43.2
Road	1,978.2	2,062.3	2,085.4
Navigation	9.2	6.8	6.5
Total	**2,027.9**	**2,111.6**	**2,135.1**

Table 60 – Final energy consumption in the transport sector, Serbia

Source: elaboration on data of Energy Sector Development Strategy of Serbia

Main actions and commitments of Serbia to achieve objectives on RES in transport sector

Important legislation which is currently in place, regulating the field of transport and energy, is the following:

- Energy Law (OG RS 40/2021),
- Law on RES Utilization (OG RS 40/2021),
- Law on Energy Efficiency and Rational Utilization of Energy (OG RS 40/2021),
- Law on Climate Change (OG RS 26/2021),
- The Energy Sector Development Strategy of the Republic of Serbia for the Period until 2025 with Projections by 2030 (OG RS 101/2015),
- NREAP for the period until 2020 (expired), and
- 4th NEEAP for the period until 31/12/2021 (expired).

Further to the laws and strategic documents above, the following sub-legislation has been adopted recently:

- Decree on conditions and method of implementation of subsidized purchase of new electric vehicles, as well as vehicles which together with an internal combustion engine are driven also by electricity (hybrid vehicles) – adopted in March 2023, and
- Amendments to the Decree on quality monitoring of petroleum products and biofuels (OG RS 97/15, 5/17, 8/17, 119/17 and 102/18), adopted in February 2023.

The NECP is being drafted, and its submission to the EC Secretariat is scheduled for June 2023.

Further measures on national level in Serbia may include:

- Extending biofuels obligations to other renewable fuels,
- Adjusting the RES-T target for 2030,
- Revising and adjusting the policies to reach the 2030 RES-T target,
- Adjusting sustainability framework to RED II (in progress),
- Increasing RES in electricity and for transport,
- Development of the electric & hydrogen transport strategy,
- Increasing electric and hydrogen-based public transport, road and rail vehicles,
- Development of electric charging & hydrogen refuelling infrastructure, and
- Completing the NECP.

8.1.1.9 Slovenia

Integrated National Energy and Climate Plan of Slovenia expects final RES consumption to grow from 133 ktoe in 2020 to 220 ktoe in 2030. A 1.7-fold increase. With successful implementation of all planned policies and measures by 2030 of Slovenia NECP, can be achieved in 2030 the goal of 21% of RES on Transport energy Consumption.

Biofuels will contribute 182 ktoe (+44% compared to 2020), of which 89 KTOE (+ 41% since 2000) will be advanced biofuels.

Electricity for transportation from RES will contribute 38k TOE (4.75-fold increase from 2020).

Estimated contribution of RES in transport sector, kTOE

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gross Final Use of RES in Transport	**133**	**140**	**147**	**153**	**160**	**167**	**177**	**187**	**198**	**209**	**220**
Biofuels	126	131	137	142	148	154	159	165	171	177	182
of which advanced biofuels (to multiply by 2)	63	67	72	76	80	85	86	87	88	89	89
Electricity from RES (to multiply by 4 for road and 1,5 for railroad)	8	8	10	11	12	13	18	22	27	32	38
Target NEPN, Share of RES % in Transport Sector*	10,2%	10,9%	11,5%	12,1%	12,8%	13,4%	14,7%	16,1%	17,6%	19,1%	20,8%

(*): With the succesful implementation of all planned policies and measures by 2030, these results can be achieved

Table 61 – Estimated contribution of RES in transport sector, Slovenia

Source: Consultant's elaboration on NECP data

Indicative objectives of National Energy and Climate Plan (NEPN Scenario) envisage the adoption of additional measures, with respect to those now in force, to increase share of RES in the transport sector. Target quotas are substantially added up only applying usual multiplicators to physical quantities foreseen for contributions of traditional biofuels (1), advanced biofuels (2), RES for automotive electricity (4) and electricity from railway traction (1.5).

Differences between NEPN Scenario and Existing Measures Scenario (EM Scenario) are significant. Share of RES in Slovenia's transport consumption by 2030 is 13% for the EM scenario (while in NEPN scenario it is 21%, as we have already seen).

Forecast of total consumption of transport sector is also different, since NEPN scenario foresees the decrease in total transport consumption after 2025 to 1942 ktoe in 2030, while EM Scenario estimates a continuous growth to 2030 at 2280 ktoe.

In NEPN scenario in 2030, 82% of final use of physical RES in transport will come from biofuels; 17% will come from Electricity from RES. In this case, proportion in EM scenario are similar.

Main actions and commitments of Slovenia to achieve objectives on RES in transport sector

Use of **biofuels** will be prioritised for development, production and use of advanced sustainable biofuels. In doing so, Slovenia will take advantage of development opportunities with respect to raw materials available on national soils and will stimulate necessary technological development with development incentives to carry out pilot projects.

In line with objectives of NEPN, Slovenia will supplement strategy in market development by establishing suitable **infrastructure associated with alternative fuels** in the transport sector in the Republic of Slovenia. Slovenia will intensively promote development of technologies for production of sustainable biofuels, advanced synthetic gas and liquid fuels and use imported ones until it develops and establishes its own production structures.

The pursuit of 2030 goals will lead the government of Slovenia to **removal of all technical and other obstacles** for production and commercialization on biofuels and RES electricity; to a sustainable orientation towards advanced biofuels and H2 (rail too), including a change in the model of liquid fuel price regulation; sustainable orientation towards the introduction of RES gases in CNG and LNG filling stations.

There will be also **financial incentives for low-emission vehicles**, which will support demand for new traditional vehicles and electric vehicles, that is for vehicles more compatible with biofuels and which will support the demand for electricity from renewables. These are purchase incentives, for the scrapping of old vehicles, incentives for the electrification of collective and individual transport, of urban areas and other incentives for sustainable mobility. To achieve its ambitious energy and climate policy targets, Slovenia will ensure better conditions for accelerated development of the **electricity** distribution network and provide an adequate support environment for introduction of alternative fuels such as liquefied natural gas (LNG) for freight transport and compressed natural gas, **biomethane** and other **synthetic fuels** and **hydrogen** (H2) for road transport.

8.1.2 Nationally Determined Contributions (NDCs) under the Paris Agreement

The policies relating to biofuels and RES of transport electricity also favor the achievement of the objectives of the Paris Agreements by all members of the European Union.

The National Determined Contributions (NDC), under Paris Agreement, are commitments that countries must implement to reduce greenhouse gas emissions. The member countries of European Union (therefore including Italy, Greece, Croatia and Slovenia) act jointly, within the framework of these commitments.

Paris Agreement requires each Party to prepare, communicate and maintain successive nationally NDCs that it intends to achieve. The EU and its Member States request the UNFCCC[179] Secretariat to publish the NDC[180] of the EU and its Member States on its website (https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx) and to take it into account when preparing the synthesis report on the aggregate effect of the NDCs communicated by Parties. At the moment, the same two documents are published on the website of the UNFCCC Secretariat for each state of the European Union, namely the INDC of March 6, 2015 and its update of December 17, 2020.

EU and its Member States NDC is a binding target of an at least 55% domestic reduction in greenhouse gas emissions by 2030 compared to 1990 (without contribution from international credits). The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits.

In December 2019, European Council endorsed the objective of achieving a climate-neutral EU by 2050, in line with the Paris Agreement. In this context, on 11 December 2020 the European Council endorsed a new, significantly more ambitious EU climate target for 2030, respect precedent binding target of 40% of march 2015.

A specific binding EU targets will reduce CO2 emissions from road transport. CO2 emissions per kilometre from passenger cars sold in the EU must be reduced, on average by 37.5% from 2021 levels by 2030, and new vans on average by 31% from 2021 levels by 2030. CO2 emissions per kilometre from new large lorries must be reduced on average by 30% from 2019/2020 reference period levels. As part of a mandated review in 2022, targets may be revised and/or extended to smaller lorries, buses, coaches and trailers. This binding target concerns strictly biofuels and electricity from transport RES.

Under Directive (EU) 2018/410 the EU Emissions Trading System: EU will reduce its emissions from the sectors covered by this legislation by 43% from 2005 levels by 2030.

Under Regulation (EU) 2018/842, each EU Member State will reduce its emissions from sectors outside the EU ETS from 2005 levels by 2030 in accordance with the following percentage: Belgium 35%, Bulgaria 0%, Czech Republic 14%, Denmark 39%, Germany 38%, Estonia 13%, Ireland 30%, **Greece 16%**,

[179] United Nations Framework Convention on Climate Change

[180] Nationally Determined Contribution

Spain 26%, France 37%, **Croatia 7%**, **Italy 33%**, Cyprus 24%, Latvia 6%, Lithuania 9%, Luxembourg 40%, Hungary 7%, Malta 19%, Netherlands 36%, Austria 36%, Poland 7%, Portugal 17%, Romania 2%, **Slovenia 15%**, Slovakia 12%, Finland 39%, Sweden 40%.

The non-EU countries belonging to the Adriatic-Ionian Region (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia and Serbia), being members of the United Nations Framework Convention on Climate Change (UNFCCC), have each fulfilled their obligation to submit the **Intended Nationally Determined Contribution (INDC)** to greenhouse gas (GHG) emissions reduction. For all countries which have ratified the Paris Agreement181, which includes the five non-EU countries listed, the INDC became **Nationally Determined Contribution (NDC)** with the ratification of the Paris Agreement.

The following table summarizes the dates of submissions of the NDC to the UNFCCC of the five countries, as well as their NDCs.

Country	Date of submission	Document	NDC for 2030
Albania	Nov-15	INDC	11.5%/705 kt of GHG emissions compared to 2016
	12/10/2021	First NDC (updated submission)	20.9 % of GHG emissions compared to 2016
Bosnia and Herzegovina	Oct-15	INDC	n/a
	20/04/2021	First NDC (updated submission)	Unconditional GHG emissions reduction target for 2030 is 12.8% compared to 2014 or 33.2% compared to 1990.
Montenegro	2015	INDC	30% compared to 1990
	15/06/2021	First NDC (updated submission)	At least a 35% reduction in total national GHG emissions compared to 1990 (base year).
North Macedonia	2015	INDC	n/a
	16/04/2021	First NDC (updated submission)	51% reduction in greenhouse gas emissions compared to 1990
Serbia	2015	INDC	9.8% greenhouse gas emissions reduction by compared to 1990
	24/08/2022	Updated NDC	13.2% compared to 2010 level (i.e. 33.3% compared to 1990)

Table 62 – Submission of the NDC to the UNFCCC

Source: UNFCCC, NDCs of the countries listed

8.1.3 Projects and other initiatives as from the national programmes

Individual states are pursuing numerous other initiatives regarding transport sector which, although not directly linked to biofuels and electricity produced by RES, can influence in important way level and quality of RES consumption in transport.

Here is description of most important themes and official initiatives of each state.

[181] https://www.un.org/sustainabledevelopment/blog/2016/04/parisagreementsingatures/.

CROATIA

The Act on the Promotion of **Clean and Energy-Efficient Vehicles in Road Transport** (OG 127/13) is currently in force, which stipulates that all purchasers and carriers performing public liner transport on the basis of a public service contract, when purchasing vehicles for road transport, must take into account their energy and environmental effects during the period of vehicle utilization. It is necessary to transpose the revised obligations under the Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles (EU 2019/1161) in order to support low-emission mobility in the context of the purchase, leasing, rental or leasing of publicly contracted road vehicles or contracting authorities if they are obliged to apply procurement procedures and operators to fulfil public service obligations under a public service contract.

In addition to the transposition of obligations from the directives in question into legislation, the Republic of Croatia will define an action plan and prescribe a timeframe for the gradual introduction of **low-carbon** solutions in the context of the provision **of public services**. In the near future, all public service providers will have the obligation to use only energy efficient low- or no- emission fleets.

To facilitate demand by users and consumers, Croatia will strength **infrastructure for distribution of alternative fuels** and implementing common technical specifications for this infrastructure. The development of infrastructure is a necessary prerequisite for the development of markets for vehicles and vessels using electricity, CNG / SBP, LNG / LBG and hydrogen in Croatia. The measure provides for the establishment of a central register of alternative fuel infrastructure that will facilitate the user experience for drivers and ultimately provide a realistic insight into energy consumption for analytical purposes.

Alternative Fuels Infrastructure Establishment Act describe **alternative fuels** are defined as fuels or energy sources that can at least partially replace fossil fuels in boat **transport**. These include electricity, including battery, hydrogen, biofuels, synthetic and paraffin fuels, natural gas, including biogas, in gaseous (CNG) and liquefied natural gas (LNG) and liquefied petroleum gas (LPG). In accordance with the "National Coastal Line Maritime Traffic development plan" and considering that the Republic of Croatia is a maritime country with developed coastal line traffic, and in addition has navigable river routes and lakes, this measure would co-finance the projects of gradual transition of the existing obsolete fleet to alternative and / or hybrid solutions and new construction. Ships using alternative fuels are generally more expensive than ships using conventional fuels, so there is no expressed interest of shipowners to invest in such ships. Therefore, it is necessary to financially support the conversion / construction of such vessels to the extent that the purchase price is equalized, or that shipowner is put in the same position as a shipowner using conventional fuel ships. This measure builds on the measure related to the development of alternative fuel infrastructure in terms of permanent users / consumers on that infrastructure, while significantly affecting the potential reduction of pollution of the sea, rivers and lakes.

GREECE

Fleet of **public transport** vehicles will be enhanced, aiming to reduce use of private vehicles. This will contribute to improve energy efficiency in transport sector and to increase RES consumption in public transport companies.

Additional challenge is to increase use of **micro mobility** vehicles ad make appropriate infrastructure for use of such vehicles.

Providing consumers with **information** on benefit of biofuels and EV, establishing incentives for people and business, to get them acquainted with the requirements and challenges of energy transition and of addressing climate change. This axis aims to provide comprehensive information and training to consumers and raise awareness among them in energy and environmental issues, for them to adopt eventually an environmentally friendlier lifestyle and to choose environmentally friendly technologies through specific decision-making criteria.

Urban planning will also be a weapon for decarbonization of transport: infrastructures for sustainable urban mobility will be optimized and car sharing practices and possibility of walking and cycling will be enhanced. Urban mobility will also be a frontier that will allow to reduce carbon footprint and noise pollution of transport sector, at the same time, also by reducing use of private cars through ban of parking and traffic and implementing public transport and use of electric car and electric car system.

ITALY

Italy also foresees initial development of **green hydrogen** which, in 2030, should contribute to about 1% of the RES in transport sector. It is expected to be used for cars, buses, trucks and trains on non-electrified routes, replacing train diesel engined. Part of hydrogen produced from renewable sources, will be mixed on grid, with natural gas. Hydrogen production from renewable energy could be used to store excess renewable electricity production when supply exceeds demand.

A contribution from renewable gas is expected for fuel for **ships and airplanes**, which is difficult to quantify at the moment. Italy will also pay attention to the recycling programs of fossil fuels (collection of differentiated plastic or fuel obtained from the recovery of CO2 from steel mills)

Others regards to transport in Italy, are need to **protect national biofuel chain**, which primarily exploits animal and vegetable oils and fats, together with greater weight of biomethane, from various origin, for transport. Other important aspects concern role of LNG/biomethane in various transport sectors and that of the enhancement of LPT, in view of a general growth of the many forms of collective and sustainable mobility, with a preferential way of expansion to be granted to electric vehicles.

Elements for a Sustainable Mobility Roadmap, drawn up in 2017 with contributions from the Ministry of the Environment and the Protection of the Territory and the Sea, the Ministry of Economic Development, the Ministry of Infrastructures and Transport, research bodies, economic operators of the sector and consumer and category associations, provides the current context of mobility in Italy and environmental impacts as well as an in-depth analysis of the opportunities offered by the technological evolution of means of transport. According to this document, the construction in Italy of an industrial chain of vehicles based on innovative technologies represents an indispensable element for developing a vast infrastructure for alternative fuels. The Roadmap also highlights the role of support measures, among which considerable importance is attributed to local policies in favor of sustainable mobility.

National Infrastructure Plan for Charging Electricity-Powered Vehicles (PNIRE), approved in 2012 and updated in 2016, was adopted through a path shared with the main competent departments as well as with the stakeholders in the sector. In this context, in 2017 the Program Agreement was signed with the Regions and local authorities for the construction of electric vehicle recharging networks aimed at concentrating the interventions for the implementation of the Plan according to the actual territorial needs, promoting and enhancing the participation of public and private entities.

National strategic framework for the development of the alternative fuel market in the transport sector and the construction of the related infrastructures favors the use of alternative fuels, in particular electricity, natural gas and hydrogen. As regards electricity, the decree provided for measures for the construction of an adequate number of recharging points. In particular, it introduces the obligation to prepare the conditions for the installation of infrastructures for electric charging in new buildings. Consequently, the municipal building regulations must be adapted to the new provisions. There is also an obligation for local authorities to equip their fleet of cars, buses and public utility vehicles, at the time of its renewal, with at least 25% electric or LNG or CNG powered vehicles. The standard also provides for the provision of refuelling points in ports for LNG for inland and maritime navigation. A path has also been established for the prospective use of hydrogen in the transport sector.

In numerous documents, Italy hopes for the acceleration of investments on the **railway** network, integrated **intramodality** program that makes the railway system a point connection between ports and airports. It is intended to give greater centrality to rail transport, making the existing fleet more efficient. Work will also be done on the electrification of ports. As regards local public transport, the Government, aware of the impact that the **public mobility** system has on the quality of life of citizens and on the environment of cities, intends to support local and urban mobility through adequate investments for the rapid transport of mass and for the renewal of the bus fleet. Economic resources will be allocated to contribute to the replacement of public transport in order to encourage transport safety and reduce CO2 emissions. Other important initiatives concern financing for the **renewal of the rolling stock** used for local public transport. Obligation to **purchase alternative fuel vehicles for the Public Administration.** Incentives for the purchase of **more efficient vehicles** with lower climate-altering emissions. **Refuelling points for alternative fuels** (DAFI), Renewal of vehicles used for freight transport.

Other themes to be developed on transport in Italy, the influence RES consumption, are: regional rail transport; rapid mass transport systems, development of cycling through cycle paths; promotion of **shared mobility** (bike, car and moto sharing with low or zero emissions); **integration** between sustainable mobility services (e.g.

parking facilities for bicycles or car and bike sharing services near public transport stops) and interchange parking lots; promotion of **smart working** tools; promotion of **car-pooling**; development of **ITS** (traffic management, info mobility, smart roads); Electric Road System (ERS): promotion, on the basis of the trials started, of initiatives for possible electrification of the motorway network through **Electric Road System** (ERS) technologies, which allow the traction of hybrid vehicles for the transport of goods and / or passengers with power supply with conductive or inductive systems (eHighway).

SLOVENIA

To speed up the development of sustainable mobility, Slovenia has developed several recent measures, which affect the consumption of fuels, biofuels and transport electricity, as follow.

Develop a strategy for the development of **public passenger transport** (2021); develop national cycling strategy (2022); draw up measures to encourage co-travel - providing system support and increasing the occupancy rate of commuting vehicles by at least 30% ('park and drive together' parking lots, providing parking spaces for high occupancy vehicles, etc.) (2021); update the concepts and schemes of **urban passenger transport** (Ljubljana, other cities) to improve the quality and accessibility (tact etc.) (2020); introduce express buses on motorways and roundabouts on the Ljubljana ring (2021); provide incentives for the introduction of **new public transport services** (upon request, etc.) - to provide PPT with new services in urban areas where there is insufficient demand for the introduction of scheduled services (2021); establish changes to the concept of parking standards: – establish restrictions on the use of parking spaces (not a minimum but a maximum number of parking spaces is specified); – limit long-term parking by increasing the cost of long-term **parking**, especially for work: higher prices (+ 30%), elimination of the possibility of extension from a distance, etc.) (2022); introduce fees for entry into a city where efficient public transport is in place: carry out a comprehensive survey of the introduction of '**increased costs for entry into the city'**, draw up appropriate legislative solutions, identify the recipient and the purpose of the funds raised (2025); promote work from home: make a comprehensive analysis and provide incentives for introducing work from home to reduce the way to work by at least 10% (legislative solutions, etc.) (2023); promoting the creation of **sustainable mobility plans** for public sector bodies and businesses promoting the use of PPT and reducing the use of passenger cars, including the abolition of free parking spaces for civil servants (2023); establish a digital platform that will promote all possibilities of public passenger transport, forms of co-travel and the search and development of new sustainable mobility business models (2020-2030).

ALBANIA

The aforementioned Law no. 9876 (2008) "On the use, transportation and trading of bio-fuels and other renewable combustibles for transport", stipulates that from 2010, the minimal annual amount of bio-fuels and other renewable combustibles which are used for transport shall not be less than 3% of the total of the combustibles traded in the market, meanwhile from 2015-ongoing, it won't be less than 10%. The currently drafted law on biofuels will have the same objective of 10% to comply with the RED. The legislation does not contain any specific objectives about the different kinds of technology.

The same law stipulates fining of retail tradesmen of fuel products who do not visibly distinguish biofuels they sell from other fuel types, including fossil fuels and their mixtures with biofuels.

Pursuant to the law on bio-fuels, from the period when the law entered into force until 2018, the excise tax for these products will be zero.

Similarly, from 2008 until 2012, in Albania regulation has been in force, stipulating exclusion from the customs taxes and the VAT for all the machineries and the necessary equipment for the production of bio-fuels and other renewable combustibles.

Other than these, to Consultant's knowledge, no specific support for biofuels, which fulfill the criteria of the Directive 2009/28/EC, has been in place in Albania.

A recent development in Albania[182] indicates the willingness of the authorities to pursue switching to electric vehicles in the public sector, e.g. through adding electric buses into public transportation fleets. Further, it was announced that the Government would stimulate anyone switching to electric vehicles with lower taxes, through reimbursing the first vehicle registration fee, i.e. making the fee zero for the customers.

BOSNIA AND HERZEGOVINA

In Bosnia and Herzegovina, in the FBiH entity, a subsidizing mechanism was in place in 2022 (01/01-12/12/2022), offering 1,000,000 BAM in total for subsidizing purchasing of new electric and hybrid vehicles (10,000 BAM per electric, 5,000 per hybrid vehicle)[183].

More recently, in February 2023, in the RS entity, information was given that the Electric Power Industry of RS (EP RS) is building a network of charging stations for electric vehicles[184].

Further support mechanisms have not been identified.

MONTENEGRO

In Montenegro, on 26/12/2022 a public call was issued by the Environmental Protection Fund for subsidizing procurement of new electric or hybrid passenger and freight vehicles, as well as electric light mobility vehicles (motorcycles, tricycles etc.)[185]. The public call is intended for individuals, as well

[182] https://www.txtreport.com/news/2022-04-20-albania-with-low-taxes-for-electric-vehicles--balluku--replace-cars-with-fuel.HylimtT4q.html .

[183] https://fbihvlada.gov.ba/bs/jedan-milion-km-poticaja-za-kupovinu-elektricnih-automobila.

[184] https://www.capital.ba/elektroprivreda-rs-gradi-mrezu-stanica-za-punjenje-elektricnih-automobila/.

[185] https://www.eko-fond.me/me/javni-konkursi/javni-pozivi/

as for entrepreneurs and companies. Maximum amounts available for applicants, per vehicle, are 5,000 EUR for electric cars, 2,500 EUR for hybrid cars, and 300-1,500 EUR for light mobility vehicles (depending on vehicle type), provided the applicants have not used this type of subsidies before. This type of financial support to green transport has been available since 2021, i.e. this is the third public call of this kind. Other incentives in the transport sector are not currently available.

NORTH MACEDONIA

In North Macedonia, for quite a while, electric and all types of hybrid cars have been exempted from the excise tax[186], which depended on the value of the vehicle. The maximum excise tax of 18% was stipulated for vehicles more expensive than 30,000 EUR, and in this case exemption of electric/hybrid vehicles from the excise tax decreased the costs significantly.

In accordance with the new Law on Motor Vehicles[187], the method of calculating the motor vehicle tax was introduced and replaced the previous vehicle excise tax – now this vehicle tax depends not only on the value of the vehicle, but also on the vehicle's CO2 emissions[188]. The new method introduces different tax percentage depending on the value of the vehicle, ranging from 0% for values up to 10.000 EUR, up to 20% for vehicles with value higher than 50.000 EUR. In addition, with this Law, the coefficient for CO2 emissions from gasoline cars is lower compared to diesel cars, reducing the tax costs for gasoline cars. This method results in 100% exemption for electric vehicles, 50% exemption for plug-in hybrid vehicles, while for self-charging hybrid cars there is no tax exemption. The calculated vehicle tax is subject to calculation for value added tax, which makes the electric vehicles more favourable, compared to vehicles with internal combustion engines, especially for vehicles that are more expensive.

SERBIA

In Serbia, subsidizing of procurement of electric and hybrid vehicles has been in place since the year 2020. The annual number of vehicles purchase using this mechanism increased over the years – from 112 vehicles in 2020, through 446 vehicles in 2021, to 625 vehicles in 2022. The mechanism continued in 2023, with the adoption of the "Decree on conditions and method of implementation of subsidized purchase of new electric vehicles, as well as vehicles which together with an internal combustion engine are driven also by electricity (hybrid vehicles)". The mechanism, similar to Montenegro, is intended for procurement of passenger, freight and light mobility vehicles, and companies, entrepreneurs as well as individuals can apply. The resources for this mechanism are secured in the Serbian budget, and the amounts of subsidies per vehicle are as follows:

- Electric vehicles – 5,000 EUR,

186 https://autofocus.mk/sporedba-na-sistemite-na-subvencii-na-elektricni-vozila-vo-germanija-i-vo-makedonija/

187 OG NM 261/2019.

188 https://customs.gov.mk/images/documents/motorniVozila/UredbaPresmetkaDMV.pdf.

- Plug-in hybrid vehicles – 3,500 EUR,
- Self-charging hybrid vehicles – 2,500 EUR, and
- Light mobility vehicles – 250 or 500 EUR, depending on vehicle type.

The Government of Serbia has issued a Decision on determining the mandatory share of biofuels which has to be put into circulation by the obligees of the system (i.e. fuel traders)[189]. In accordance with the Decision, this share for the year 2023 is 0.5%, while in 2024 it would be 1%. At present, subsidizing production of biofuels is not being considered, nor exemption of biofuels from excise taxes.

8.2 Supply of Clean Fuels and Clean Vehicles, with prospects to 2030

8.2.1 Clean fuels demand

Most important biofuels for road transport

Today most popular biofuels are by far those related to transport, and in particular biodiesel, biogasoline and biogases.

Biofuels can be imported or produced within the country where they are consumed.

Biodiesel can be made from vegetable oils, animal fats or exhaust cooking oils. Bio-petrol can be produced from vegetable sugars (corn, beet, sugar cane) or lignocellulosic materials. Finally, biogas can be produced from agricultural residues (manure or vegetable residues), forestry or urban waste.

The consumption of biofuels in Italy (EUSAIR Regions) is very high, compared to that of other countries. Their total level will not vary much in 2030 from the current level (from 840 ktoe in 2020 to 1064 ktoe in 2030). In 2020, biofuels covered 5% of the final energy consumed on the road.

But share of biodiesel, on total road biofuel demand, will drop from 9/10 to 2/3 in favor of bio-petrol and biomethane. The market share of biogasoline will rise from 2% to 15%, while policies to support biomethane will raise the share of biogas from 7% to 19%.

The demand for biogas is activated by a very widespread methane car fleet, as we will see below, and by the phenomenon of methane trucks, supported also in this case by a strong commitment of government through incentives and tax breaks.

[189] OG RS 104/2021.

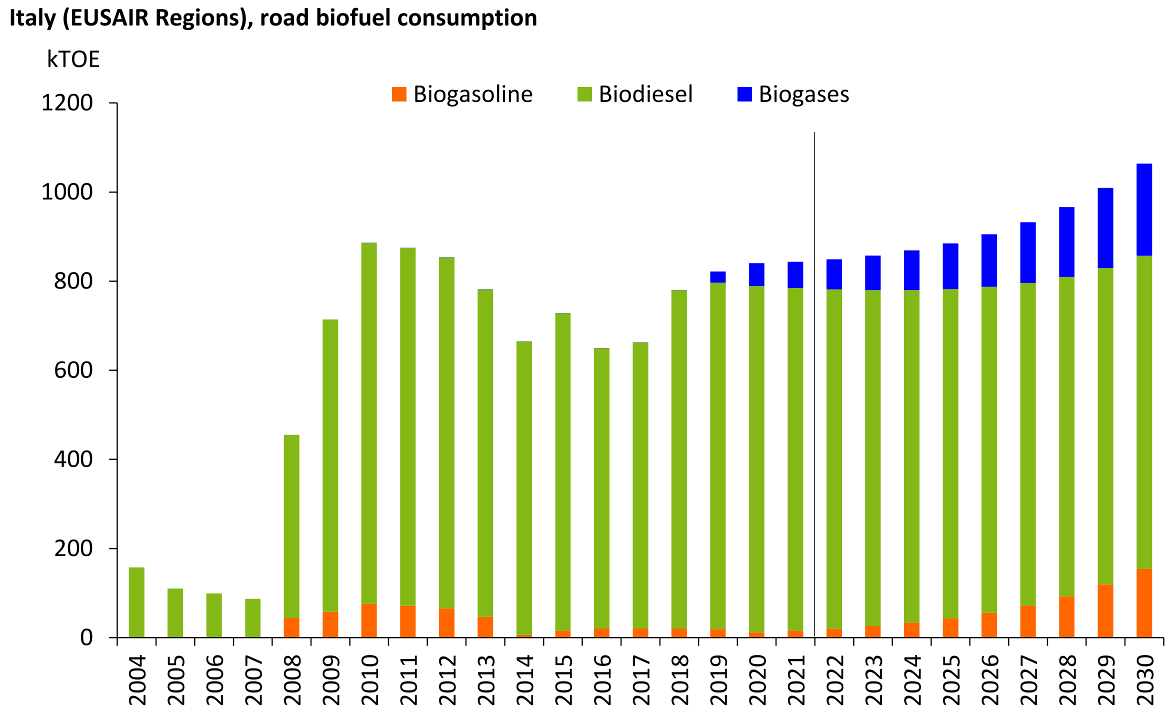

Figure 124 – Road biofuel consumption, Italy (EUSAIR Regions)

Source: Consultant's elaboration and forecast on EU Energy Balances

If orders of magnitude of absolute consumption level of biofuels are very different between Italy and other countries of Adriatic-Ionian area, the weight on final consumption on the road is instead similar. In 2020, biofuels covered 4,4% of final energy consumed on the road in Greece, 3,5% in Croatia and 6% in Slovenia.

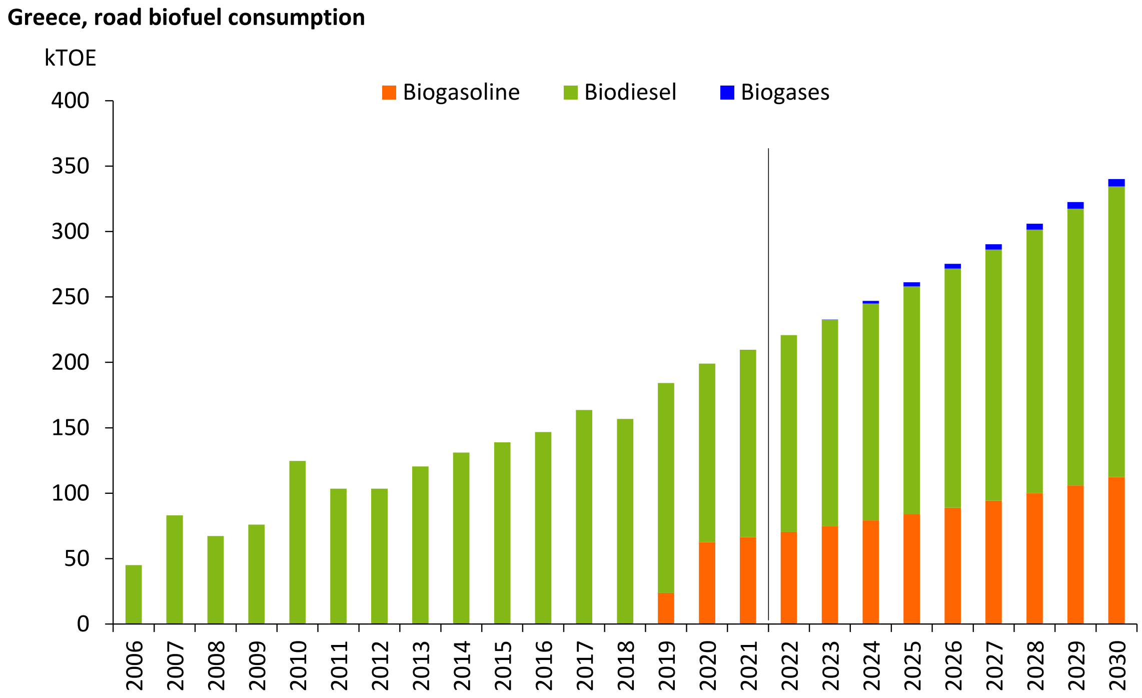

Figure 125 – Road biofuel consumption, Greece

Source: Consultant's elaboration and forecast on EU Energy Balances

By 2030[190], the spread of biofuels will increase linearly and gradually, in all countries from the Adriatic-Ionian area, in line with the various EU provisions. The only notable difference that, in all probability there could be, concerns the spread of biomethane and methane vehicles, given the increase in the price of fuel, which began well before the war in Ukraine.

[190] NE Nomisma Energia forecasts and assessments differ from those formulated by NCPS.

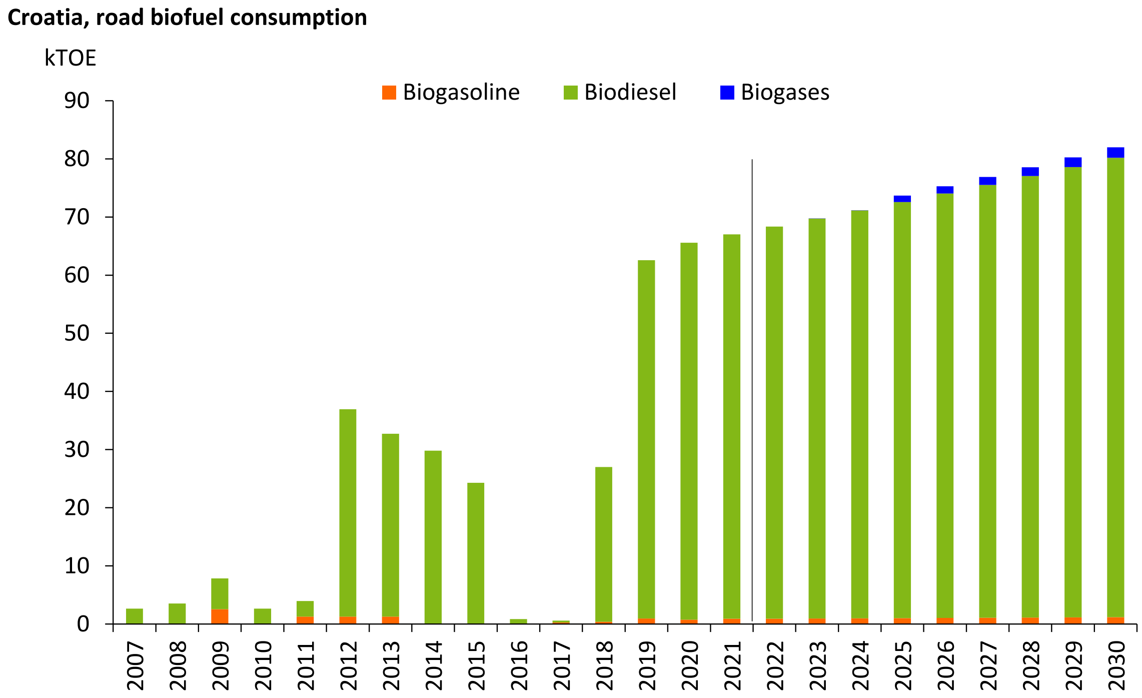

Figure 126 – Road biofuel consumption, Croatia

Source: Consultant's elaboration and forecast on EU Energy Balances

Compared to Italy, other Adriatic-Ionian countries will likely be more uncertain, about support biomethane and methane vehicles. In Italy, gaseous fuel tradition began as early as the 1930s.

The incentives to support biomethane, methane heavy vehicles and methane cars, have already been launched for some time and will produce effects also in the present and in the future, i.e. even after the shock in methane prices.

But in other countries, after these increases, methane-fuelled cars and heavy vehicles now have much lower prospects. government interventions to favor biomethane and methane are also much less likely, with such price increases.

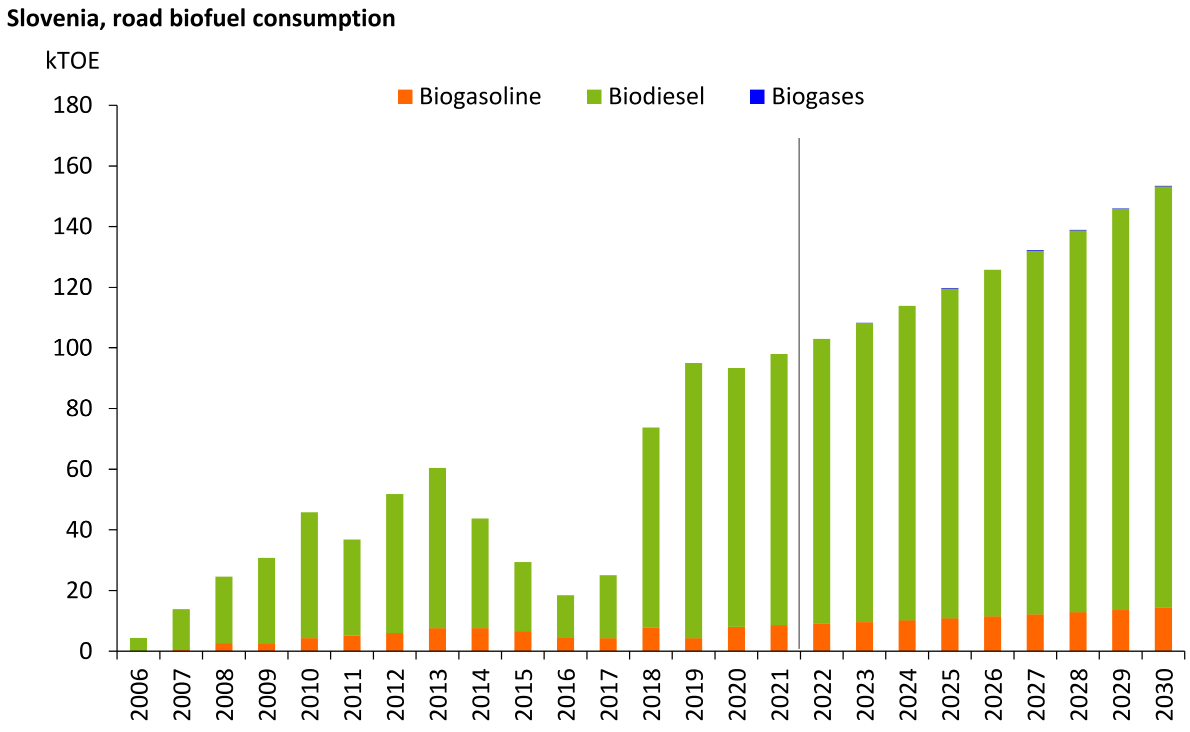

Figure 127 – Road biofuel consumption, Slovenia

Source: Consultant's elaboration and forecast on EU Energy Balances

In 2030 Greece will have increased demand for biofuels by around 71%, compared to 2020, to 340 ktoe. Bio-petrol will cover 1/3 of consumption; 65% biodiesel and 2% biomethane.

Consumption of biofuels in Croatia will rise by about 1/4 to 82 ktoe, made up of 96% biodiesel and to a minimum share of bio-petrol and biomethane.

Same situation for Slovenia, where in 2030 the demand for biofuels will rise by 65% to 153 ktoe. Market share of bio-petrol will be 9%; the biodiesel one of 90%.

NECPs for Serbia, Bosnia and Herzegovina and Montenegro are currently being prepared. However, some data are available from other strategic documents.

In Serbia, preliminary analyses done in the course of preparing the NECP, which were presented in public consultations and are publicly available[191], resulted in the following projections.

191 https://www.mre.gov.rs/dokumenta/strateska-dokumenta/integrisani-nacionalni-energetski-i-klimatski-plan-republike-srbije-za-period-2021-do-2030-sa-vizijom-do-2050-godine.

RES share in FEC (preliminary NECP analyses), in % (WEM Scenario)			
Sector/year	**2019**	**2025**	**2030**
Transport (RES-T)	0.4%	0.4%	1.5%
Total (RES)	21.4%	28.0%	27.6%

Table 63 – RES share in FEC, Serbia

Source: Consultant's estimations on the basis of Energy Development Strategy and preliminary NECP analyses

Estimated biofuels in Serbia for the WEM/reference scenario, on the basis of the Energy Development Strategy until 2015 and taking into account the analyses performed in the course of preparing the NECP, are as follows.

Estimated biofuels, in ktoe (WEM/reference scenario)			
Year	**2019**	**2025**	**2030**
Biofuels	231.3	237.2	243.1

Table 64 – Estimated biofuels consumption, Serbia

Source: Consultant's estimations on the basis of Energy Development Strategy and preliminary NECP analyses

Analyses in the course of preparing the NECP, apart from the WEM scenario, include several other scenarios with different sets of measures applied, with or without nuclear energy. The most advanced scenario in terms of predicted RES shares results in the following figures.

RES share in FEC (preliminary NECP analyses), in % (Advanced scenario)			
Sector/year	**2019**	**2025**	**2030**
Transport (RES-T)	0.4%	3.1%	14.4%
Total (RES)	21.4%	32.8%	50.4%

Table 65 - RES share in FEC, Serbia

Source: Consultant's estimations on the basis of Energy Development Strategy and preliminary NECP analyses

Estimated biofuels, in ktoe (Advanced scenario)			
Year	**2019**	**2025**	**2030**
Biofuels	231.3	351.9	1,790.7

Table 66 – Estimated biofuels consumption, Serbia

Source: Consultant's estimations on the basis of Energy Development Strategy and preliminary NECP analyses

There are no available data on the basis of which biogasoline, biodiesel and biogas could be distinguished within biofuels. Current utilization of each of these energy sources in the transport sector is negligible or practically zero.

In Bosnia and Herzegovina, as already presented in Chapter 8.1.1.2, the projected amount of biodiesel in the year 2030 is **79.2 ktoe** (from 6.9 ktoe which were projected for 2020). Data on biogasoline or biogas, current or projected to 2030, are not available.

In Montenegro, as explained above, current contribution of biofuels in the transport sector is practically zero, although legislation has been introduced to enforce putting certain amounts of biofuel into the market. Therefore, there are no data on the basis of which an estimation of biodiesel consumption in the year 2030 could be done.

8.2.2 Clean vehicles on the road

Fleet and forecasts for CNG and LNG vehicles 2012-2030

Methane is the fossil fuel for transition which, however, has a lower environmental impact than gasoline and diesel. Not only with regard to CO2 (-15% in front of gasoline and same emission of diesel), but above all with regard to real pollutants[192].

Furthermore, methane vehicles can be easily fed with biomethane, without any type of modification. Therefore, it is important to evaluate consistency of methane fleet, for prospects that biomethane could have in 2030 and beyond.

Infrastructural endowment and consumption of CNG or LNG (also from bio font) is function of number of users to be served.

In order to avoid possible misunderstandings, it is necessary to specify right now that operation of a CNG or LNG vehicle is the same. Gaseous or liquid form of methane does not affect functioning of engine, which remains identical. Liquid form (LNG) is used exclusively to store more energy in tank, and therefore have greater autonomy, especially important for heavy vehicles for freight (trucks) or passengers (buses) transport.

In 2021 methane cars fleet in Italy was 972,144, against 4,360 in Greece, 133 in Croatia and 230 in Slovenia.

Commercial vehicles were 101,877 in Italy, 260 in Greece, 96 in Croatia and 100 in Slovenia.

There were 4,191 methane buses on the road in Italy, 280 in Greece, 100 in Croatia and 83 in Slovenia, 54 in Macedonia[193].

192

Emission Factor (g/km) for Euro 6 Heavy Duty Passenger Vehicle

	CO	NOx	PM2,5
Gasoline	6,21300	0,23000	0,00030
Diesel	0,31800	0,37400	0,00100
CNG	0,05400	0,26600	0,00002

University of Pereira (Colombia), faculty Mechanical Engineering

193 http://www.jsp.com.mk/vest.aspx?vest=2314 and https://sdk.mk/index.php/dopisna-mrezha/vladata-da-ni-dade-pomosh-za-gorivo-ili-ke-gi-redutsirame-privatnite-avtobusite-veli-lenin-jovanovski-od-sloboda-prevoz/

With regard to trucks, of 3,288 gas-powered trucks circulating in Italy, 3,076 are also equipped with an LNG tank. In Greece fleet of gas trucks was 110, in Croatia it was 9 and in Slovenia it was 14.

In North Macedonia the data is available cumulatively for gasoline – gas vehicles, where total of 12.320 vehicles were of such kind, out of which 11.762 were car fleet, 58 buses, 415 trucks and only 6 commercial vehicles[194].

Recent increases in price of natural gas have strongly slowed down fleet growth of these vehicles.

Especially heavier vehicles, such as trucks and buses, counted on higher economy of gaseous fuel, compared to diesel fuel. Competitive variable that has temporarily failed to a large extent.

It should also be considered that in absence of incentives, price of a truck or bus that runs on natural gas only, is considerably higher than a similar diesel vehicle. First of all because it is necessary to ensure that an Otto Cycle engine (newest part of heavy fleet, which can only run by methane) involves high costs, which can only be equalized on Diesel engine price through high public incentives. Furthermore, duration of an Otto Cycle heavy vehicle is about half that of a Diesel Cycle.

For these reasons, a very moderate growth of these vehicles is expected by 2030. High price of methane will also slow down transformations of diesel vehicles into hybrid, diesel-methane vehicles. Slowdown will only end if price of methane returns to historically normal levels.

In the next few years, methane (and potentially biomethane) fleet vehicles will increase very slowly, with a slight acceleration towards the end of the decade.

[194]https://makstat.stat.gov.mk/PXWeb/pxweb/mk/MakStat/MakStat__Transport__RegistriraniVozila/275_Trans_Reg_voz_Gorivo_mk.px/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef

	Italy		Greece		Croatia		Slovenia	
	CNG	LNG	CNG	LNG	CNG	LNG	CNG	LNG
CARS								
2008	506000							
2009	612000							
2010	661000							
2011	681000							
2012	720000		6		66		48	
2013	774000		280		219		29	
2014	833668		280		203		120	
2015	883190		484		202		122	
2016	911246		496		96		163	
2017	926704		701		126		225	
2018	945184		920		133		244	
2019	965000		2567		133		230	
2020	981000		3829		133		230	
2021	972144		4360		133		230	
2022	972241		4360		133		230	
2023	972338		4361		133		230	
2024	972436		4361		133		230	
2025	972533		4362		133		230	
2026	972630		4362		133		230	
2027	982356		4406		134		232	
2028	992180		4450		136		235	
2029	1002102		4494		137		237	
2030	1012123		4539		138		239	
COMMERCIAL VEHICLES								
2008	44000							
2009	56000							
2010	61200							
2011	61000							
2012	83023							
2013	86000							
2014	90000							
2015	93000						73	
2016	97000		25		75		73	
2017	95872		68		92		74	
2018	97966		130		96		74	
2019	101281		200		96		100	
2020	102929		260		96		100	
2021	101887		260		96		100	
2022	101897		260		96		100	
2023	101907		260		96		100	
2024	101918		260		96		100	
2025	101928		260		96		100	
2026	101938		260		96		100	
2027	102448		261		97		101	
2028	102960		263		97		101	
2029	103475		264		97		102	
2030	103992		265		98		102	
BUS								
2008								
2009								
2010								
2011								
2012	2300		600		71		20	
2013	2300		618		78		24	
2014	2300		618		78		47	
2015	1840		310		100		69	
2016	4101		310		92		84	
2017	4023		226		102		83	
2018	4199		247		100		83	
2019	4274		260		100		83	
2020	4269		280		100		83	
2021	4191		280		100		83	
2022	4233		281		101		83	
2023	4275		283		101		84	
2024	4318		284		102		84	
2025	4361		286		102		85	
2026	4405		287		103		85	
2027	4449		289		103		86	
2028	4493		290		104		86	
2029	4538		291		104		86	
2030	4584		293		105		87	
TRUCKS								
2008								
2009								
2010								
2011								
2012	1200		102		18			
2013	3000		102		3			
2014	500		102		3		5	
2015	2160		106		3		8	
2016	2160		106		3		8	8
2017	2380	416	101		4		39	8
2018	2550	1111	109		9		60	8
2019	2938	1907	110		9		14	
2020	3178	2458	110		9		14	
2021	3288	3076	110		9		14	
2022	3291	3079	110		9		14	
2023	3295	3082	110		9		14	
2024	3298	3085	110		9		14	
2025	3301	3088	110	1	9		14	
2026	3304	3091	111	3	9		14	
2027	3338	3122	112	4	9		14	
2028	3371	3154	113	5	9		14	
2029	3405	3185	114	6	9		14	
2030	3439	3217	115	6	9		15	

Table 67 – Methan veichles in use in Croatia, Greece, Italy and Slovenia

Source: Consultant's elaboration on data from EC - European Alternative Fuels Observatory

Therefore, in transport sector, natural gas mobility is above all an Italian phenomenon, which continues a long-standing tradition. In the other countries, the sector, which has only recently begun, is in a stationary phase, except in Greece where growth appears to be sustained.

8.2.3 Electric Car and Van fleet

In 2021 BEV[195] fleet (cars and vans) of Italy was 132,110, that is 0,31% of total cars and van fleet of Italy. PHEV[196] fleet was 115078, that is 0,29% of total car and van fleet. Total electric vehicles (BEV + PHEV) were 0,6% of fleet.

In Greece BEV fleet was 3311, that is 0,06% of total cars and van fleet. PHEV fleet was 6826, that is 0,13% of total car and van fleet. Total electric vehicles (BEV + PHEV) are 0,19% of fleet.

Electric Car and Van fleet, 2021

	BEV	% on total fleet	PHEV	% on total fleet	BEV + PHEV % on total fleet
Italy	132110	0,31	115078	0,29	0,60
Greece	3311	0,06	6826	0,13	0,19
Croatia	2548	0,14	940	0,05	0,19
Slovenia	5574	0,47	1088	0,10	0,57

Table 68 – Electric car and van fleet in Croatia, Greece, Italy and Slovenia

Source: Consultant's elaboration on data from EC - European Alternative Fuels Observatory

Croatia: BEV fleet was 2548, that is 0,14% of total cars and van fleet. PHEV fleet was 940, that is 0,05% of total car and van fleet. Total electric vehicles (BEV + PHEV) are 0,19% of fleet.

Slovenia: BEV fleet was 5574, that is 0,47% of total cars and van fleet. PHEV fleet was 1088, that is 0,10% of total car and van fleet. Total electric vehicles (BEV + PHEV) are 0,57% of fleet.

In 2030 the electric cars in circulation in Italy will be 490 thousand-5.9 million, range calculated according to the minimum annual increase of the electric fleet (10% annual average, H10%) or the maximum (50% annual average, H50%). For Greece the range is 18,4 thousand-178 thousand); Croatia 7,5 thousand-105 thousand; Slovenia 14,8 thousand-222 thousand.

[195] Battery Electric Vehicle

[196] Plug in Hybrid Electric Vehicle

Electric car fleet forecast in 2030

	$H_{10\%}$			$H_{30\%}$			$H_{50\%}$		
	BEV	PHEV	TOTAL	BEV	PHEV	TOTAL	BEV	PHEV	TOTAL
Italy	311.508	178.524	490.032	1.400.960	404.830	1.805.791	5.078.752	857.398	5.936.150
Greece	7.807	10.589	18.397	35.111	24.013	59.125	127.286	50.858	178.144
Croatia	6.008	1.458	7.466	27.020	3.307	30.327	97.954	7.004	104.957
Slovenia	13.143	1.688	14.831	59.109	3.827	62.937	214.283	8.106	222.390

Table 69 – Electric car fleet forecast in 2030 in Croatia, Greece, Italy and Slovenia

Source: Consultant's elaboration and forecast on data from EC - European Alternative Fuels Observatory

Forecasts to 2030 on car fleet, beyond EU and individual states plans, are extremely uncertain, as they depend not only on public policies, but realistically also on purchasing power of consumers and their propensity to buy electric cars.

At the moment social classes that buy electric car are mainly the more affluent ones. Electric car is a vehicle that, compared to conventional ones, costs a price more than double and has an effective autonomy, for the BEV version, of 1/3-1/2, compared to diesel or petrol engines. It is therefore logical that a higher price, combined with a lower service, can only be afforded (and wants to be afforded) only by richest citizens.

And it is very likely that if price of electric cars will not fall sufficiently and usefulness of these vehicles will not significantly increase, in terms of driving range, electric car fleet will hardly be much larger than today. Also because increase in sales would cause a sharp increase in state burden for incentives, necessary to induce the purchase, and therefore an increase in the tax burden for taxpayers, ie a decrease in their purchasing power. A classic vicious circle.

Today we have seen that in no country does electric cars reach 1% of total fleet. With regard to BEVs only, share is even lower than 0.5%. This despite over a decade of very generous incentives and other facilitations for purchase and use of electric vehicles.

Nevertheless, electric car charging network is beginning to be quite widespread, in these countries.

Major economies, Italy and Greece, have 1 charging point for every 5 BEV cars on the road, Croatia has 1 charging point for every 3 BEV cars on the road and in Slovenia the ratio is 1:1.

On top of that, medium and fast speed charging points clearly prevail, both for AC and DC charging points, in all countries considered.

The insufficiency of recharging points cannot therefore be considered the decisive factor, which limits the spread of electric cars. By way of comparison, we recall that in Italy each service station serves, on average, over 1700 cars, as well as 190 trucks and 4 buses.

If this factor is not totally resolved, it is at least partially overcome. While the problems of the cost of the car, charging times and battery life remain. Which, even in presence of a penetration of 1 refill point per car, would not be exceeded. On the contrary, the increase in investments for service stations would increase the cost of electricity for motor vehicles.

AC recharging point for electric vehicles, 2021

	Slow AC recharging point, single-phase (P < 7.4kW)	Medium-speed AC recharging point, triple-phase (7.4kW ≤ P ≤ 22kW)	Fast AC recharging point, triple-phase (P > 22kW)	TOTAL AC
Italy	3525	19643	1378	24546
Greece	23	583	1	607
Croatia	37	576	30	643
Slovenia	191	5078	44	5313

DC recharging point for electric vehicles, 2021

	Slow DC recharging point (P < 50kW)	**Fast DC recharging point (50kW ≤ P <150kW)**	**Level 1 - Ultra-fast DC recharging point (150kW ≤ P < 350kW)**	**Level 2 - Ultra-fast DC recharging point (P ≥ 350kW)**	**TOTAL DC**
Italy	55	1613	495	151	2314
Greece	1	7	14	0	22
Croatia	46	188	57	6	297
Slovenia	49	151	23	24	247

Table 70 – Number of AC and DC recharging points for electric vehicles in Croatia, Greece, Italy and Slovenia

Source: Consultant's elaboration on data from EC - European Alternative Fuels Observatory

European Union obliges Member states to adopt National Policy Framework (NPF) targets.

Greece will have to increase sales points of electricity for vehicles from 629 in 2021 to 4000 in 2025;

Croatia already had 940 electric refuelling points in 2021, up from an NFP of 602 in 2025.

Slovenia will have to increase sales points of electricity for vehicles from 5560 in 2021 to 7000 in 2025.

European Union has no data of **Italy** for 2025.

In Albania, in 2021 there were 740,669 registered vehicles in total, out of which 593,280 were passenger cars. The number of registered electric vehicles in the year 2022 amounts to 2,588.

In Bosnia and Herzegovina, the following numbers of registered electric vehicles are noted:

- Year 2021: 1,586 cars:
- Year 2022: 2,368 cars:
    - Hybrid gasoline-electric: 1,561 cars,
    - Hybrid diesel-electric: 348 cars,
    - Electric: 138.
    - Passenger SUVs (hybrid diesel-electric): 95,
    - Passenger SUVs (hybrid gasoline-electric): 40,
    - Buses (hybrid gasoline-electric): 8,
    - Buses (electric): 32,
    - Freight vehicles (hybrid or electric): 84[197].

The total number of registered vehicles in the year 2021 was 1,152,743.

[197] https://bhsc.trtbalkan.com/region/u-bih-za-pedeset-posto-povecan-broj-hibridnih-i-elektricnih-automobila-12232827.

In Montenegro, as of 31/12/2021, there were 265,464 registered vehicles. In the year 2022, the number of registered hybrid vehicles was 33, while there were 444 electric vehicles. The total number of registered vehicles in 2022 was 265,470.

In North Macedonia, the total number of registered vehicles in 2021 was 549,653 vehicles, out of which 477,820 were passenger cars. The number of registered electric vehicles reached 243 in 2021[198].

	Until 2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total	387,373	37,131	22,064	17,026	14,068	9,829	7,924	7,956	8,642	8,530	7,848	7,960	8,048	7,528	7,491
Passenger cars	350,020	30,478	18,589	14,206	10,963	7,301	5,557	5,150	6,086	5,926	5,499	5,231	5,364	3,680	3,770
Buses	1,801	270	158	170	213	99	43	26	21	14	10	22	35	52	12
Freight vehicles	22,537	4,030	2,240	1,651	642	1,234	1,195	1,293	1,239	1,097	1,132	1,067	1,137	806	1,027
Motorcycles	4,597	1,044	679	502	524	550	438	479	440	550	564	948	960	2,017	1,494
Working vehicles	498	22	32	14	12	10	9	6	6	25	4	13	14	20	34
Towing vehicles	2,125	536	146	167	243	261	324	641	503	469	248	178	103	50	125
Tractors	1,337	27	24	31	34	36	59	41	83	60	65	177	116	428	418
Auxiliary vehicles	4,458	724	196	285	437	338	299	320	264	389	326	324	319	475	611

Table 71 – Total number of registered vehicles in North Macedonia

The number of electric vehicles is gradually increasing – in 2019, there were 51 electric cars in the country, in 2020 there were 69, and in 2021 there were 128 electric cars registered.

In Serbia, in the recent years, numbers of registered electric cars were as follows:

- Year 2020: 30 passenger cars,
- Year 2021: 113 electric cars in total (71 passenger cars, 41 light commercial vehicles).

There is an increasing trend, however projections for the year 2030 would be very difficult to make, considering the economy issues, i.e. financial capabilities of the population to buy electric cars.

The total number of registered cars in Serbia in the year 2020 was 2,164,818, and 2,235,794 cars in the year 2021.

8.2.4 H2 Mobility

Currently, hydrogen mobility, in the countries of the Adriatic and Ionian area, is only in an experimental phase, moreover currently active only in Italy.

In 2021, 45 hydrogen cars were circulating in Italy and 1 Eni service station operated in San Donato Milanese. In 2022, a second hydrogen service station was opened, Venice-Mestre.

Both experimental service stations are part of a collaboration plan with Toyota to promote hydrogen traction.

198 https://makstat.stat.gov.mk/PXWeb/pxweb/mk/MakStat/MakStat__Transport__RegistriraniVozila/275_Trans_Reg_voz_Gorivo_mk.px/table/tableViewLayout2/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef

Compared to BEV mobility, H mobility is therefore far behind. Yet environmental characteristics of a hydrogen car are similar to those of a BEV car, while functional ones are even higher and, in terms of autonomy, even comparable with those of a diesel engine.

To confirm these statements, it is appropriate to briefly describe operation of a hydrogen car, its characteristics and refuelling time.

To make the exposure clearer, we will refer to a model already available in price list and purchasable, that is Toyota Mirai.

In a hydrogen fuel cell technology car (such as Mirai) fuel cell produces electricity by binding hydrogen, stored in the three tanks, with oxygen entering in the air intakes from the outside. This powers the engine and charges the battery, which supplies energy to the drive wheels.

So, hydrogen fuel cell car is nothing more than an electric car which, instead of having large batteries that need to be recharged often, draws its primary energy from the hydrogen tanks of the car itself. With only 5.6 kg of hydrogen (which occupy a volume of 142 litres), Mirai has a range of 650 km. That is: with another 5.6 kg of hydrogen, the range would exceed that of most of all diesel cars available on the market.

The refuelling time of the Mirai is currently 5 minutes. That would rise to 10 minutes in the event of doubling capacity of the tanks. Emissions consist of water vapor only, while specific consumption is 116 km/kg.

Autonomy and refuelling times are therefore almost comparable with traditional cars. But price is still high, given Mirai price starts at EUR 66,000.

Although the network of hydrogen distributors is still practically absent in the Adriatic-Ionian countries, the European Union initiative, TEN-T, provides that H refuelling station will have to be available every 150 km along the TEN-T core network and in every urban node serving both light duty vehicles including passenger cars and heavy-duty vehicles.

Hydrogen can be produced, as well as with traditional methods starting from fossil fuels, also through electrolysis from nuclear, wind, solar or biomethane energy. The advantage of the fuel cell transport, compared to the battery one, is that it can be stored until the moment of actual use, without running the risk of energy loss. Losses to which a battery is subject, even if it is not used.

In various Italian cities, such as Bolzano, Milan and Venice, public transport is also involved for experimental programs involving hydrogen buses.

The NECP of Albania recognizes hydrogen as fuel of the future in the transport sector, and sets the following targets related to hydrogen:

- Hydrogen in rail will contribute to RES-T (Target 0.005% and 0.1 ktoe amount of renewable fuel used by 2030),
- Hydrogen (urban buses and long-distance coaches) will contribute to RES-T (Target 0.005% and 0.1 ktoe amount of renewable fuel used by 2030), and

- Hydrogen road vehicles (passengers' cars and trucks) will contribute to RES-T (Target 0.12% and 1.2 ktoe amount of renewable fuel used by 2030).

Non-EU members from the Adriatic-Ionian region which have not prepared the NECP so far (Serbia, Montenegro, BiH) have not declared their targets regarding hydrogen in the transport sector. Developments related to introduction of hydrogen in these countries are not expected to start soon.

There are no references to usage of hydrogen in the transport sector of North Macedonia.

9 Section 9 - Towards a carbon-neutral Adriatic-Ionian Region

9.1 The EUSAIR Carbon Neutral by the year 2050 Scenario

For the **carbon neutral scenario by the year 2050**, for each EUSAIR Country, the **IEA "Net Zero Emission" Scenario** (the so-called "NZE" scenario) has been used as main reference. This scenario maps out a way to achieve a 1.5 °C stabilisation in global average temperature and meet key energy-related UN Sustainable Development Goals.

The IEA NZE scenario is designed to show what is needed across the main sectors by various actors, and by when, to **achieve net-zero energy-related CO2 emissions by 2050**.

In the Master Plan for:

- each **Country**,
- each **sector** (industry, buildings, transport, etc.),
- and each **energy source** (gas, oil, renewables, coal, etc.)

have been developed scenarios with specific trajectories based on those contained in the IEA Net Zero Scenario.

The main results are reported as following.

In terms of **<u>final energy consumption</u>**, the 2030 scenarios already discount a significant **increase in energy efficiency**, in particular in the case of the NZE scenario.

The **growing role of electrification and renewables** displaces the consumption of gas and oil products.

In 2050, in the EUSAIR area, considering on average **97% of electricity renewable**, the average level of coverage of total final energy consumption with RES is **around 90%**.

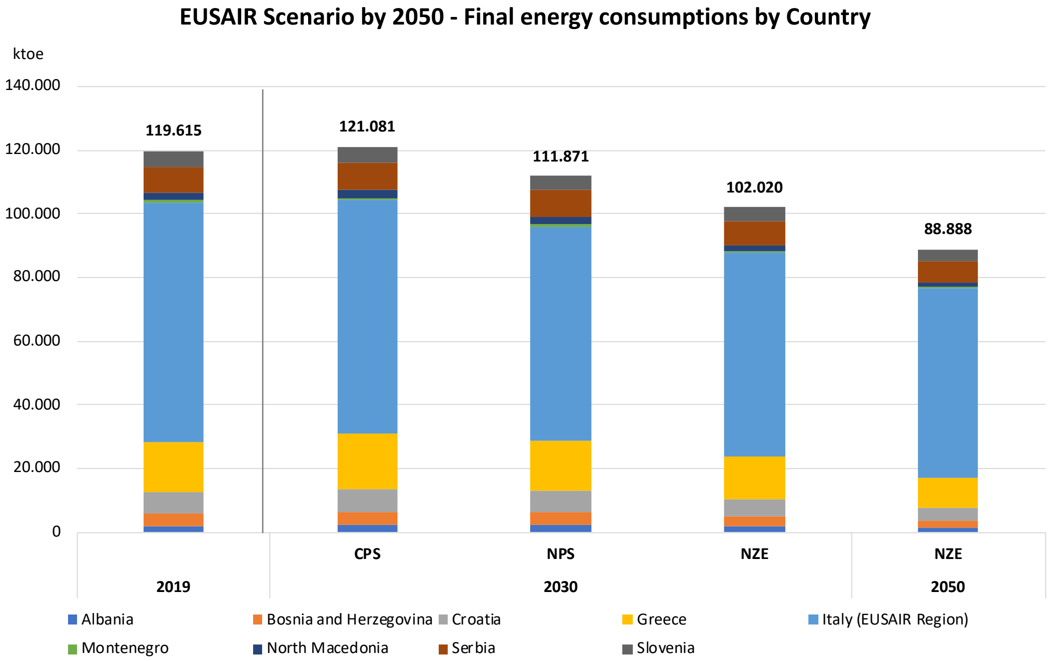

Figure 128 – EUSAIR NZE Scenarios by 2050 - Final energy consumptions by Country

Source: Consultant's elaboration on Eurostat, NECP and IEA data

In **sectoral terms**, the only sector for which an increase in consumption is expected by 2050 is the industrial sector, driven by strong electrification and new processes related also to synthetic fuels.

For all the other sectors, a significant drop in consumption is expected by 2050, thanks above all to a strong efficiency improvement of buildings and technologies.

In the case of transport, this drop is close to 2050; in services it exceeds 40%; in the residential sector almost 60%.

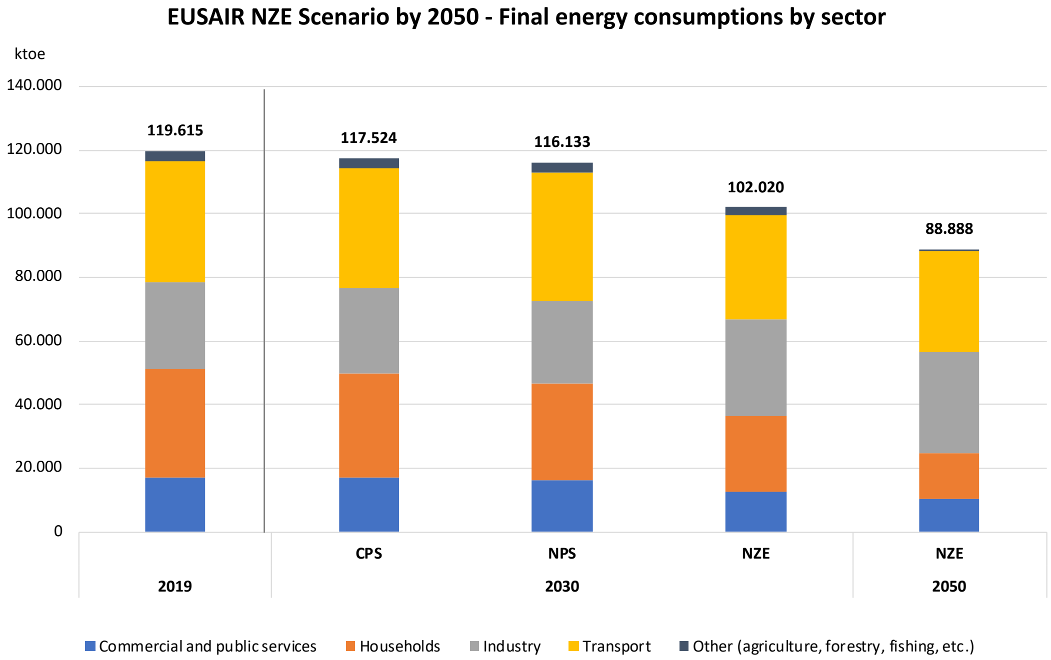

Figure 129 – EUSAIR NZE Scenarios by 2050 - Final energy consumptions by sectors

Source: Consultant's elaboration on Eurostat, NECP and IEA data

As regards **natural gas consumption**, based on the CPS and NPS scenarios (cfr. **Section 7**), a significant drop in consumption is expected by 2030, falling from 65 billion cubic meters in 2019 to just over **58 billion cubic meters** in the NPS scenario (**-10%** respect the base year).

The NZE scenario envisages a very sharp drop in gas consumption as early as 2030 and then **substantially zeroing, except in Italy, in 2050**.

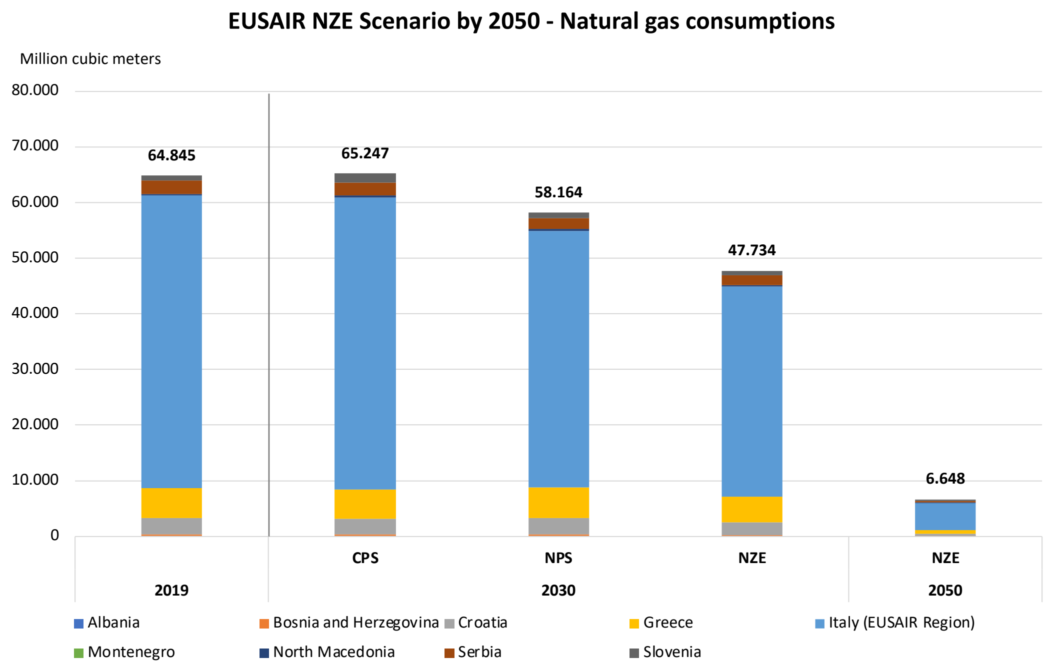

Figure 130 – EUSAIR NZE Scenarios by 2050 – Natural gas consumptions

Source: Consultant's elaboration on Eurostat, NECP and IEA data

As regards **electricity consumption**, on the basis of the CPS and NPS scenarios (cfr. **Section 5**), a relatively limited increase in such consumption is expected in 2030, ranging from 28.6 Mtoe in 2019 to 30.0 Mtoe in 2030 in the CPS scenario or 30.3 Mtoe in the NPS scenario (**+6%** respect the base year).

The NZE scenario instead envisages a significantly higher level of electrification, which in 2050 leads to an electricity consumption equal to almost **2 and a half times** that recorded in the base year.

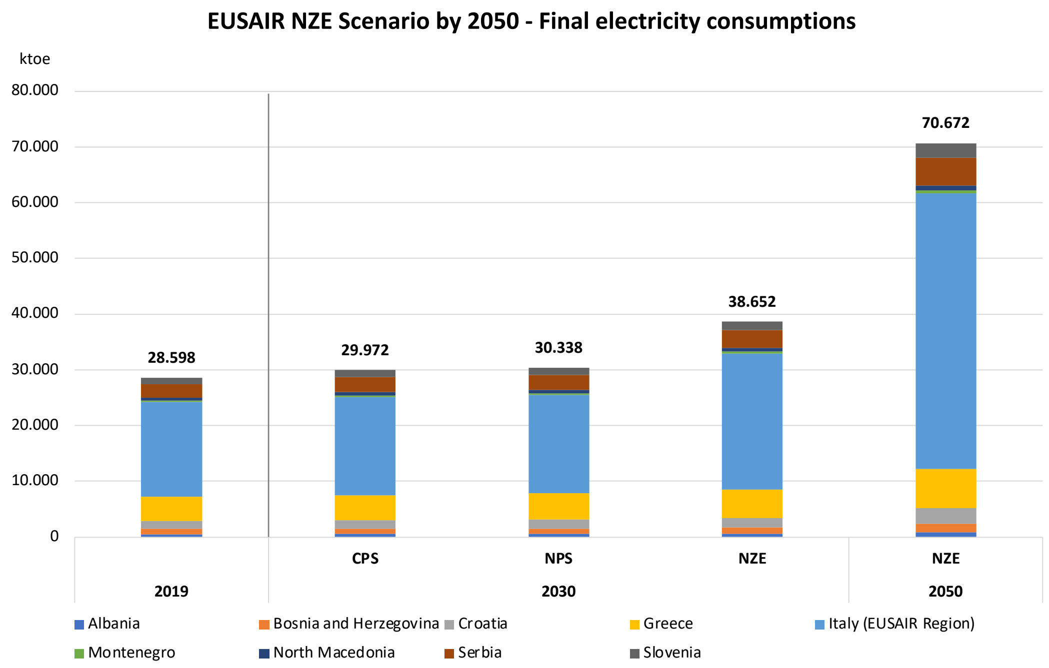

Figure 131 – EUSAIR NZE Scenarios by 2050 - Final electricity consumptions

Source: Consultant's elaboration on Eurostat, NECP and IEA data

The **power generation** scenarios are **closely linked** to those of electricity consumption.

In 2030, both the **CPS and NPS** scenarios **do not foresee significant deviations**, with the exception of some local situations, compared to the situation of the base year (cfr. **Section 5**).

The **NZE scenario**, on the other hand, enhances strongly the electricity generation from renewables and low-emissions technologies.

In 2050, electricity production in the NZE scenario is **almost three times** that of the base year.

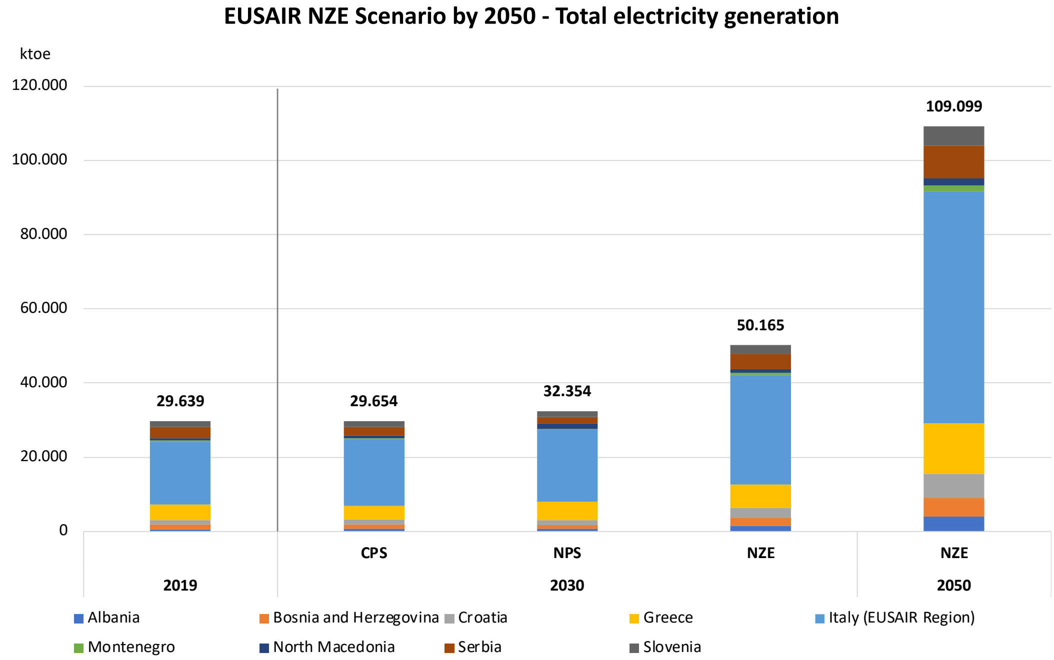

Figure 132 – EUSAIR NZE Scenarios by 2050 – Total electricity generation

Source: Consultant's elaboration on Eurostat, NECP and IEA data

The production of electricity from **RES is expected to grow in all scenarios, in all countries**.

In 2030, it is expected **to double in the NPS scenario**, covering almost two thirds of the total electricity production (64%).

In 2050, in the NZE scenario, electricity production from RES is expected to be **around 8 times** that of the base year, covering **around 97%** of the area's power generation.

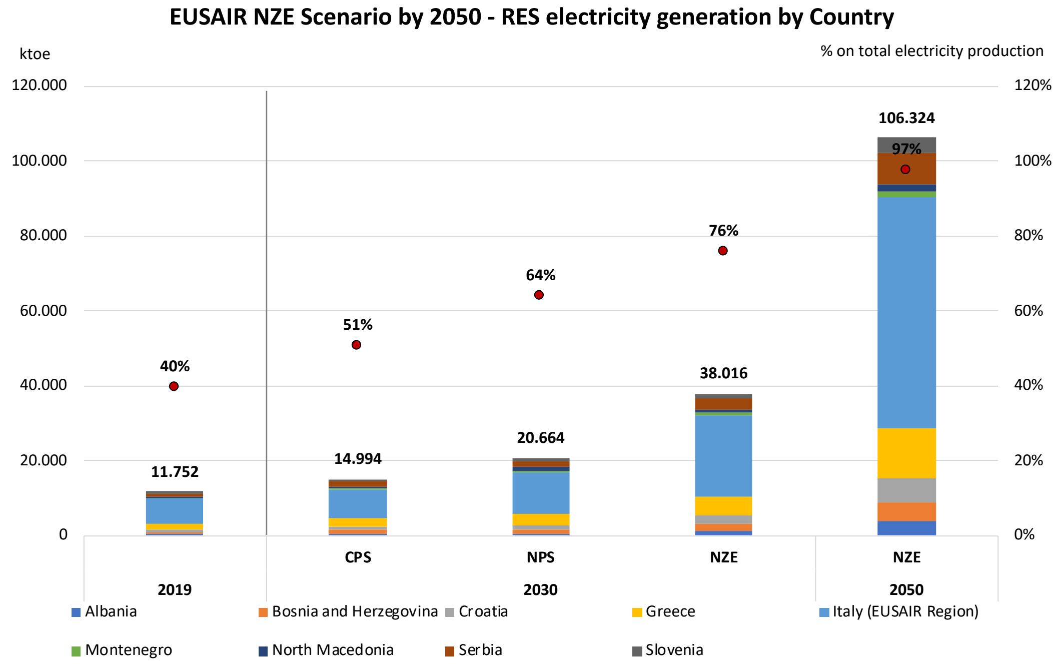

Figure 133 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by Country

Source: Consultant's elaboration on Eurostat, NECP and IEA data

Regarding the deployment of RES production, in 2050 this production is expected to be almost 10 times that achieved in the base year.

The main contribution to electricity production from renewables is expected to come from photovoltaics, which will cover around 60% of total production from renewables in the NZE scenario by 2050.

Hydro, historically the most widespread renewable source in the EUSAIR area, especially in non-EU Countries, although doubling its production will be largely surpassed by wind power, which in 2050 will cover over 20% of electricity production from renewables (hydroelectric will drop from current 53% to about 11% in 2050).

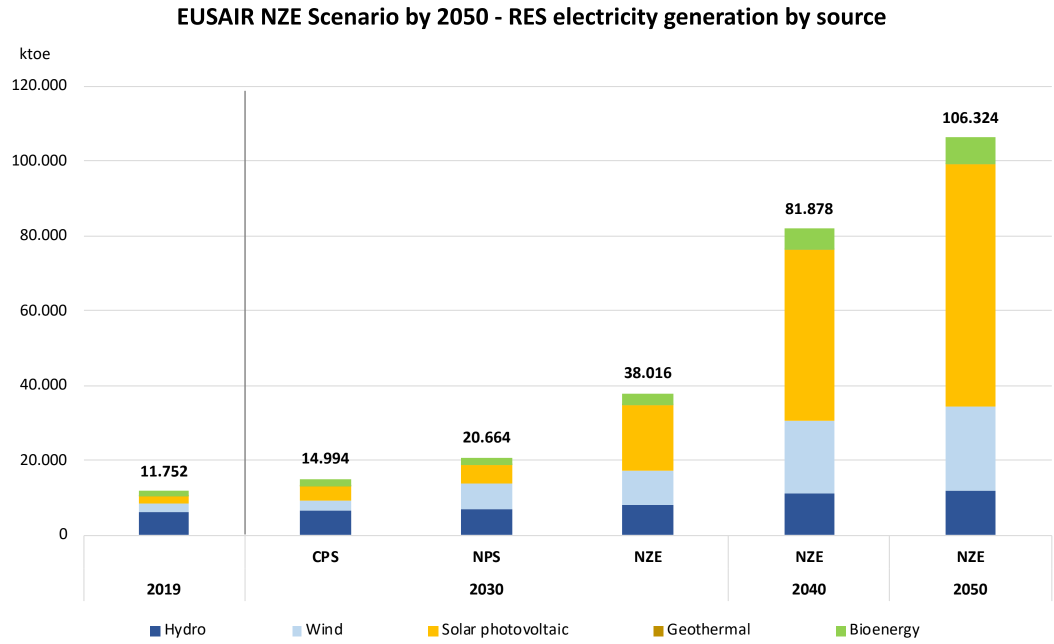

Figure 134 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by source

Source: Consultant's elaboration on Eurostat, NECP and IEA data

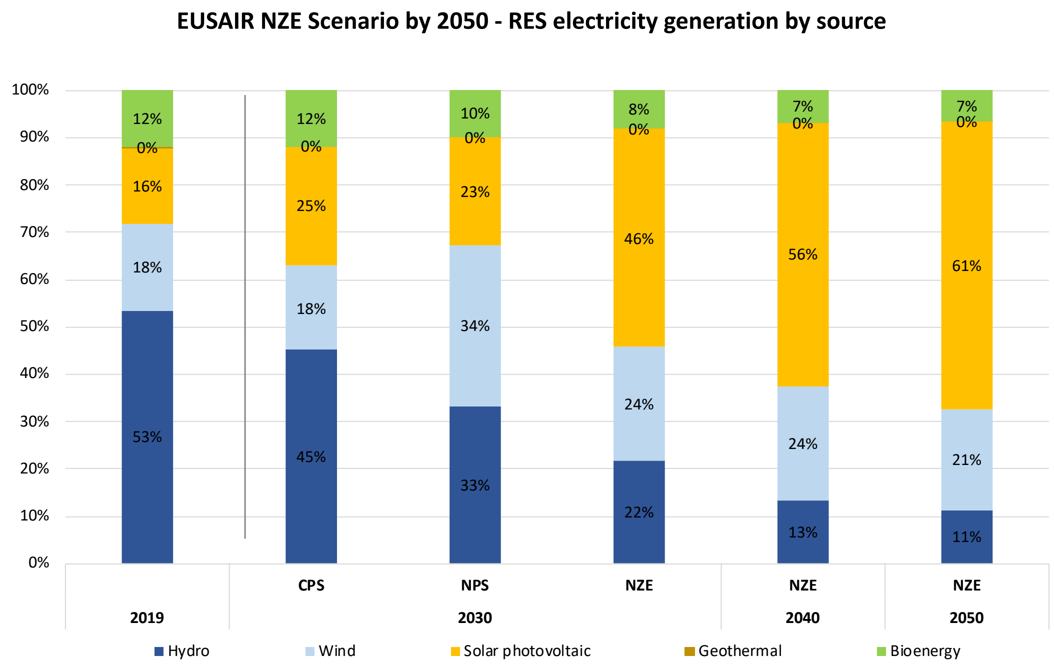

Figure 135 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by source (%)

Source: Consultant's elaboration on Eurostat, NECP and IEA data

To reach these production levels, approximately 650-700 GW of photovoltaic plants will be needed, compared to the 20 GW currently installed in the EUSAIR area.

Similarly, wind power of around 150-200 GW (currently 17 GW installed in EUSAIR) and around 70 GW of hydroelectric plants (currently around half) will be needed.

Also for bioenergy, a significant growth in installed plants is expected (from 3 to 16 GW), such as to reach around 7% of electricity production from RES.

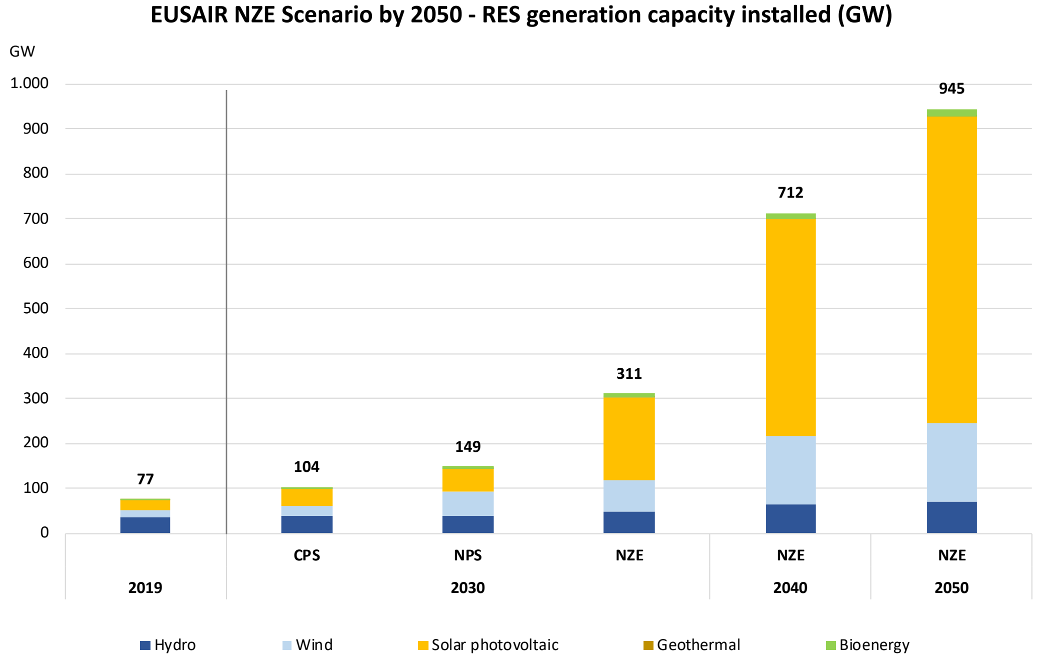

Figure 136 – EUSAIR NZE Scenarios by 2050 – RES generation capacity installed (GW)

Source: Consultant's elaboration on Eurostat, NECP and IEA data

Power generation using natural gas is currently mainly concentrated in Italy and Greece, which account for about 96% of the total generation from gas in the EUSAIR area.

Looking ahead, if the current **coal-fired generation** is not replaced by gas, **there will be a general decrease in the gas** consumption for power generation since it will be **displaced by RES**.

However, gas-fired electricity capacity **remains an opportunity** also in perspective in terms of **grid security and stability**, in view of the enormous development of RES.

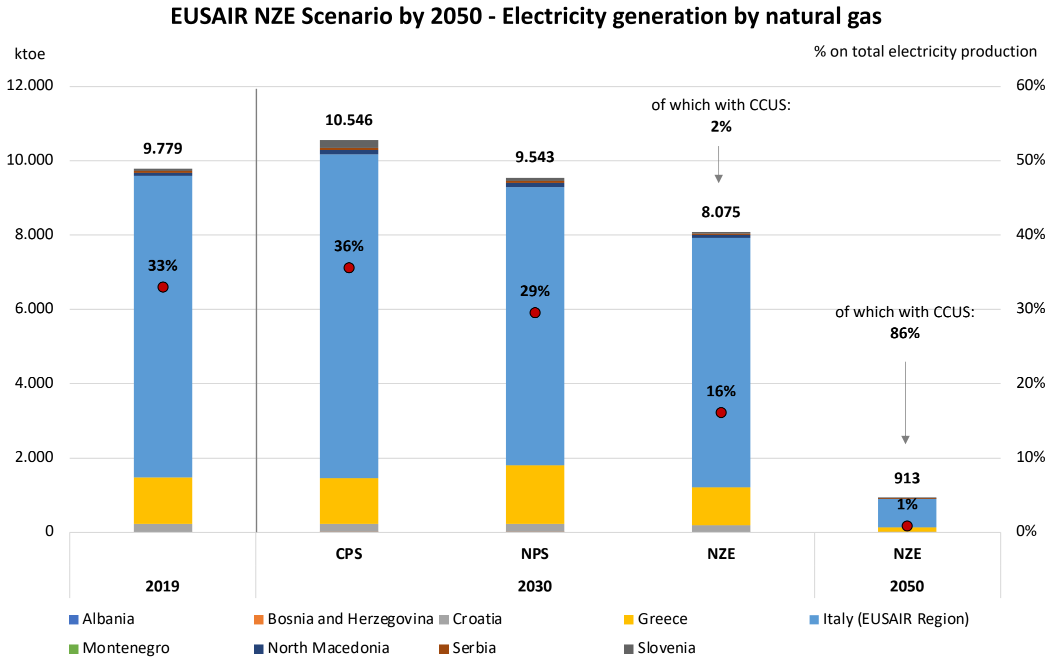

Figure 137 – EUSAIR NZE Scenarios by 2050 – Electricity generation by natural gas

Source: Consultant's elaboration on Eurostat, NECP and IEA data

The role of **coal** in electricity generation is **expected to decline**.

However, the conversion of coal power generation could take place through three main ways:

- replacement with **RES**
- replacement by **natural gas**
- keeping coal-fired power generation with **carbon capture use and storage (CCUS).**

Depending on which path will be taken, especially in the Balkan countries, the role of coal in the long term will be declined.

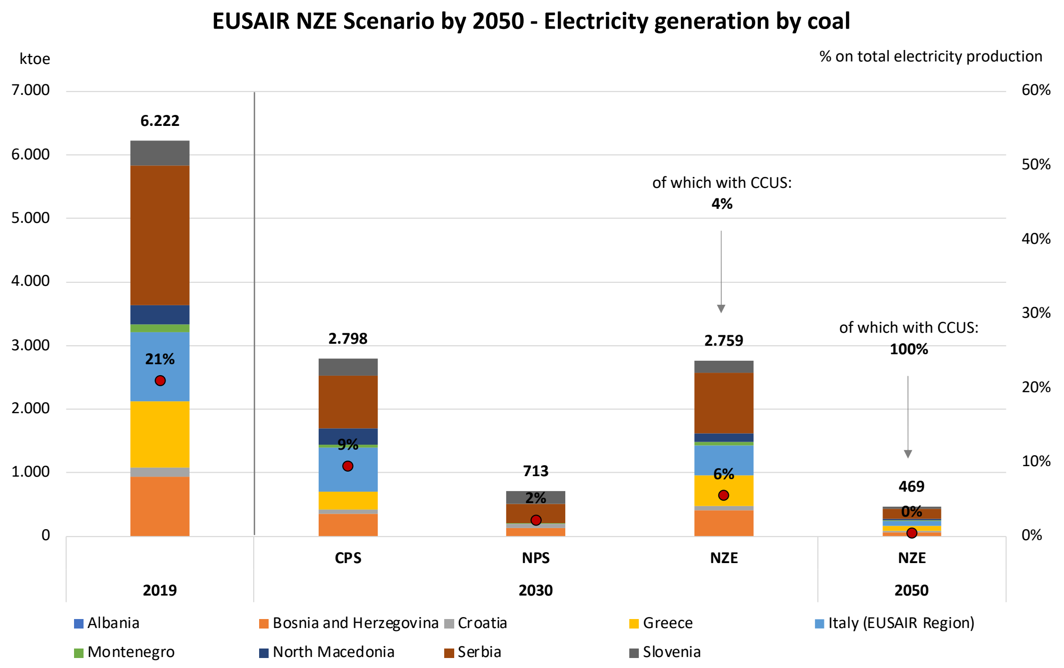

Figure 138 – EUSAIR NZE Scenarios by 2050 – Electricity generation by coal

Source: Consultant's elaboration on Eurostat, NECP and IEA data

The role of **nuclear electricity generation** in the EUSAIR area is relatively limited, equal to **less than 2%** in the base year and present only in Slovenia (co-owned with Croatia): no significant changes to this configuration are expected by 2030 in CPS or NPS.

The NZE scenario of the IEA, however, assigns an important role to nuclear, with a growth in the long term: in the case of the EUSAIR area, this means approximately **a doubling of the current nuclear generation**, representing in any case less than 1% of the total production of the entire area.

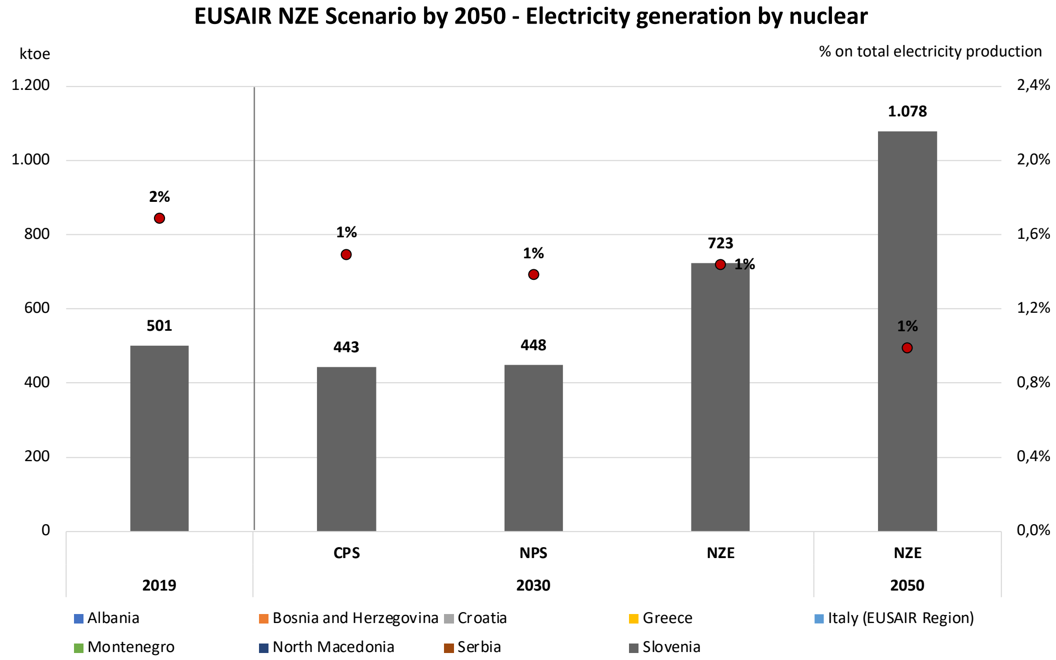

Figure 139 – EUSAIR NZE Scenarios by 2050 – Electricity generation by nuclear

Source: Consultant's elaboration on Eurostat, NECP and IEA data

9.2 The EUSAIR Scenarios compared with the 2030 EU targets

Considering the previous scenarios, strong steps forward emerge by the energy data concerning each one of the EUSAIR Members States for the year 2030 and their comparison with the EU targets. Trends from 2019 through the year 2030 are reported here as follows.

Information includes:

- Renewable energy
- Energy efficiency
- CO2 emissions reduction

9.2.1 Renewable energy

The share of renewable energies covering final energy consumption by single EUSAIR country and by single scenario, in the two reference time horizons (2030 and 2050) is shown below.

In the case of the CPS and NPS scenarios to 2030, the information and targets contained in the NECPs of the respective countries were considered in line with the methodology adopted in this Master Plan. For this reason, this information is not shown below for countries without NECPs.

Considering the 2030 data available for the CPS and NPS scenarios, compared to the current EU target of **32%** for 2030, it can be seen that the average EUSAIR country has a target that tends to be higher than the current European one, for with the exception of Italy, which aims for a share of renewables in the NPS scenario of 30%, and Slovenia (27%).

In the NZE scenario, however, all countries are above the current European target, reaching an average of almost **36%** of final consumption covered by renewables. However, this is still an insufficient level compared to that proposed in the Fit for 55 package (**40%**) and, even more so, in the REPowerEU (**45%**).

Country	2019	2030			2050
		CPS	NPS	NZE	NZE
Albania	36,7%	33,5%	54,4%	52,0%	89,0%
Bosnia and Herzegovina	37,6%	n.a.	n.a.	37,2%	89,8%
Croatia	28,5%	34,0%	36,4%	38,1%	88,1%
Greece	19,7%	n.a.	35,0%	34,1%	86,4%
Italy (EUSAIR Region)	18,2%	21,2%	30,0%	34,3%	91,1%
Montenegro	37,4%	n.a.	n.a.	46,5%	88,6%
North Macedonia	16,8%	33,0%	38,0%	34,3%	81,8%
Serbia	21,4%	n.a.	n.a.	47,6%	91,2%
Slovenia	22,0%	n.a.	27,0%	35,1%	74,6%
EUSAIR	**24,0%**	**n.a.**	**n.a.**	**35,8%**	**89,7%**

Table 72 - Summary of RES share in final energy consumption in different EUSAIR scenarios

Source: Consultant's elaboration on Eurostat, NECP and IEA data

9.2.2 Energy efficiency

With respect to energy efficiency, the following table shows the savings values in terms of final energy consumption compared to 2019 levels.

Since it is not possible to make considerations with respect to the savings obtainable with respect to the reference projections of non-EU countries, for uniformity of discussion below, the energy savings per individual Country have been considered with respect to the consumption of the base year (2019).

Also in this case, for countries without NECPs the information and targets contained in the NECPs of the respective countries are absents for CPS and NPS scenarios to 2030.

As can be seen, in the NPS scenario, only Italy and Slovenia expect a reduction in consumption in 2030 compared to 2019 levels: all the other countries, in fact, assume a certain growth in consumption in 2030, albeit more contained than in the CPS scenario thanks to increased energy efficiency efforts in all sectors.

It should be noted, however, that the NZE scenario already imposes a significant drop in consumption by 2030 for all countries.

Country	2030			2050
	CPS	NPS	NZE	NZE
Albania	23,7%	10,7%	-9,6%	-32,5%
Bosnia and Herzegovina	n.a.	n.a.	-26,2%	-46,2%
Croatia	5,7%	1,8%	-17,6%	-38,2%
Greece	11,4%	0,3%	-13,5%	-37,9%
Italy (EUSAIR Region)	-2,8%	-10,9%	-15,3%	-21,6%
Montenegro	n.a.	n.a.	-16,0%	-27,5%
North Macedonia	34,2%	18,7%	-13,2%	-35,5%
Serbia	n.a.	n.a.	-7,8%	-17,0%
Slovenia	5,5%	-6,1%	-10,7%	-23,1%
EUSAIR	**1,2%**	**-6,5%**	**-14,7%**	**-25,7%**

Table 73 - Summary of energy savings in final energy consumption in different EUSAIR scenarios (compared to 2019 levels)

Source: Consultant's elaboration on Eurostat, NECP and IEA data

9.2.3 CO2 emission reduction

With respect to CO2 emissions reduction, the following table shows the reductions in 2030 (and 2050) compared to 1990 levels (unless otherwise specified).

Also in this case, for countries without NECPs the information and targets contained in the NECPs of the respective countries are absents for CPS and NPS scenarios to 2030. Similarly, for some Countries information for base year (1990) are not available, thus also in NZE the data are not reported.

As can be seen, with the exception of Albania, all EUSAIR Countries foresee a certain decrease in their greenhouse emissions already in the CPS scenario; consequently, in the NPS scenario this reduction is considered even more marked in each Country.

Also in this case it should be emphasized that the EU target of a 55% reduction in net emissions in 2030 compared to 1990 values would not be achieved even in the NZE scenario, which should therefore be further investigated to achieve the European target.

Country	2030				2050
	NDC Paris Agreement	CPS	NPS	NZE	NZE
Albania*	+18,1%	15,4%	-6,1%	-19,4%	-86,2%
Bosnia and Herzegovina	-33,2%	n.a.	n.a.	n.a.	n.a.
Croatia	-55% (as EU)	-28,9%	-33,5%	-47,7%	-92,4%
Greece	-55% (as EU)	n.a.	-42,0%	-49,2%	-92,5%
Italy (EUSAIR Region)	-55% (as EU)	-26,2%	-36,9%	-43,7%	-92,9%
Montenegro	-35,0%	n.a.	n.a.	n.a.	n.a.
North Macedonia	-82,0%	-20,1%	-82,0%	-86,0%	-97,1%
Serbia	-33,3%	n.a.	n.a.	n.a.	n.a.
Slovenia**	-55% (as EU)	-18,0%	-36,0%	-45,9%	-81,8%

* Compared to 2016 levels for NDC under Paris Agreement and compared to 2018 levels for CPS, NPS and NZE scenarios.
** Compared to 2005 levels for CPS, NPS and NZE scenarios.

Table 74 - Summary of CO2 emission reduction compared to 1990 levels in different EUSAIR scenarios

Source: Consultant's elaboration on Eurostat, NECP and IEA data

9.3 An alternative EUSAIR scenario by the year 2050

In the previous paragraphs, a carbon neutral scenario was proposed for the EUSAIR area, created starting from the climate objectives that the EU has set itself in recent years.

However, it must be kept in mind that achieving a carbon neutral scenario in such a heterogeneous area as the EUSAIR represents a very complex challenge, which encompasses important social, political and economic complexities as well as purely technological ones.

To this end, it is in any case useful to recall the possibility of maintaining a perspective to 2050 which does not necessarily achieve the climate objectives set at EU level but which, instead, represents a compromise between the different needs of individual countries and communities and any 2050 objectives more limited in terms of reducing climate-changing emissions.

In this sense, it may be useful to recall, qualitatively, an alternative scenario to 2050 where energy consumption is not so substantially different from that of the base year (2019) but which instead remains at these levels, in particular as regards gas natural and electricity.

This would imply not only the need to maintain the current infrastructures for the transport and distribution of gas and electricity in operation, but certainly to adapt, update and probably develop them in view in any case of alternative energy sources/vectors that could be mixed in the networks (e.g. hydrogen or e-fuels) and the growing penetration of renewable sources in the electricity sector.

9.4 Enabling factors, drivers and actions along the path to climate neutrality by the year 2050

9.4.1 Impact of carbon pricing mechanisms and carbon trading within the ETS

Common driver for decarbonization in all AIR countries can be found among the UN sustainable development goals, or more precisely, SDG 13 - Climate Action. Namely, in order to limit global warming to 1.5° above pre-industrial levels, as set out in the Paris Agreement, global greenhouse gas emissions will need drop by 43 per cent by 2030 and to net zero by 2050. Countries are required to develop climate action plans to cut emissions and adapt to climate impacts through nationally determined contributions (NDCs). All AIR countries are signatories of the Paris Agreement, having submitted the NDCs to the UNFCC.

Concerning carbon pricing, two groups of countries within AIR can be differentiated – EU countries where the carbon pricing mechanism is governed by the ETS Directive (and the Effort Sharing Regulation), and non-EU countries, where the carbon pricing mechanism is under development within the regulatory framework of the Energy Community (mirroring relevant EU acquis), with a view to achieve full integration of Energy Community Contracting Parties onto the EU ETS mechanism in mid-term.

In October 2020, as one of the activities envisaged by the EU Green Deal, European Commission (EC) issued the Communication *"An Economic and Investment Plan for Western Balkans"*[199], with an objective to support economic recovery, green and digital transition and regional integration, as well as the EU accession of the region. The plan envisages 9 billion EUR of EU funding directed towards infrastructure projects in the region. In addition to this, the plan envisages establishment of a new Western Balkans Guarantee facility, with a potential to mobilize up to 20 billion EUR in the next decade.

This communication is accompanied by the EC Staff Working Document *"The Green Agenda for the Western Balkans"*[200], announcing initiatives related to, among others, enabling technical assistance for introducing EU ETS and alternative fossil fuels, as well as an early inclusion[201] of Western Balkans in the EU ETS as a key tool for creating economic incentives for climate action and a mean for a smooth transition towards climate neutrality.

In the *Sofia Declaration*[202], adopted on November 10, 2020 on a Western Balkans 6 (WB6) initiative summit, the WB6 ministers fully endorsed the Green Agenda for Western Balkans. Among others, within the pillar "Climate, Energy and Mobility", the WB6 ministers expressed their intention to proceed with the alignment with the EU ETS.

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[199] https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-10/communication_on_wb_economic_and_investment_plan_october_2020_en.pdf

[200] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0223&from=EN

[201] i.e. before accession to EU

[202] https://www.energy-community.org/dam/jcr:8950ad3b-0790-4026-921f-6d28e5fc8cab/Declaration-WB6_SOF_112020.pdf

On the EU – Western Balkans summit of October 6, 2021 in Ljubljana, an *Action Plan for Green Agenda for Western Balkans*[203] has been endorsed. The Action Plan resulted from a process coordinated by the Regional Cooperation Council (RCC), with a goal to provide more detailed guidance for implementation of the Green Agenda for the Western Balkans. The Action Plan provides an indicative framework for implementation of the agreements stipulated in the Sofia Declaration, while its structure mirrors the structure of the Green Agenda. Among others, the Action Plan envisages alignment with EU ETS (indicatively) until 2024, based on an Energy Community Ministerial Council Decision on implementation of emission trading, while the Energy Community Secretariat coordinates the activities.

At the Energy Community Ministerial Council Meeting of November 11, 2021 in Belgrade, the ministers adopted the *"Decarbonization Roadmap for the Contracting Parties of the Energy Community"*[204]. Among other actions, the Decarbonization Roadmap envisages implementation of carbon pricing policy in Energy Community Contracting Parties in two phases:

- In the *first phase* the EU regulatory framework for implementing carbon pricing, more precisely, the acts on monitoring, reporting and verification (MRV) of GHG[205] emissions, will be transposed as a necessary prerequisite for introducing any carbon pricing policy by end 2023, and fully implemented by end 2026.
- In the *second phase*, the EU ETS Directive[206] shall be adopted by the Energy Community Ministerial Council, and transposed and implemented by the Contracting Parties. Notably, even indicative deadlines for transposition and implementation of the ETS Directive are not provided in the Action Plan

Further advance towards decarbonization in the Energy Community Contracting Parties occurred on at the 20th Ministerial Council of December 15, 2022, where a Decision has been adopted setting the MRV system as envisaged in the Energy Community Decarbonization Roadmap (phase 1 of the carbon pricing implementation). In addition to this, GHG reduction targets for the Energy Community and all Contracting Parties have been adopted.

Work on the design of an EU- compliant Energy Community carbon pricing system, as envisaged by the phase 2 of the Decarbonization Plan, is currently underway, with a view to develop proposals for an effective carbon pricing system by end 2023. If the Energy Community Contracting Parties keep to follow the deadlines for implementation of their MRV systems in line with the Decarbonization Plan deadlines, the prerequisites for integration of the non-EU AIR countries into the EU ETS scheme could be fulfilled in 2026.

203 https://www.rcc.int/docs/596/action-plan-for-the-implementation-of-the-sofia-declaration-on-the-green-agenda-for-the-western-balkans-2021-2030

204 https://www.energy-community.org/dam/jcr:c28b58eb-22db-4ad5-9ed1-4e93b5b613b7/19thMC_Decarbonisation_Roadmap_301121.pdf

205 Regulation (EU) 2018/2066 on monitoring and reporting, Regulation (EU) 2018/2067 on accreditation and verification

206 Directive 2003/87/EC establishing a system for greenhouse gas emissions allowance trading within the Union

- ***Conclusions:***
  - Carbon pricing is an external factor (outside of EUSAIR influence) affecting the sector, but it is neither perceived as a direct driver nor as an enabler of the EUSAIR path towards climate neutrality.
  - The implementation status of carbon pricing mechanisms in EU and non- EU AIR countries differs significantly. While the EU countries have an established and mature carbon pricing mechanism, the non- EU countries are in the phase of implementing the relevant acquis and designing the pricing system. Taking into consideration the current policy (UNFCC, Paris Agreement, EU accession, Energy Community acquis under development) and implementation efforts, it seems that the way towards implementation of ETS in the Energy Community and merge with EU ETS is irreversible, while the challenges are related to timing, coordination and system design issues. Clearly, levelising the playing field between EU and non- EU EUSAIR countries in this area (which is underway) will be beneficial also for the macro- region.
  - The timing and conditions under which non- EU AIR countries will join the EU ETS depends on the dynamics and quality of the implementation efforts within Energy Community on one hand, the countries' flexibility to reduce their thermal power generation output in response to carbon emissions price and decarbonization ambition and options provided in the NECPs, once finalized in all AIR countries[207].
  - Non- EU AIR countries have an opportunity to avoid payments via CBAM by implementing the ETS in line with the Energy Community Decarbonization Roadmap, and use carbon allowances revenues to support energy efficiency and RES and to finance measures alleviating energy poverty. On the other hand, while the EU countries implemented decarbonisation policies (such as coal phase out) after accession to EU, supported with significant EU funds (e.g. Just Transition Fund, Social Climate Fund), the Western Balkans non-EU countries efforts are limited by the countries' low financial strength.
- ***Recommendations:***
  - There are no recommendations on EUSAIR level, or for EU AIR countries national level. Carbon pricing is an external factor (one- way influence on EUSAIR) affecting the energy sector, but it is neither perceived as a direct driver nor as an enabler of the EUSAIR energy sector transformation.
  - Non- EU AIR countries should continue with their efforts on implementing the carbon pricing mechanism in Energy Community and follow the dynamics of regional and national

[207] For time being, only Albania and North Macedonia adopted their NECPs.

transposition of relevant EU acquis as per the Energy Community Decarbonization Roadmap.

- ***Actions:***
  - No actions, processes or projects on EUSAIR level are proposed in the area of carbon pricing and carbon trading mechanisms. This project has not identified tangible and direct benefits of macro- regional approach to this topic (i.e. developing macro- regional Actions) in the case of AIR.

9.4.2 Digitalisation of the power system and smart communities and cities

Digital technologies have been intrinsic part of energy systems for decades. In the 20th century digital solutions were used in few areas, such as transmission and distribution network operation and power generation, while today their use widened both horizontally (across sectors) and vertically (across the value chains), being in the hearth of the energy sector transformation; therefore, the ongoing energy and digital systems technological transformation are often referred as a "twin transition".

The ambitious decarbonisation efforts of AIR countries driven by the European Green Deal and the Green Agenda for the Western Balkans, are being further accelerated by the need to respond to the global energy crises triggered by the war in Ukraine. Concerning the EU states of AIR, while the GHG reduction target remains 55%, RePowerEU Plan[208] envisages increase of the Union's RES target from 40 to 45%, as well as the energy efficiency target from 9% to 13% until 2030. The non-EU AIR countries have also adopted ambitious decarbonisation targets at the Energy Community Ministerial Council Meeting of December 16, 2022 (e.g. Energy Community GHG target amounts 60.9%, while its RES target is 31%). This energy sector transformation, characterized by phase- out of fossil generation, integration of RES in the energy mix and focus on energy efficiency, is already changing the way energy is generated, transmitted, distributed and used. Wide penetration of distributed energy resources, storage, demand side management, flexibility, peer- to- peer trade at prosumers' level require extensive use of digital technologies.

The European Strategy for data[209] envisages establishment of nine common data spaces, among others a ***Common European energy data space****, "to promote a stronger availability and cross-sector sharing of data, in a customer-centric, secure and trustworthy manner, as this would facilitate innovative solutions and support the decarbonisation of the energy system"*. As per the EC Communication "Digitalising the energy system – EU Action Plan"[210], this common EU data space shall be implemented in 2024 latest, supporting participation in electricity markets of more than 580 GW of flexible energy resources by 2050, covering more than 90% of the EU electricity networks' flexibility needs, provided

[208] https://commission.europa.eu/document/download/26b26894-254d-4a65-8b4d-bced92365d1b_en

[209] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0066&from=EN

[210] https://energy.ec.europa.eu/communication-digitalising-energy-system-eu-action-plan-com20225522_en

by the means of energy communities, virtual power plants, aggregators, smart buildings, smart heating with heat pumps, bidirectional charging of EVs etc. The governance of the common European data space will be designed in a form of a framework for sharing and using the energy data, which shall be deployed after finalization of the preparatory phase scheduled to 2024.

The Action Plan “Digitalising the energy system” also envisages creation of a ***digital twin of the European transmission and distribution grid***. The digital twin is a virtual model of the European electricity grid which aim is to enhance the efficiency and smartness not only of the networks themselves, but of the energy system as a whole. It will be created through continuous and coordinated investment in five areas- oobservability and controllability, efficient infrastructure and network planning, operations and simulations for a more resilient grid, active system management and forecasting to support flexibility and demand response and data exchange between TSOs and DSOs. In December 2022, ENTSO-E and EU DSO Entity signed the Declaration of Intent for developing a Digital Twin of the European Electricity Grid, both associations announced *“establishment of a common Task Force which will work out an implementation plan and identify joint actions and deliverables”*.

The EU Action Plan also envisages designing ***common smart grid indicators***, a task entrusted to ACER and the national regulatory authorities (NRAs), with an objective to equip the NRAs with appropriate tools to monitor investments in smart grids annually as of 2023 and measure the progress towards establishment of the digital twin networks.

Digitalization is an important enabler of the ***communities*** to take part in energy markets. The energy communities, pooling the members’ consumption and generation, could contribute to the reduction of dependence of remote rural communities from central grids and supply, which may be expensive or insecure. Furthermore, energy systems digitalization could benefit to ***cities***, especially in terms of managing distributed generation, storage and final use to enable a decarbonised urban energy system with high inputs of intermittent renewable sources. On the supply side, energy monitoring and management systems and virtual power plants (VPP) can increase reliability and quality of supply. Tools focusing on monitoring, prediction and control of flows can optimize the use of district heating and cooling networks or storage, improving load balancing and allow more flexibility providers to enter in the market. On the demand side, digital solutions can be deployed as part of smart buildings, smart vehicles, smart meters, and smart lighting projects, improving efficiency, increasing demand-side flexibility and reducing costs for the users, while reducing peak loads of the grid.

According to a recent study[211], in 2040, most households can be active customers, either individually or through energy communities, using demand response to reduce cost of energy, sharing renewable energy for self- consumption and participating in the flexibility markets.

An important enabler of the energy system digitalization is that consumers have a smart meter installed at home. According to the latest ACER Market Monitoring Report[212], depicting the status of

[211] See https://cinea.ec.europa.eu/publications/digitalization-urban-energy-systems_en

[212] https://www.acer.europa.eu/sites/default/files/documents/Publications/MMR_2021_Energy_Retail_Consumer_Protection_Volume.pdf

end 2021, only three AIR countries have more than 80% of smart meters installed (Italy- 98%; Slovenia- 88% and Montenegro- 83%), while other AIR countries[213] have significantly fewer smart meters installed (Bosnia and Herzegovina- 13.5%; Albania- 3.5%; Greece- 3%; Serbia- 3%).

Average share of households with smart meters in EU was 54% (ACER, 2022), indicating that a significant number of EU consumers might not have access to smart meters in the short term. The EC has already called the EU member states who are lagging with smart meter rollout to reassess their cost- benefit analysis in case the results were negative, and to increase their national objectives concerning the rollout in their updated NECPs. The decarbonisation efforts of the non- EU AIR countries (with exception of Montenegro) could also be seriously hindered due to the lack of smart meters – none of the countries has performed the cost benefit analysis yet, as a first step to draft the smart meter rollout plan as required by the Electricity Directive.

- ***Conclusions:***
    - The green and digital transition are interlinked ("The twin transitions"), and the EUSAIR can play a significant role also in the digital transition, supporting the implementation of the European Digital Strategy in the region within the Priority Topics of all four EUSAIR Pillars.
    - Establishing Europe- wide level playing field in the area of digital transition of the energy sector is an essential enabler of the green energy transition and Pan- European energy market integration. As a part of the single European Energy Market, the Energy Community Contracting Parties should also be a part of the European common data space.
- ***Recommendations:***
    - Efforts should be made on EU, Energy Community and national level not to leave behind the Energy Community Contracting Parties (including all Western Balkans EUSAIR countries) while creating the Common European data space, and especially (and relevant for this project) the ***Common European energy data space***.
    - Western Balkans EUSAIR countries' electricity TSOs and DSOs (with participation or coordination of Energy Community institutions, if deemed necessary) should take part in the joint ENTSO-E – EU DSO task force with a view to integrate Western Balkans electricity networks in the ***digital twin of the European transmission and distribution grid***.
    - All EUSAIR countries with low penetration of smart meters are advised to ***revisit their smart meter roll- out policies***, taking into consideration the current energy policy and technology developments. This could include reassessing their cost- benefit analysis in case the results were negative, and increasing national objectives concerning the rollout in the draft/ updated NECPs.

[213] Data for North Macedonia are not available in the ACER report

- Western Balkans non- EU AIR countries are advised to prioritize cost- benefit analysis on smart meters rollout, taking into consideration the requirements on smart meter functionalities.

- ***Actions:***

  - No direct EUSAIR actions, processes or projects are proposed in the area of digitalization within this Section. However, digitalization will be embedded in a number of actions and projects proposed within this Master Plan (e.g. under Chapter 10.1).

9.4.3 Power to gas interaction

Drivers and enabling factors for power to gas (P2G) interaction are discussed in detail in Chapter 7.3: *"The electricity-natural gas interaction: power to gas, grid stability and optimization"*. Actions related to P2G are listed in Chapter 10.1: *"Key actions, options (projects) and programmes"* of Section 10: *"Options and means for the carbon-neutral transformation of the energy system"*. Therefore, following the structure of Chapter 9.3[214], this sub-chapter provides remaining elements of the analysis - conclusions (derived from Chapter 7.3) and recommendations on P2G interaction.

- ***Conclusions:***

  - Main drivers for introducing P2G technologies in the EU are EU strategic documents (such as "Energy System Integration strategy" and the "EU Hydrogen Strategy" and the *"RePowerEU Plan"*), together with related (draft or applicable) legal framework. The Hydrogen strategy will be translated in EU legal framework by adoption of the Hydrogen and decarbonised gas market package[215]. Another driver on EU level is the revised TEN-E Regulation[216], adopted in June 2022 and introducing, among others, new infrastructure categories and reconfiguration of priority corridors and areas while strengthening cross-sectoral energy infrastructure planning. Transposition of TEN-E Regulation in the Energy Community legal framework is scheduled for December 2023, whereby certain time will be needed for national implementation.

- ***Recommendations:***

  - The Energy Community should adapt and implement the Hydrogen and decarbonised gas market package as soon as possible after adoption of TEN-E in EU, contributing thereby to levelising the playing field in the Adriatic- Ionian macro- region.

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[214] Discussion – Conclusions – Recommendations - Actions

[215] This package comprises revised gas Directive and Regulation

[216] Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2022.152.01.0045.01.ENG&toc=OJ%3AL%3A2022%3A152%3ATOC

- Non-EU AIR countries are advised to prioritise national implementation of the revised TEN-E, creating thereby a level playing field in relation to Projects of Common Interest (potentially financed by CEF) and Projects of Energy Community Interest (potentially financed by IPA III/ WBIF). This is a prerequisite for these countries' project promoters to propose projects to be included in the European Hydrogen Backbone, especially the EUSAIR relevant priority hydrogen corridor HI East in Central Eastern and South Eastern Europe.
- Western Balkans AIR natural gas TSOs are advised to apply for participation of European Hydrogen Backbone initiative and benefit from experience exchange and networking.

9.4.4 Stranded costs associated to an accelerated transformation of the energy system

Stranded costs are properly incurred costs that cannot be recovered by the company due to an unanticipated change of business conditions, and must be written off. Such change of business conditions could occur, among other reasons, due to policy decisions, technical or environmental constraints and low demand, leading to underutilization of assets and consequent decrease of revenues.

The topic "stranded costs" has been widely discussed in the mid-1990s with introduction of competition in the electricity sector (and resulting decreased revenues of the electricity generators), whereby the main question was who should bear the stranded costs (utilities, consumers, taxpayers). Today, the specter of stranded costs in the energy sector is arising from an array of sources, potentially affecting a broader range of asset classes. Taking into consideration the EU objective to achieve "net-zero" GHG emissions until 2050, all the infrastructure needed to produce, transport and process fossil fuels, as well as the coal, oil and natural gas reserves left underground are stranded assets. According to IRENA[217], the total global value of stranded assets resulted from full implementation of the Paris Agreement would be app. $10 trillion.

Facilities under most obvious risk of becoming stranded assets in the AIR region (as in the rest of Europe) are ***coalmines and coal power plants***. There is a clear policy of coal phase out in force in EU for a long time, supported by an emissions trading system (EU ETS), whereby emission allowances are skyrocketing for more than a year. All EU AIR countries have defined their coal phase out dates (between 2025- Italy and 2033- Slovenia). Two non- AIR countries announced their coal phase out - North Macedonia (2030) and Montenegro (2035[218][219]), while Serbia and Bosnia and Herzegovina did not announce their targets (Albania has no coal power plants in its generation portfolio). On the other hand, coal mining and generation sectors have a long history of phase-out support - in addition to

[217] "Stranded Assets and Renewables", IRENA, 2017 (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jul/IRENA_REmap_Stranded_assets_and_renewables_2017.pdf?rev=169eb7d8d20e42baadf8a96a8dc91880).

[218] https://balkangreenenergynews.com/montenegro-announces-coal-phaseout-by-2035/

[219] https://www.just-transition.info/montenegro-to-decide-on-life-after-coal/

national support measures[220], a EU- level initiative - the Just Transition Mechanism – has been established with a view to address the social and economic impacts of the transition. In the period 2021-2027 this mechanism will help mobilizing app. 55 billion EUR in the affected regions. The non-EU AIR countries are part of the initiative Coal Regions in Transition in the Western Balkans, launched by EC in 2020, with an objective to help the countries of the region to phase out coal, mainly by means of connecting stakeholders, exchanging experiences, technical assistance and training and education.

According to EC Staff Working Document[221] accompanying the RePowerEU Plan due to higher gas prices and the implemented EU measures on decoupling with Russian gas supplies, the installed capacity of ***gas- fired power plants*** will further decrease 8GW by 2030 compared with Fit- for- 55 forecast, corresponding to 67% decrease of electricity output from gas power plants. Higher fuel prices, volatile prices of carbon allowances, probable shift from the role of base-load towards the role of peak-load providers due to intermittent RES penetration and long- term perspective of phase-out due to net- zero policies in EU (lifetime of a gas fired power plant is app. 30 years) brings also this asset class under risk of becoming stranded.

The connection of zero- marginal cost generation to the power grids[222], further boosted in EU by rapid implementation of the RePowerEU Plan and recent efforts to decouple EU electricity and natural gas markets, leaves conventional generation resources such as ***natural gas and nuclear power plants*** to compete over the remaining slice of the market, being pushed towards the right side of the supply-demand curve towards extramarginal generators. Therefore, it would be no surprise if stranded costs appear in all three conventional power generation asset types – coal, natural gas and nuclear.

Renewable energy sources represent another asset class where the risk of incurring stranded costs may arise in coming years. New generation may be commenced at a faster rate than is warranted by electricity market demand[223], leading to underutilization and decreased revenues.

Shifts in the location of the electricity generation mix due to the penetration of renewables, as well as shifts in electricity consumption are changing ***electricity transmission*** needs and could ultimately lead to stranded investments in these assets. Similarly, rapid penetration of distributed energy resources, structural demand changes, or rollout or replacement of smart meters may lead to stranded costs in the ***electricity distribution*** system due to possible non- compliance with required functionalities.

According to the EC Communication RePowerEU Plan, natural gas consumption in EU has to decline 36% until 2030 compared to 2020, and continue decreasing until 2050. LNG and non- Russian natural

[220] e.g. the German phase- out of coal is underway for decades, and will be finalized in 2038, followed by strong social support policies from the very beginning.

[221] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0230&from=EN

[222] According to IEA flagship report "World Energy Outlook 2022", "renewables are set to dominate global capacity additions, accounting for 75-80% of all new capacity to 2050 ..., led by solar PV and wind". According to EMBER "European Electricity Review 2023, solar generation increased for 41 GW in 2022 (47% more than in 2021), participating together with wind generation 22% in total EU electricity generation.

[223] The global phenomenon of (inter)connection queues is a clear indicator that stranded costs might become an issue even in this highly propulsive sector. According to UK's National Grid Electricity Transmission, the connection queue currently (January 2023) amounts 176 GW (compared to 64GW installed capacity today)

gas pipeline imports need to increase in order to satisfy (declining) natural gas demand, while certain natural gas infrastructure will be adapted to bio- methane and renewable hydrogen. Expected service life of ***LNG terminals and natural gas transmission pipelines*** is app. 50 years, well into the forecast period for the fossil fuels phase out. In case of natural gas transport infrastructure, not only the possible underutilization of pipelines transporting Russian gas into IAR is subject of concern, but also new natural gas pipelines and LNG terminals might easily become stranded within a decade or two with Europe advancing towards climate neutrality. Repurposing gas pipelines and LNG terminals for hydrogen[224], as well as constructing new infrastructure as hydrogen ready might reduce the risk of stranded natural gas assets to a certain extent; on the other hand, the question of economic viability of hydrogen pipeline transport is one of hot topics on the agenda of academics and industry.

The stranded costs risks of electricity and natural gas networks might be more controllable because these are regulated activities. As a rule, the national regulatory authorities (NRAs) are involved in network development planning, sharing thereby the responsibility for operator's network investment decisions. Moreover, NRAs role in network price regulation provides them with a set tool to address the stranded costs, if deemed prudently incurred, such as changes in depreciation policies (e.g. accelerated depreciation), including full or partial stranded costs in the regulatory asset base, carry forward mechanisms (smoothing) and rate- of- return uplifts.

- ***Conclusions:***
    - A wide specter of energy infrastructure classes, such as coal mines and power plants, natural gas pipelines, but also RES are subject to the stranded costs risk related to the ongoing energy system transformation.
    - Coal mines and power plants, as well as natural gas infrastructure, are well known and obvious "candidates" for becoming stranded before cost recovery. On the other hands, especially in case of coal mines and plants where the phase- out is underway for a long time, there is a significant experience in addressing these issues, such as the EU just transition mechanism.
    - Potential development of stranded assets is a challenge on the path towards carbon neutrality even for new assets[225], such as LNG terminals and natural gas pipelines aimed to replace Russian gas. This risk of producing overcapacity could be (at least partially) addressed by using existing planning tools, such as the EU-wide and national TYNDPs, feasibility studies etc. Proper economic and financial cost- benefit analysis, together with identifying options for repurposing underutilized natural gas pipelines, could help to decrease stranded costs risk.

[224] Notably, the proposal of EU gas infrastructure operators gathered in the European Hydrogen Backbone envisages developing a 53.000 km European H2 network, based on using 60% of repurposed natural gas pipelines and 40% of new H2 pipelines.

[225] Please see the BELLONA-EMBER-RAP-E3G briefing https://ember-climate.org/app/uploads/2022/03/EU-can-stop-Russian-gas-imports-by-2025.pdf

- Macro- regional dimensions of the stranded assets risks have not been identified within this project.

- ***Recommendations:***
  - Efforts should be made to assist the non-EU countries to cope with the financial burden of coal phase out and ETS implementation, possibly through EU and other funding programmes or flexible implementation dynamics. While the EU countries coal phase out (launched after their accession) is supported by significant solidarity funds (Just Transition, Climate Social Fund), the non-EU countries efforts could be seriously constrained and achievement of GHG targets endangered due to inability to finance the green transition.
  - The AIR national regulatory authorities are advised to pay special attention to the feasibility of natural gas pipelines projects during the process of approval of hte TYNDP in order to avoid overcapacity.
  - AIR countries are advised to pursue broad application of PPAs and CfDs for renewable energy. Swift implementation of the new electricity market design after the adoption of relevant EU Regulations is recommended, as well as transposition of the EMD regulation in the Energy Community acquis a.s.a.p.
  - Financial viability of any investment in upstream fossil energy infrastructure should be thoroughly checked, as there is a non- negligible possibility that rapid penetration of RES could contribute to their underutilization.

- ***Actions:***
  - No actions, processes or projects on EUSAIR level are proposed in the area of stranded costs. This project has not identified tangible and direct benefits of macro- regional approach to de-risking infrastructure investments against stranded costs and alleviate stranded assets consequences (i.e. developing macro- regional Actions, processes and projects and embedding them into relevant EU or national financing programmes).

9.4.5 Governance of the energy transformation of Adriatic – Ionian macro- region towards carbon neutrality

Governing framework

The highest and common governance layer for all AIR countries are the Paris Agreement obligations.

Four AIR countries – the EU Member States - are driven towards carbon neutrality by the EU strategic, institutional and legal framework. The non- EU AIR countries except San Marino are EU candidate countries, obliged to transpose and implement EU acquis, including these on decarbonisation. Moreover, as signatories of the Treaty establishing the Energy Community, Albania, Bosnia and Herzegovina, Montenegro, Serbia and North Macedonia are implementing relevant EU energy, environment, competition and renewables EU acquis with a view to create a single Pan – European energy market on the ground of legally binding framework ("single regulatory space") even before their formal accession to the EU. Although the Energy Community regulatory framework lags in terms of scope and content in comparison to relevant EU acquis, a significant and encouraging progress occurred in 2021 and 2022, when the Contracting Parties agreed to new, more ambitious GHG reduction, RES and energy efficiency targets. Moreover, they agreed on implementation of the Clean Energy Package and several EU Network Codes, contributing to the Treaty objective to establish a single regulatory space across Europe. Transposition of the Governance Regulation and development of National Energy and Climate Plans is especially important for streamlining efforts of non-EU AIR Countries across all five dimensions of the Energy Union, including decarbonisation. For time being, only Albania and North Macedonia have adopted the NECPs, while the remaining non-EU AIR countries are in drafting phase.

A common strategic framework for all AIR countries is set in 2014 by the "EU Strategy for the Adriatic – Ionian Region"[226] and its accompanying Action Plan (the latter has been updated and replaced in 2020 by a new EC Staff Working Document[227]). The Strategy identifies four thematic priorities (so called "Pillars") agreed among the participating countries – Blue, Growth, ***Connecting the Region*** (transport and energy networks), Environmental quality and Sustainable tourism. The Strategy also identify priority topics for each of the Pillars.

The second pillar – Connecting the Region – has an ***overall objective*** *"to improve connectivity within the region and with the rest of Europe in terms of transport and energy networks"*[228]. Based on the specific objectives for this pillar, three ***priority topics*** are identified: maritime transport, intermodal connections to the hinterland and ***energy networks***; the latter is the subject of this Master Plan. The topic Energy Networks targets three overarching EU energy policy objectives – competitiveness, security of supply and sustainability.

The EUSAIR Action Plan[229] identifies ***indicative*** actions and actors, as well as ***possible*** projects contributing to increased competition, security of supply and sustainability (Table 75):

[226] https://www.adriatic-ionian.eu/wp-content/uploads/2018/02/com_357_en.pdf
[227] https://www.adriatic-ionian.eu/wp-content/uploads/2020/04/EUSAIR-SWD-2020.pdf
[228] EUSAIR Action Plan
[229] EC SWD(2020) 57 final

Actions	Indicative actors	Examples of possible projects
Cross border electricity interconnections	Transmission system operators, project promoters	Example of possible projects amongst the 2013 PECI (Project of Energy Community Interest) list: • 400 kV OHL Banja Luka (BiH) - Lika (HR) • 400 kV OHL Brinje - Lika - Velebit – Konjsko including 400 kV sub-station Brinje • 400 kV HVDC SS Vlora - Bari West
Gas ring	Transmission system operators, project promoters	• Realising the TAP and its IAP connection • LNG infrastructure in ports to allow fuel switching in shipping
Support the establishment of a well- functioning electricity market	National and regional competent authorities, energy companies	• Establishment of a Coordinated Auction Office (CAO)
Remove barriers for cross-border investments	National, regional competent authorities	• Coordinate and align permits and regulations. • Joined capacity building and innovative solutions for implementing a common market.

Table 75 – THE EUSAIR Action Plan: indicative actions, actors and projects

Source: EUSAIR Action Plan, draft June 2023

It should be noted that the third revision of the current EUSAIR Action Plan is underway.

Based on Catania Declaration[230] of May 2018, the EUSAIR partners developed so called Flagships[231]-priority actions defined for each EUSAIR pillar, addressing main challenges of macro-regional importance in line both with EU and national objectives, developed with a view to be embedded into programmes of EU Cohesion funds (ESI) and IPA III programming framework. Pillar 2 (Connectivity) has three flagships related to its subgroup "Energy networks":

[230] https://www.adriatic-ionian.eu/wp-content/uploads/2018/03/catania_declaration_approved.pdf

[231] https://www.adriatic-ionian.eu/wp-content/uploads/2020/06/EUSAIR-flagships-GB_F.pdf

1. ***"Power networks and market for a green Adriatic- Ionian region"***, proposing projects *Transbalkan Electricity Corridor*, *Power market coupling* and *Integration and digitalisation of the power system, smart grids, deployment of renewable energy sources*
2. ***"Integrated natural gas corridors and market for a green Adriatic- Ionian region"***, comprising proposed actions *Transbalkan Gas Ring*, *Ionian-Adriatic Gas Pipeline (IAP)*, *Eastern Mediterranean Gas Pipeline (East Med)*, *North Macedonia gas interconnectors* and *Natural gas trading hub for the Balkan Region*
3. ***"Development and operation of logistics for direct LNG use as a clean fuel for the Adriatic-Ionian region"***, proposing actions *Harbour infrastructure*, *Road transport* and a pilot project *Engine conversion*.

Embedding the Flagship projects into the ESI and IPA III framework has expanded opportunities to finance even capital-intensive energy infrastructure projects, as is the case with the Pillar 2 projects.

EUSAIR governance structure

EUSAIR management and governance structure has been initially defined in the *Joint Statement on Governance*[232] endorsed by the representatives of participating countries, which includes the Working Paper *"Towards a streamlined governance and management architecture for the EUSAIR"*. It consists of three layers – political, coordinating and operational. The *political level* comprises ministers (of EU funds and/ or foreign affairs), gathered annually on the occasion of the EUSAIR Annual Forums' Ministerial Meeting and chaired by the annually rotating Presidency (comprising of the past, current and future presidencies). The *coordinating level* is represented by the Governing Board, providing guidance to the Thematic Steering Groups for the implementation and management of the EUSAIR and its action plan. Governing Board's members are National Coordinators, Pillar Coordinators., Commission services (DG REGIO, DG MARE and DG NEAR) representatives, a representative of the European Parliament, a representative of the Committee of the Regions, a representative of its Adriatic-Ionian Interregional Group, a representative of the European Economic and Social Committee, the Permanent Secretariat of the Adriatic-Ionian Initiative, representatives of the Managing Authority of the Interreg ADRION transnational cooperation programme and representatives of the EUSAIR Facility Point. The *implementation level* is responsibility of Thematic Steering Groups, set up one for each pillar, whereby the Thematic Steering Group for Pillar 2 (Connecting the Region) has two sub- groups – transport and energy. The Thematic Steering Groups are co- chaired by one EU member state and one or more[233] non-EU countries.

The *EUSAIR Facility point* is a project[234] implemented and financed the INTERREG ADRION programme, providing administrative and operational support to the Governing Board and Thematic Steering Groups. The Facility point gathers project partners from all EUSAIR participating countries, led by Slovenian administration.

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[232] https://www.adriatic-ionian.eu/wp-content/uploads/2018/03/joint_statement_governance_en.pdf
[233] This is a case in the Thematic Steering Group 2
[234] the *"EUSAIR Facility Point Strategic Project – Supporting the governance of the EUSAIR"*

Performance of the governance mechanism

EUSAIR has established a solid permanent multi- layer regional governance structure. Its performance is monitored by the EC, within the overall reporting on the EU macro- regional strategies. The latest report[235] on implementation of EU macro- regional strategies, published in December 2022 together with the accompanying Staff Working Document[236], provided high- level analysis and recommendations, among others, "*to work on revising and updating the strategy taking into account new EU priorities and the above-mentioned crisis, the REPowerEU Plan, as well as the acceleration of the EU Green Deal and the Green Agenda for the Western Balkans*". Several studies and reports addressed the issue of performance and governance of the EUSAIR, among others "Evaluation of the European Union Strategy for the Adriatic and Ionian Region (EUSAIR)"[237] (2022, Project 4), *"EU Strategy for the Adriatic and Ionian Region (EUSAIR) facilitating the enlargement process of Western Balkans"*[238](2021, OBC Trans Europa, CeSPI), *"Multi-level Governance and Cross-Sector Practices Supporting EUSAIR"* (2019, OECD)[239], *"Study on macroregional strategies and their links with cohesion policy"*[240](2018, COWI et al.) and *"EC Report concerning the governance of macro-regional strategies"*[241] (2014, EC). Each of them identifies strong and weak points of EUSAIR governance mechanism, and provides an array of recommendations how to enhance EUSAIR governance and performance.

As the subject of this Master Plan are Energy Networks (Priority Topic 3 of the Pillar 2- "Connecting the Region), other aspects of EUSAIR governance will not be further discussed.

From the point of view of project management, a proper way to assess performance of EUSAIR energy transformation towards carbon neutrality would be to check the progress in delivering the outputs and relevant outcomes[242] of the Priority Topic Energy Networks, as defined in the EUSAIR Action Plan. However, there is no evidence) on planning (outside the EUSAIR Strategy and Action Plan), implementation (what is the status of implementation of actions and projects) and monitoring the progress of individual Actions and Projects, neither those listed in the Action Plan, nor those identified in the List of Flagship Projects for subgroup "Energy Networks". Consequently, it is not clear whether the fully or partially implemented projects (such as *"Establishment of a Coordinated Auction Office (CAO)"* or *"Realising the TAP and its IAP connection"*) are actually outputs of the EUSAIR or other interventions.

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[235] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0705&from=EN

[236] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0397&from=EN

[237] https://www.adriatic-ionian.eu/wp-content/uploads/2023/02/EUSAIR-evaluation-v.3-final-delivery-CLEAN_F.pdf

[238] https://ec.europa.eu/regional_policy/sources/policy/cooperation/macro-regional-strategies/adriatic-ionian/eusair_enlarg_west_balkans.pdf

[239] https://www.adriatic-ionian.eu/wp-content/uploads/2019/07/OECD-EUSAIR-Synthesis-Report_FINAL.pdf

[240] https://op.europa.eu/en/publication-detail/-/publication/4424edbc-20f4-11e8-ac73-01aa75ed71a1

[241] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0284&from=EN

[242] Outcome (Specific Objective) of this topic is *"To achieve a well- interconnected and well- functioning internal energy market supporting the three policy objectives in the EU – competitiveness, security of supply and sustainability."*

The indicative nature of the actions and projects proposed in the EUSAIR Action Plan is understandable if the intention was to allow for flexibility and variety of activities contributing to the specific objectives, whereby productivity in producing tangible outputs is to be ensured by effective and result oriented functioning of the governance mechanism on all three levels. However, such approach embeds a risk of underperformance, especially in managing complex and capital-intensive actions as is the case in Energy Networks subgroup.

Furthermore, in order to address the gaps between EUSAIR and EU/ Energy Community strategic priorities, it is necessary to revisit the high-level objectives, actions and projects of EUSAIR topic "Energy Networks" taking into account new developments in EU and Energy Community energy sectors, especially the REPowerEU Plan, the acceleration of the EU Green Deal and the Green Agenda for the Western Balkans. Ideally, all Energy Union dimensions with macro- regional relevance need to be taken into consideration within current review of the EUSAIR Action Plan in a balanced way (the current Action Plan favorizes actions and projects related to one dimension- integrated energy market.

Finally, it is worth mentioning that the critics of the applicable "3 NOs rule" (no new EU funds, no additional EU formal structures and no new EU legislation) are growing in all macro- regions. Obviously, this constraint makes addressing common Adriatic- Ionian challenges extremely cumbersome in terms of planning, financing and governance, especially when addressing a complex capital-intensive sector under accelerated transition as is the energy sector. Concerning the latter, managing such constrained initiative through a multi- layer governance mechanism (EUSAIR political, operational and implementation levels, national EUSAIR governance structures) proved to be difficult, especially in terms of achieving tangible macro- regional outcomes.

- ***Conclusions:***
  - Proper governance is both an enabler and driver for the transition towards net- zero economy on all levels- EU/ Energy Community, EUSAIR and national.
  - NECPs and national long-term strategies are the main instruments governing EU/ Energy Community and national transition towards carbon neutrality.
  - Full transposition of the Governance Regulation, finalization of National Energy and Climate Plans and developing national long- term strategies is especially important for streamlining efforts of non-EU AIR Countries across all five dimensions of the Energy Union. It is also a prerequisite for assessing potential synergies within the AIR macro-region and identify joint actions and instruments contributing achievement of energy and climate targets. Similar exercise has been executed within EUSDR macro- region[243].
- ***Recommendations:***

[243]https://energy.danube-region.eu/wp-content/uploads/sites/6/sites/6/2021/03/NECP_Danube_Region_REKK_2020_final_0215logo.pdf

- The “3NOs rule” applicable for European macro- regions should be further analysed, with a view either to change it, or to adjust the macro- regional ambitions, especially related to the Energy Union dimensions to the reality.
- Western Balkans AIR countries are advised to prioritize work on finalizing the NECPs and long- term climate strategies in order to move from planning to implementation phase on time to reduce risk to miss the GHG, RES and energy efficiency targets agreed at the Energy Community Ministerial Council of December 2022 due to late start.
- From the perspective of the AIR energy sector, both the EU Strategy for Adriatic- Ionian Region and the EUSAIR Action Plan should be adjusted to new global, EU and Energy Community developments, and especially by recognising the five dimensions of the Energy Union. The Priority Topic “Connecting the Region” could be further developed, either by replacing the Subgroup “Energy Networks” with five new subgroups corresponding the Energy Union dimensions (i.e. security, integrated energy market, energy efficiency, decarbonisation including renewable energy and research, innovation and competitiveness), or by introduce five sub- levels within the Subgroup “Energy Networks”.
- Based on the work done (studies, recommendations), EUSAIR should execute proposed changes of its governance mechanism in order to support achieving of Priority Topics outputs and outcomes, including decarbonization. Special attention should be given to country level improvements, as a key to unlock the full potential of EUSAIR multi-level governance.
- Establish cooperation between EUSAIR Energy Networks subgroup and appropriate policy areas of other macro- regional strategies for the purpose of exchanging best practice experiences, training and creating professional networks.
- Establish a task force (network of national and regional programming authorities, supporting financing of EUSAIR action plans) with a mandate to support embedding a limited number of the Energy Networks subgroup projects in available funding programmes[244] (e.g. national, EU, other donors and IFI), as well as monitoring implementation of the embedded projects.
- Ensure sufficient resources to Energy Networks subgroup on regional and local levels, supporting shifting the focus from planning to implementation of projects and processes.
- The 2023 Action Plan should set out the monitoring and evaluation framework for the EUSAIR, including for the subgroup Energy Networks.
- Thematic coordinators of the sub-group Energy Networks, supported by the Facility Point, should prepare annual reports on the achievements of the subgroup, including status quo on actions, projects and flagships.

[244] Such task force has been successfully established in EUSDR and included in its governance structure.

- National structures supporting EUSAIR programming and implementation shall be established, if this is not a case already. National coordinators shall coordinate programming, implementation, embedding and monitoring of actions and processes on national level (including those of the Energy Networks subgroup) through the established coordination groups, following the structure of the Pillars (thematic priorities) and their priority groups and sub-groups. The monitoring results should be presented in national Annual Reports on EUSAIR implementation. Development of Local (national) Action Plans, specifying the means of national implementation of te EUSAIR Action Plan should be considered.

- ***Actions:***
  - No actions, processes or projects on EUSAIR level are proposed in the area of governance.

10 Section 10 – Options and means for the carbon-neutral transformation of the energy system

10.1 Key actions, options (projects) and programmes

Both EU and non- EU EUSAIR countries have set targets on GHG reductions, RES share and energy efficiency. Currently applicable EU targets for 2030 are at least 40% cuts in GHG emissions (from 1990 levels), at least 32% share for RES and at least 32.5% improvement in energy efficiency. Even more ambitious targets are under preparation in EU, originally as a part of the European Green Deal (designed to support EU obligations under Paris Agreement, enabling the shift towards climate neutral economy in 2050), and further adjusted in 2022 following the RePowerEU Plan; the targets currently proposed by the EC are at least 55% cuts in GHG emissions, at least 45% share for RES and increase to the binding EU energy efficiency target from 9% to 13% compared to the 2020 Reference Scenario.

The Energy Community (including the EUSAIR Countries) adopted its overall Energy Community targets on the Ministerial Council Meeting of December 2022: decrease of GHG emissions of 60.9% below 1990 levels, at least 31% share of RES and 79,06 Mtoe max. share of final energy consumption.

As per the Regulation on Governance of the Energy Union and Climate Action 2018/1999, each EU country and Energy Community Contracting Party is required to establish a NECP, outlining its path towards 2030 targets for energy efficiency, renewable energy and GHG emissions.

One of the objectives of the ongoing revision of the EUSAIR Action Plan is to take into consideration changes of EU energy policy, the five Energy Union dimensions, as well as the aforementioned green transition targets. Having in mind that the main national planning documents (NECPs) are structured around the five dimensions, and that proposed Actions to be included in the revised Action Plan will most probably support them, five corresponding ***Action Programs*** are proposed for implementation by the EUSAIR Energy Networks subgroup: *energy security*, *energy market integration*, *energy efficiency*, *decarbonisation (including RES)* and *Research, innovation and competitiveness*. Figure 10.1.1 depicts the proposed hierarchy (grey shapes are those relevant for the energy component of EUSAIR).

Each Action Program comprises of ***Actions.*** As defined in the EUSAIR Action Plan[245], *"an Action is the intervention which countries and stakeholders carry out in order to address the different topics"*. ***Main objective of proposed Actions is to support EUSAIR countries to achieve the EU/Energy community and national GHG, RES and targets and explore macro- regional synergies in implementing their NECPs***. Notably, the Actions proposed in the current EUSAIR Action Plan correspond to two proposed Action Programmes - Energy security (electricity interconnectors; gas ring) and Energy market integration (Support to the electricity market; Remove barriers for cross- border investment). Actions proposed in this Master Plan are related to remaining three Energy Union dimensions – Action Programmes 3-5, and they include Actions required by the Outline of the Master Plan of Energy Networks for the Adriatic – Ionian Region, annexed to the Terms of Reference of this Master Plan.

[245] EC SWD(2020) 57 final; https://www.adriatic-ionian.eu/wp-content/uploads/2020/04/EUSAIR-SWD-2020.pdf

Actions consist of individual ***Projects***. Projects listed in this Master Plan are proposals or examples (past or current projects), while ***the final list of projects to be included in the EUSAIR Action Plan and implemented will be developed in a bottom- up and participative approach within the governance mechanism of the EUSAIR***, taking into consideration proposals and examples listed in this Master Plan if deemed appropriate.

The most challenging issue while designing EUSAIR projects related to subgroup Energy Networks is to identify projects with ***tangible impact*** on the macro- region while governed by EUSAIR mechanism, projects that actually generate synergies compared to national implementation. This is an issue in all macro- regional initiatives, including EUSAIR.

Furthermore, it is suggested to ***establish an Embedding Task Force*** within EUSAIR governance structure, in line with best practice experience observed in EUSDR, to support creating a short list (up to three) of ***Top Priority Projects*** to be further supported by the Task Force in the planning, embedding and implementation phase.

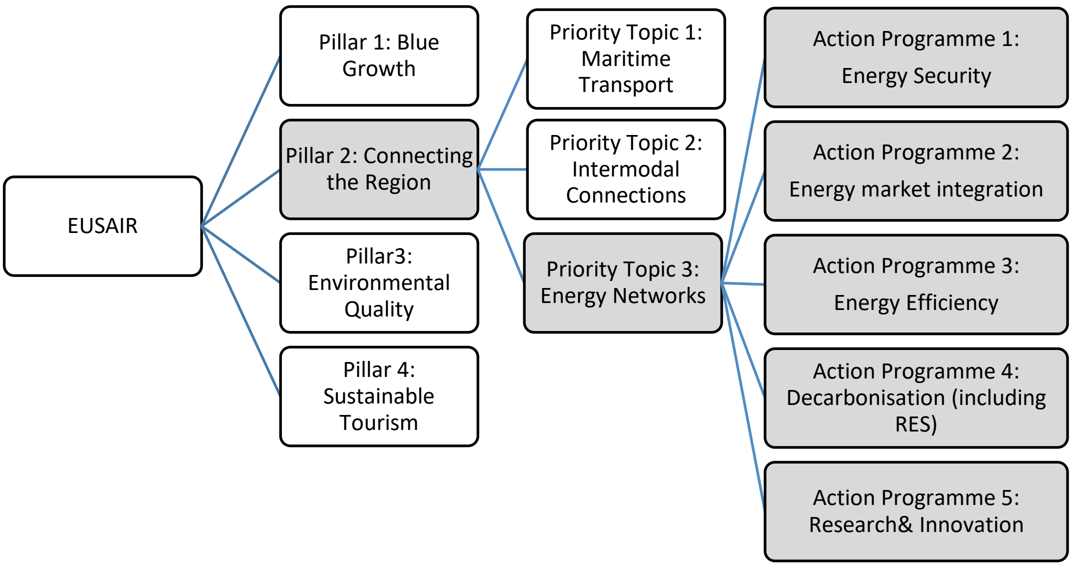

Figure 140 - Pillars, priority topics and proposed action programmes of EUSAIR

Source: EUSAIR Intranet

While drafting this Chapter, effort has been made to achieve compliance with criteria for proposing Actions and Projects set in the EUSAIR Action Plan[246] to the extent possible:

- To address identified priorities and meeting the needs, reinforcing EU and Energy Community policies, such as the Energy Union, Green Deal, RePowerEU Plan, the Green Agenda for the Western Balkans and the Economic and Investment Plan for the Western Balkans.

[246] SWD(2020) 57 final, Page 3, 2nd Paragraph

- Their scope and impact should be transnational, if not macro- regional.
- They should be realistic and credible.
- They should be built on existing initiatives
- They should pay attention to the cross- cutting aspects
- They should be coherent and mutually supportive.

Furthermore, Actions are designed with a view to allow for including a broad range of projects supporting achievement of EUSAIR objectives.

10.1.1 Energy efficiency and behavioural change.

Action:	Enhancing energy efficiency and behavioural change in the region by increased regional cooperation Description: This Action supports achievement of national, EU and Energy Community energy efficiency targets, promotes the "energy efficiency first" principle and explores synergies in the implementation of NECPs, Long term renovation strategies and other energy efficiency policies.

Examples of possible projects:

- Designing options, criteria and mechanisms for support of energy vulnerable customers in the EUSAIR within the framework of EU and Western Balkans Renovation wave.

  One of the priority investment flagships proposed in the EC Communication "An Economic and Investment Plan for the Western Balkans" is expanding the EU Renovation wave to Western Balkans. By targeting energy poor households within this initiative an important cross- cutting issue is addresses simultaneously with pursuing energy efficiency targets.

  This project is proposed as a Top Priority project.

- Improving energy efficiency in public and private buildings by enhancing the capacity of decision makers.

  The core idea of *the project* is to work in tandems consisting of experienced energy efficiency firms and institutions and local administrations. In the initial phase of the project the local situation and needs for improvements of energy efficiency will be investigated in ten selected municipalities. Individual capacity building schemes for partner communities will be developed from the results of this analysis. All experiences gained and tools developed during the project will feed into further dissemination of the capacity building process also outside the project. The project is implemented within EUSBSR activities (Act Now!)

- Toolbox with financial methods that can improve profitability, facilitate funding and reduce the risk of energy investment in public buildings.

  The goal is to increase the number of energy efficiency measures implemented in existing public buildings. The target group are public building managers faced with financial barriers for energy efficiency investments. Examples of tools are profitability calculations, action packages, contribution optimization, EPC, multifunctional agreements, green leases and economic models for both production and energy use. The project is implemented as a flagship within EUSBSR activities (EFFECT4buildings)

10.1.2 Increasing electrification

Action:	Increasing electrification in Adriatic – Ionian macro- region This action is aimed to explore feasibility and potential synergies in electrification of end- user sectors in Adriatic- Ionian region, such as using heat pumps for space heating or low-temperature industrial processes, electric vehicles for transport, or electric furnaces in certain industries. Increased electrification in end- user sectors will provide additional flexibility for the overall management of the energy system, which is also subject of this action, including smart charging and vehicle to grid (V2G) services.

Examples of possible projects:

- Cost- benefit analysis for roll- out of heat pumps in buildings in Adriatic- Ionian Region

  Project would analyze viability of accelerated heat pump roll- out in buildings and district heating, taking into consideration changes in the electricity generation mix and provide appropriate regional action plan, taking into consideration the NECPs.

- Pilot project for the electrification of low-temperature process heat in industrial sectors

  Support pilot projects using industrial heat pumps to decarbonise the low temperature heat supply or enable waste heat recovery within industries.

10.1.3 Deployment of renewable energy sources.

Action:	Supporting RES development in the Adriatic Ionian region and cross- border RES projects Description: This Action supports achievement of national, EU and Energy Community RES targets, ***explores synergies in the implementation of NECPs***, supports renewables deployment (including offshore, respecting the EU strategy to harness the potential of offshore renewable energy for a climate

	neutral future) and facilitates development of cross- border cooperation projects in EUSAIR. The Action could also support signing a Memorandum of understanding or intergovernmental agreement on offshore RES development in Adriatic- Ionian agreement in line with the Offshore RES strategy recommendations. It can facilitate sharing best practices on renewable energy communities and renewable self - consumption and explore possibilities and modalities to use cooperation mechanisms, such as cross-border and joint support schemes, joint projects, statistical transfers and the renewable development platform established under the recast Renewable Energy Directive.

Examples of possible projects:

- EUSAIR offshore wind energy cooperation

  Study comprising the following tasks: identification of potential offshore wind power sites; modelling to examine the impacts of different levels of both offshore wind power deployment and regional cooperation on the power and transmission system; identification of administrative and regulatory barriers to the efficient deployment of offshore wind power in the region; initial recommendations on how an initiative might seek to address the barriers, provided in the form of a roadmap and action plan. Project example based on EUSBSR project "BEMIP Offshore Wind Cooperation" and the North Sea Energy Cooperation (NSEC).

  This project is proposed as a Top Priority project.

- Mapping potential offshore development sites in Adriatic- Ionian Region

  Identify the potential for a joint regional effort in developing offshore energy and supporting grid infrastructure, following similar studies for the North, Baltic and Mediterranean Seas. Croatia, Greece, Italy, and, Slovenia has been included in the geographic scope of the aforementioned study for the Mediterranean Sea[247]. A new study could take a stock on the status quo of EU countries, provide additional analyses on EU EUSAIR countries if deemed necessary and perform the full analysis for non-EU EUSAIR countries (i.e Albania, Bosnia and Herzegovina, Montenegro). Furthermore, the study could expand the research on technologies not covered in the previous study- floating PV, CSP, P2X solutions (green hydrogen generation), and (green) gas transmission. Furthermore, it could explore flexibility potential and demand of other storage options, as well as and infrastructural planning (power grids versus gas grids).

  This project is proposed as a Top Priority project.

- Promoting the sustainable utilization of the deep geothermal resources in the heating sector.

[247] https://op.europa.eu/en/publication-detail/-/publication/91d2091a-27bf-11eb-9d7e-01aa75ed71a1/language-en

Mapping the untapped deep geothermal energy resources and the heat demands to be matched in EUSAIR. Project implemented within EUSDR activities DARLINGe.

- Climate & energy solutions for small enterprises.

  The project has the following outputs: to identify available tools for performing Corporate Carbon Footprint (CCF) assessments and to adapt them to meet the needs and capacities of small enterprises; to integrate the CCF approach with existing energy efficiency audit tools (integrated CCF&EE audit); to test the tool through pilot projects in partner countries; to prepare easy-to-use guidelines for performing CCF&EE audits in small enterprises and disseminating the tool among industry clusters and enterprises. Project example based on EUSALP project CAESAR 2 (Climate & energy solutions for small alpine enterprises).

10.1.4 Bioenergy and biofuels (renewable fuels).

Action:	Explore synergies in use of bioenergy and biofuels in various sectors (transport sector, heating sector) in the Adriatic- Ionian region Description: This action supports phase-out of fossil fuels and/ or reduction of air pollutants in domestic and industrial heating sectors and public and freight transport.

Examples of possible projects:

- Adriatic Ionian Region Bioenergy and Biofuels Action Plan

  Analysis of the state of play in the Adriatic- Ionian Region regarding biomass use, identifying priorities for further improvement, promoting the development of a common position on the use of biomass in the countries of the EUSAIR and provide recommendations at EU, national and regional level. Similar project has been implemented within EUSDR activities.

- Sustainable use of biomass in domestic heating sector

  Addressing the problem of domestic stoves (particle pollution, low energy efficiency). Problem formulation, impact analysis and suggested solutions, both from the technical and regulatory points of view. Explore possibilities of combining the proposed solution with energy poverty alleviation measures. Similar project has been implemented within EUSDR activities.

10.1.5 Production and delivery of hydrogen and hydrogen-based fuels.

Action:	Production and delivery of hydrogen and hydrogen-based fuels in Adriatic – Ionian region.

	Explore synergies, main opportunities and challenges of hydrogen as a future energy vector for the Adriatic- Ionian area.

Examples of possible projects:

- Establishing od EUSAIR macro- regional platform for support of coordinated infrastructural planning and development for renewable H2 projects across EUSAIR regions

  Form a network of project promoters, inaugurate coordination regarding development of the European Hydrogen Backbone and projects developed in the context of TEN-E, such as supporting development of the Priority Hydrogen Corridor HI East in Central Eastern and South Eastern Europe.

  This project is proposed as a Top Priority project.

- Exploring options to enhance hydrogen economy in the EUSAIR

  Analyse the entire hydrogen value-chain (production, transport/storage, end-uses) at macro-regional level, identify strengths and opportunities (e.g. production and transport capacities) and visions (e.g. various end-use development scenarios), provide make policy recommendations. Flagship project in Danube macro- region.

10.1.6 Carbon capture (use) and storage.

Action:	Exploring possibilities for employing macro- regional synergies in carbon capture, use and storage (CCUS) technologies Description: This Action aims to establish a broad platform for coordinated macro- regional activities on investigating and supporting decarbonization of the energy sector by means of CCUS.

Examples of possible projects:

- Establishing a EUSAIR macro- regional platform for support of coordinated infrastructural planning and development for cross- border carbon dioxide networks across EUSAIR regions.

  Form a network of project promoters, inaugurate coordination regarding development of the cross- border carbon dioxide networks to be developed in the context of TEN-E under Priority Thematic Area “Cross- border carbon dioxide network”.

- Mapping potential sites for safe geological storage of carbon dioxide

  Estimate of the geologic storage sites that may be available for CO2 injection and storage and quantification of potential storage resources.

- Study on potentials for Bio-Energy Carbon Capture and Storage (BECCS) deployment in EUSAIR

Analysis of BECCS deployment in Adriatic- Ionian region, considering the limits and availability of sustainable biomass in order to avoid excessive demand of biomass for energy that would have negative effects on carbon sinks and stocks, biodiversity and air quality.

10.1.7 Research and Innovation in EUSAIR

Action:	Support coordination of research activities in advanced energy technologies and digitalization of the energy sector in the Adriatic- Ionian Region. Description: EUSAIR could support research and innovation activities and demonstration projects supporting decarbonization, such as emerging technologies (P2X, biofuel production from algae, floating PV, digitalization, blockchain, IoT)

Examples of possible projects:

- Establish an Adriatic- Ionian research and innovation network

  Establish an Adriatic- Ionian research and innovation network. Develop a common Research and Innovation Agenda in the EUSAIR, exploring the possibility of joint programming. Similar project exists in the Alpine macro- region.

- Improve efficiency and cost- efficiency of carbon capture and storage technologies

  Projects developing new CCUS technologies or enhancing efficiency and financial viability of existing ones.

- Prospects of using microalgae and cyanobacteria in biofuel production

  Microalgae are major primary producers of organic matter in the marine environment. One of commercial applications of microalgae is in the production of advanced biofuels. In addition to a fast growth rate, and high biomass areal productivity, microalgae have the capacity to mitigate carbon dioxide, which makes production processes with microalgae more sustainable, economically viable and environmentally friendly. This project would research the means to increase production efficiency of microalgal biomass and ensure its economic sustainability.

- Use of floating PV in coastal and near- shore areas

  While floating PV is a deployed technology in inland waters, its use in near- shore and coastal areas is worth of investigation and may have a promising potential.

10.1.8 Funding programmes

As stipulated in the EUSAIR Action Plan, actions *"shall be implemented by mobilizing and aligning all available EU, international, national and private funding of relevance for the four pillars and the specific topics identified under each pillar".*

EUSAIR funding mechanism is based on the concept of macro-regional cooperation: effective and more coordinated ***use of existing funding sources***, and the ***promotion of synergies and complementarities***. This means that there is no funding programme earmarked exclusively for any macro- regional initiative, including EUSAIR.

As a rule, financing of projects is determined on case- by- case bases, depending on an array of factors. In the text below an attempt has been made to identify funding programmes available for projects supported by the Energy Networks subgroup under Pillar 2: Connecting the Region.

The European Regional Development Fund (ERDF)[248], one of the European Structural and investment funds (ESI funds), is addressing imbalances between EU regions. ERDF policy objective (PO) in period 2021 – 2027 relevant for EUSAIR Action Programmes is *PO2: a Greener, carbon free Europe, implementing the Paris Agreement and investing in energy transition, renewables and the fight against climate change*. PO2 includes, among others, promoting energy efficiency measures; promoting renewable energy and developing smart energy systems, grids and storage outside TEN-E. It is relevant for EUSAIR all five action programmes.

Cohesion Fund (CF)[249]**,** another ESI fund, is aimed at EU member states whose GNI per capita is less than 90% of EU average. It aims to reduce economic and social disparities and to promote sustainable development. CF also supports PO2, more specifically, investments in the environment, including investments related to sustainable development and energy presenting environmental benefits, with a particular focus on renewable energy. For 2021-2027 period, the CF concerns EUSAIR countries Greece, Croatia, and Slovenia.

Horizon Europe[250] is the EU's key funding programme for research and innovation with a budget of EUR 95.5 billion. It tackles climate change, helps to achieve the UN's Sustainable Development Goals and boosts the EU's competitiveness and growth. Both EU and non- EU countries are eligible for this funding programme. This funding programme is relevant for EUSAIR Action Programme 5: Research and Innovation.

Connecting Europe Facility (CEF)[251] is a key EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. It supports the development of high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services. It is relevant for the Action Programmes 1 (Energy Security) and 4 (Decarbonization including RES).

The **Recovery and Resilience Facility**[252] (RRF) will make EUR 723.8 billion in loans and grants available to support reforms and investments undertaken by EU Member States. The original aim was to mitigate the economic and social impact of the coronavirus pandemic. The RRF Regulation was

[248] http://ec.europa.eu/regional_policy/en/funding/erdf/

[249] https://ec.europa.eu/regional_policy/funding/cohesion-fund_en

[250] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

[251] https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/connecting-europe-facility_en

[252] https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/recovery-and-resilience-facility_en

amended[253] in May 2022 with a view to support the implementation of the REPowerEU Plan by integrateing dedicated REPowerEU chapters in Member States' existing Recovery and Resilience Plans.

European Territorial Cooperation (ETC)[254] known as **Interreg**, provides a framework for the implementation of joint actions and policy exchanges between national, regional and local actors from different member states and third countries. Interreg is built around three strands of cooperation: cross-border (Interreg A), transnational (Interreg B) and interregional (Interreg C). Interreg B is relevant for EUSAIR Action Programmes. The budget 2021-2027 supports 14 transnational cooperation programmes with almost 1.5 billion EUR, among others the programme Interreg IPA Adrion (targeting the Adriatic- Ionian macro- region), benefiting also from large IPA contribution. IPA Adrion programme supports cooperation between EU Member States and IPA countries; it is relevant for all five EUSAIR Action Programmes.

The **Innovation Fund**[255] is an EU funding programme for demonstrating innovative low-carbon technologies in the areas of energy intensive industry, renewable energy, energy storage and carbon capture and storage. The fund supports innovations that can cut out emissions significantly, for instance by replacing high energy intensive processes and technologies with more energy-efficient alternatives. It is relevant for the EUSAIR Action Programme 5: Research and innovation.

The **Modernisation fund**[256] will contribute to the investment needs of the 10 lower-income EU countries, among others one EUSAIR country (Croatia). It supports investments in generation and use of energy from renewable energy sources, energy efficiency, energy storage, modernisation of energy networks and the just transition in carbon-dependent regions. The total revenues of the fund may amount to some EUR 14 billion in 2021-30, depending on the carbon price.

Instrument for Pre-Accession Assistance- IPAIII (2021-2027)[257] is an EU funding programme for candidate and potential candidate countries, among others the EUSAIR non- EU countries (Albania, Montenegro, North Macedonia and Serbia). The IPA III instrument is clearly aligned with the flagships and priorities of the 'Economic and Investment Plan for the Western Balkans[258], the Western Balkan Strategy 'A credible enlargement perspective for and enhanced EU engagement with the Western Balkans[259], and the Commission Communication 'Enhancing the accession process – a credible EU

[253] https://commission.europa.eu/system/files/2022-05/com-2022-231_en.pdf

[254] https://ec.europa.eu/regional_policy/policy/cooperation/european-territorial_en

[255] https://ec.europa.eu/clima/policies/innovation-fund_en

[256] https://climate.ec.europa.eu/eu-action/funding-climate-action/modernisation-fund_en

[257] https://neighbourhood-enlargement.ec.europa.eu/enlargement-policy/overview-instrument-pre-accession-assistance_en#:~:text=The%20Instrument%20for%20Pre%2Daccession,and%20technical%20assistance%20since%202007.

[258] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1811

[259] https://ec.europa.eu/info/sites/info/files/communication-credible-enlargement-perspective-western-balkans_en.pdf

perspective for the Western Balkans[260]. IPA III Regulation identifies the key thematic priorities for assistance, structured into 5 thematic windows, whereby Window 3 (Green agenda and sustainable connectivity) and Window 5 (Territorial and cross border cooperation-CBC) are relevant for implementation of EUSAIR Action Programmes. IPA III allows for Cross-Border Cooperation between IPA III beneficiaries and Member States (Interreg-IPA CBC), whereby IPA III funds are pooled together with European Regional Development Funds (ERDF). Under Window 5 IPA III can financially support the participation of IPA III beneficiaries in ERDF transnational and interregional cooperation programmes, i.e. IPA III funds can be pooled together with ERDF.

Just transition fund[261] is governed by the Just Transition Fund regulation and Common provisions Regulation. The Just Transition Fund (JTF) is the first pillar of the Just Transition Mechanism (JTM) and will be a key tool to support the territories most affected by the transition towards climate neutrality providing them with tailored support. It is implemented under shared management, under the overall framework of Cohesion policy, which is the main EU policy to reduce regional disparities and to address structural changes in the EU.

Climate investment fund (CIF)[262] aims to accelerate climate action in low- and middle-income countries by empowering transformations through their programs. It is a leading multilateral climate finance partnership that channels concessional finance through six multilateral development banks (MDBs) for both upstream advisory and downstream investment activities to support climate action.

The World Bank Group, including the International Finance Corporation, the African Development Bank, the Asian Development Bank, the European Development Bank, and the Inter-American Development Bank, are the implementing partners of CIF's investments.

CIF comprises two funds: the Clean Technology Fund (CTF) and the Strategic Climate Fund (SCF).

CIF's large-scale and long-term financing lowers the risks and costs of climate financing. It enables the testing of new business models, builds a track record in unproven markets, and boosts investor confidence to unlock additional sources of finance. Building on its success, in addition to the already existing programs, CIF has launched new programs that focus on accelerating transitions away from the use of coal, renewable energy integration, industry decarbonization, and the development of climate-smart cities. The following are some of the programs: The Accelerating Coal Transition Investment Program, Clean Technology Fund, Global Energy Storage Program, Integration of Renewable Energy into Power Systems, The Industry Decarbonization Program, The Nature, People and Climate Investments program, Climate-Smart Urbanization, and Pilot Program For Climate Resilience.

[260] https://neighbourhood-enlargement.ec.europa.eu/document/download/d9b782a2-af07-4669-a2ee-7b00ed7fdf2f_en?filename=enlargement-methodology_fr.pdf

[261] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism/just-transition-funding-sources_en

[262] https://www.cif.org/

10.2 Proposals by the EC, Energy Community and others

10.2.1 TEN-E Regulation

The Trans-European Networks for Energy (TEN-E) is an EU policy that aims to achieve a more integrated internal energy market by linking the energy infrastructures between Member States and with third countries.

The original TEN-E Regulation (hereinafter Regulation), adopted in 2013, established the regulatory frameworks for the development of cross-border energy infrastructure within the European Union. The Regulation defined a Project of Common Interest (PCI) status, enabling infrastructure projects belonging to the list of priority corridors to benefit from faster permitting and regulatory approval, as well as EU financial assistance.

The first list of energy PCIs was adopted in October 2013. The fourth list was adopted in October and entered in force in March 2020. The majority of PCIs are electricity and gas projects, together with some oil, CO2 network and smart grid projects. In November 2021, the EC published the fifth list. The selection of PCIs is based on the Ten-Year Network Development Plan (TYNDP) developed biennially by the European Network of Transmission System Operators for Electricity and Gas (ENTSOs) which provides a detailed scenario for Europe's electricity and gas supply and demand. Each candidate infrastructure project is judged and awarded PCI status on whether it is critical to realising these scenarios. Thus, these projects must be aligned with the EU's medium- and long-term energy targets. PCI project are eligible for EU financing from the Connecting Europe Facility (CEF).

The initial Regulation has undergone significant changes. The Paris Agreement and EU Green Deal involve significant transformation of the current energy infrastructures in line with the EU Green Deal 55% GHG emission reduction targets by 2030 and into a fully carbon-neutral energy integrated system by 2050. The initial objectives of the Regulation such as market integration, competition and sustainability are still relevant, but the changes are needed in the energy infrastructure that will gradually evolve as emerging technologies are deployed in order to reach targets in 2030 and 2050. The revised TEN-E Regulation was agreed in December 2021 by the Council, the Parliament and the EC and entered into force on 23 June 2023.

The most important change from the previous Regulation is evident: **natural gas (methane) infrastructure projects will no longer be eligible as PCIs** and thus unable to secure CEF funding. However, policymakers agreed a derogation for gas infrastructure already approved under the 4th and 5th list of PCIs.

Highlighting the importance of interconnectivity with neighbours, the revised Regulation **introduces projects of mutual interest (PMI) with third countries.** The revised Regulation updates the infrastructure categories eligible for support with an emphasis on decarbonisation and, besides electricity lines, storage and smart electricity grids, adds a new focus on offshore electricity grids, hydrogen infrastructure and smart gas grids. PMI status can be granted to electricity, hydrogen and CO2 transport and storage project but not to electrolyser and smart grid projects.

The revised Regulation provides:

- for an **improved regulatory treatment of low carbon hydroge**n and is less unfriendly towards natural gas than the EC Proposal. It is more supportive of gas network decarbonization by providing a legal/regulatory framework for repurposing the existing gas networks to enable them carry hydrogen in the future. In summary, all support for new natural gas and oil project will end, and the EU will introduce mandatory sustainability criteria for all projects. During a transitional period until 31 December 2029, dedicated hydrogen assets converted from natural gas can be used to transport or store a pre-defined blend of hydrogen with natural gas or biomethane. Selected projects shall demonstrate how, by the end of this transitional period, these assets will cease to be natural gas assets and become dedicated hydrogen assets.
- EU support for investments in **blending infrastructure** will end in 2027, and all blending projects will have to convert to 100% hydrogen by 2029.
- Expands the definition of **smart gas grids** (beyond digitalisation) to include physical upgrades and any equipment and installation that enables blending hydrogen with methane in natural gas networks.
- **Smart electricity grids** is exiting PCI category and would be made a priority through upgraded rules to facilitate rapid electrification and scale up renewable electricity generation
- **Makes CO2 transport and storage facilities** eligible for PCI/PMI status. CCUS (Carbon capture, utilisation and storage) constitutes a key element of low carbon hydrogen production in addition to enabling industrial capture of CO2
- Establishes a dedicated procedure for **offshore grid planning** which includes both offshore electricity grid development (thus supporting offshore production of renewable electricity) and offshore hydrogen grid development (thus supporting offshore production of renewable hydrogen) as part of the offshore grid priority corridors. As a result, both electricity and hydrogen lines are eligible for PCI status

Overall, the Regulation provides a positive contribution towards a regulatory framework for the decarbonization of the EU's natural gas infrastructure. It introduces a transition period until 2030 and provides additional instruments for developing low carbon hydrogen (**by introducing PCI eligibility for CCUS and CO2 transport projects).**

10.2.2 Adaptation of the new TEN-E in the Energy Community

Energy Community

The Energy Community is established by the Treaty, entered in force in 2006 and brings together Albania, Bosnia and Herzegovina, Georgia, Kosovo, North Macedonia, Moldova, Montenegro, Serbia, Ukraine and the EU with the goal of creating a common energy market. The key objective of the Energy

Community is to extend the EU internal energy market rules and principles to countries in South East Europe, the Black Sea region and beyond on the basis of a legally binding framework. This includes the obligation for member countries to implement selected pieces of EU energy, competition and environmental law, including renewable energy and energy efficiency targets and state aid guidelines, as well as recently adopted greenhouse gas emissions reduction targets[263].

As part of the Energy Community (EnC) acquis, the updated TEN-E Regulation of 2022 is currently in the process of adaptation and will be proposed by the Commission to be adopted by the Energy Community Ministerial Council (EnCMC) in December 2023. It will be then equally applicable in the non-EU countries, and will set the orientation for infrastructure priorities also at the macro-regional level. PECI/PMI list will be updated in accordance with the new regulation in 2024.

The scope and objectives of the Energy Community Secretariat (EnCS) are to:

- Provide for the identification of projects on the Energy Community list of Projects of Energy Community Interest (PECI) and of Projects of Mutual Interest (PMI);
- Facilitate the timely implementation of projects on the Energy Community list by streamlining, coordinating more closely and accelerating permit granting processes, and by enhancing transparency and public participation;
- Provide rules for the cross-border allocation of costs and risk-related incentives for projects on the Energy Community list;
- Determine the conditions for eligibility of projects on the Energy Community list for Union technical and financial assistance from the Instrument of Pre-Accession Assistance (IPA) and the Neighbourhood Investment Facility.

The process of adaptation and adoption in the Energy Community foresees discussion with EnC Stakeholders, coordination with and within the European Commission, organisation of workshops and discussion with the Contracting Parties in the first three quarters of 2023. The adoption of the revised TEN-E Regulation by EnC MC) in December 2023 will be followed by the new PECI selection process, preferably in a one-year timeframe. Thus, a new PECI/PMI list which was due to be chosen in 2022 and postponed until the EU's new TEN-E Regulation is adopted at the EU level and in the Energy Community[264], will start its selection process in January 2024, expected to be finished by Summer 2024, and to be approved at the Ministerial Council meeting at the end of 2024.

New projects to be selected for trans-European energy infrastructure must fall in at least one of the eligible energy infrastructure categories and areas:

- ✓ High and extra-high voltage overhead transmission lines (≥220 kV) and underground/submarine transmission cables (≥150 kV);
- ✓ Energy infrastructure for offshore renewable electricity;

[263] www.energy-community.org

[264] Energy Community Ministerial Council, Decision 2021/11/MC-EnC: amending Decision 2015/09/MC-EnC on the implementation of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure, 30 November 2021

- ✓ Energy storage
- ✓ Smart electricity grids
- ✓ Smart gas grids
- ✓ Hydrogen facilities (pipelines, storage, reception)
- ✓ Electrolysers

Moreover, the potential overall benefits of the project must compensate its costs, including in the longer term. Project must involve at least two Contracting Parties or a Contracting Party and a Member State by directly or indirectly crossing the border of two or more Contracting Parties, or of one Contracting Party and one or more Member States. And finally, the project must be located on the territory of one Contracting Party, either inland or offshore, including islands, and has a significant cross-border impact.

Until the establishment of a new list of Projects of Energy Community interest, the previous lists annexed to Decision 2020/04/MC-EnC[265] and Recommendation 2020/01/MC-EnC[266] formally remain valid, including the construction of gas infrastructure projects that, together with oil pipelines, will no longer be eligible for PECI/PMI status. Much has changed since the lists were selected in 2020, both in terms of EU policy, which is gradually becoming more ambitious on climate goals and in terms of the risks of relying on gas.

These PECI/PMI projects, involving the EUSAIR countries are:

List of PECI in Electricity

- *EL_01 Transbalkan corridor*
    a) New 400 kV OHL SS Kragujevac 2 (RS) – SS Kraljevo 3 (RS), with voltage level upgrade in SS Kraljevo 3 (RS) to 400 kV voltage level
    b) New double circuit 400 kV OHL SS Obrenovac (RS) – SS Bajina Basta (RS) with upgrade of SS Bajina Basta (RS) to 400 kV
    c) New 400 kV interconnection between SS Bajina Basta (RS) - Visegrad (BA) - Pljevlja (ME)

List of PECI in Gas

- *Gas_13 Albania-Kosovo* Gas Pipeline - ALKOGAP Supplying Kosovo* competing projects 'cluster*
- *Gas_26 North Macedonia–Kosovo* Interconnector Supplying Kosovo* competing projects' cluster*
- *Gas_11 Interconnector Serbia-North Macedonia Supplying North Macedonia competing projects' cluster*
- *Gas_09 Interconnector Bulgaria-Serbia (PCI) as a competing project with TurkStream expansion in Serbia (Gastrans project) N/A*

List of PMI in Gas

[265] Decision D/2020/04/MC-EnC on the establishment of the list of projects of Energy Community interest ('Energy Community list'), 29 December 2020

[266] Recommendation R/2020/01/MC-EnC on Projects of mutual interest between Contracting Parties and Member States of the European Union

- *Gas_10 Gas Interconnector Serbia-Croatia (Phase I) N/A*
- *Gas_28 Trans-Anatolian Pipeline Expansion - TANAPX Southern Gas Corridor Expansion-TANAPX-SCPFX-IAP*
- *Gas_22 South Caucasus Pipeline Further Expansion - SCPFX Southern Gas Corridor Expansion-TANAPX-SCPFX-IAP*
- *Gas_16 Ionian Adriatic Pipeline - IAP Southern Gas Corridor Expansion-TANAPX-SCPFX-IAP*
- *Gas_4b Interconnector Greece-North Macedonia Supplying North Macedonia competing projects' cluster*
- *Gas_01 Interconnector Bosnia and Herzegovina - Croatia North Supplying Bosnia and Herzegovina competing projects' cluster*
- *Gas_03 Interconnector Bosnia and Herzegovina - Croatia South Supplying Bosnia and Herzegovina competing projects' cluster*

10.2.3 Some financing opportunities

TEN-E Regulation provides funding through the Connecting Europe Facility (CEF) for investments in energy and gas infrastructure projects. CEF provides funding through grants for electricity transmission, natural gas transmission and smart grids. For the 2021-2027 period, EUR 5.84 billion has been allocated to energy projects under CEF for Energy**.** The revised TEN-E Regulation, as described above, added hydrogen transport infrastructure and certain types of electrolysers under its gas category. Projects have to be categorised as PCIs to qualify for CEF funding, meaning that must have a significant impact on energy markets and market integration in at least two Member States, boost competition, help the EU's energy security by diversification, as well as support the achievement of the climate and energy goals.

Other significant projects are Important Projects of Common European Interest (IPCEIs). These are innovation and infrastructure projects, targeting to significantly support the achievement of EU strategies. In contrast to CEF, these are led by the Member States and funded by national budgets, but the status of IPCEI leads to an opportunity to exceed the limits of state aid regulated by the Commission. The revised IPCEI communication[267], in effect from 1 January 2022, sets the criteria for the Commission to assess national support for IPCEIs.

Beyond CEF funding and IPCEIs, there are several EU funding opportunities and financial instruments that offer grants and loans in the context of energy, as well as instruments and mechanisms to facilitate funding and leverage private sector financing:

- Modernisation Fund[268]: Supporting ten lower-income EU Member States (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia) through grants,

[267] COMMUNICATION FROM THE COMMISSION, Criteria for the analysis of the compatibility with the internal market of State aid to promote the execution of important projects of common European interest, 25.11.2021

[268] European Commission, n.d., Funding for climate action, Modernisation Fund. Available at: https://ec.europa.eu/clima/eu-action/fundingclimate-action/modernisation-fund_en.

guarantees, loans and capital injections for investments in energy networks and energy security among other. The fund derives its revenues from the auctioning of 2% of the total ETS allowances for 2021-30 and its total revenues may amount to EUR 48 billion from 2021 to 2030 (at EUR 75 / tCO_2);

- European Fund for Energy, Climate Change and Infrastructure - Marguerite Fund[269]: Equity fund with participation of European Investment Bank and other international financial institutions for greenfield and brownfield infrastructure investments amounting to EUR 700 million in 2018 – 2028;
- InvestEU: Under the Climate and Infrastructure Funds[270] offered by the European Investment Fund (EIF), the EIF provides equity investments for renewable energy generation, transmission, distribution and storage as well as for cross-border energy infrastructure and PCIs;
- Recovery and Resilience Facility (RRF): Funding for green and sustainable energy sector projects and interventions through grants and loans. A minimum of 37% of the EUR 672.5 billion needs to be allocated to green investments and reforms. The 26 submitted National Recovery and Resilience Plans (NRRPs) contain EUR 52.73 billion dedicated to the energy sector[271]; and
- Innovation Fund and the newly proposed European Hydrogen Bank: In the State of the Union speech, the Commission announced a new European Hydrogen Bank[272], worth EUR 3 billion. It will support the achievement of the EU hydrogen targets and aim to close investment gaps and connect supply and demand by guaranteeing the purchases of hydrogen to create certainty of demand. However, there is still no detail about the function of this bank apart being funded by the Innovation Fund[273].More than EUR 38 billion of ETS revenues were allocated to the Fund for 2020-2030, and EUR 1.8 billion in clean tech projects, including hydrogen[274],
- European Investment Bank (EIB) no longer supports natural gas energy projects and any other project concerning traditional fossil fuels. Instead, for energy infrastructure, it focuses on supporting the development of infrastructure to transport low-carbon gases such as hydrogen

[269] For more information, see: https://www.marguerite.com/portfolio/.

[270] For more information, see: https://engage.eif.org/investeu/climate-infrastructure-funds.

[271] EUR 52.73 billion is dedicated to the economic sector of electricity, gas, steam and air conditioning supply (NACE code D), available at: https://www.bruegel.org/dataset/european-union-countries-recovery-and-resilience-plans.

[272] The State of the Union 2022 by Ursula von der Leyen, 14 September 2022, available at: https://ec.europa.eu/commission/presscorner/detail/en/speech_22_5493.

[273] There has been some speculation the new Hydrogen Bank would use its capital to buy up all ten million tonnes of the EU's 2030 green hydrogen annual production target and then resell it to market at a lower price under a Carbon Contracts for Difference scheme, see: https://www.rechargenews.com/energy-transition/from-niche-to-scale-eu-launches-3bn-european-hydrogen-bank-with-a-bang-but-keeps-quiet-about-the-details/2-1-129913

[274] European Commission communication of the Innovation Fund, available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4402.

(next to electricity infrastructure)[275]. In 2020, the EIB provided EUR 455 million in investment for gas[276]. For hydrogen, the EIB signed an advisory agreement with Hydrogen Europe to support the identification of projects that could receive EIB financing[277]. Furthermore, the European Clean Hydrogen Alliance launched a call for electrolyser manufacturing and electrolyser deployment projects to submit applications for EIB Advisory support[278]

10.2.4 EU Economic and Investment Plan (EIP) for the Western Balkans

Economic and Investment Plan for the Western Balkans adopted in October 2020 by the European Commission is aiming to support the countries towards energy market integration, decarbonisation and clean energy, just transition, digitalisation of the system and smart grids, energy efficiency, including modernisation of district heating and energy security. Decarbonisation is a key pillar of this EIP in line with the aims of the European Green Deal. Enhanced connectivity and extension of the Energy Union to the Western Balkans are also important for a successful clean energy transition in the region.

The EIP set out ten flagship areas for investment, and Western Balkan governments have submitted proposed projects for financing in these fields. It foresees up to EUR 30 billion for ten flagship investments in the areas of sustainable transport, clean energy, environment and climate, digital future, the private sector and human capital. This consists of EUR 9 billion in EU funding, through the Instrument for Pre-Accession (IPA) with up to EUR 20 billion of investments over the next years.

In the area of energy, there are three investment flagships: Renewable energy, Transition from coal (gas and electricity transmission) and Renovation Wave (energy efficiency).

Flagship - Renewable Energy

This Flagship proposes increased use of renewable energy sources, that ought to be in line with the region's potential and national preferences. Its objective is to diversify energy sources in order to increase potential for the country and ultimately the region to produce more energy from renewable sources. This flagship initially (October 2020) proposed the following projects:

[275] EIB, 2019, EIB Energy Lending Policy. Supporting the energy transformation. Available at: https://www.eib.org/attachments/strategies/eib_energy_lending_policy_en.pdf.

[276] EIB, 2021(a), Energy Overview. Available at: https://www.eib.org/attachments/thematic/energy_overview_2021_en.pdf.

[277] EIB, 2021(b), 29 July, EIB signs advisory agreement with Hydrogen Europe. Available at: https://www.eib.org/en/press/all/2021-284-eibsigns-advisory-agreement-with-hydrogen-europe

[278] EIB, 2022, 16 March, EIB looking to invest in Hydrogen projects. Available at: https://www.eib.org/en/press/news/eib-looking-to-invest-in - hydrogen-projects

a) In Albania, both rehabilitation of the Fierza Hydro Power Plant[279] and construction of the Skavica Hydro Power Plant are due to be completed so as to increase potential for the country (and the region) to increase the export of electricity from clean energy.

b) In Montenegro, the Piva Hydro Power System will be expanded with construction of the Komarnica Hydro Power Plant[280].

c) In Kosovo*, preparations for construction of the Ibër-Lepenc Hydro System Phase II will be accelerated.

d) In North Macedonia, a wind park and solar power plant investment will be substantially advanced, to serve as an example for future-proof investments making use of the region's renewable energy potential. North Macedonia Oslomej 1 Solar Photovoltaic Power Plant and North Macedonia Oslomej 2 and Bitola Photovoltaic Power Plants. Some of these projects have already secured financial resources from IFIs or investments by private companies, such as the wind park and solar power plant investment schemes in North Macedonia undertaken by the German renewable energy company WPD that plans to build a EUR 500 million wind farm in the north-eastern part of North Macedonia[281]

e) Another EIP Flagship project has been added in February 2022, namely a EUR 12 million investment in the first floating Solar Power Plant in Albania, more specifically the installation of a floating solar photovoltaic power plant at the Vau Dejës reservoir. This will be the first application of pure-floats technology in the Western Balkans, with significant potential to replicate it in other reservoirs both in Albania and across the region; the plant is expected to produce over 18 GWh of electricity and displace 8 700 tonnes of CO2 annually.

Flagship - Transition from Coal

This flagship proposes ending the use of highly polluting coal by making a transition towards more sustainable and green energy sources. Its objective is to reduce not only carbon dioxide and other emissions, but also air pollution generally, thereby enabling the region to meet its commitments under the Paris Agreement. Decarbonising energy systems is critical for achieving the EU's long-term aim of carbon neutrality by 2050. Under this Flagship, the following projects are planned:

a) Construction of the Fier-Vlora gas pipeline in Albania will be completed as part of the Trans Adriatic Pipeline and the Ionian-Adriatic gas pipeline along the coast will be prioritised, facilitating a major diversification of gas supply to the Western Balkans region and beyond.

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[279] I. Todorović, Albania's KESH to reconstruct its hydropower plant Fierza, Balkan Green Energy News, published on 31 January 2022.

[280] Hydroreview, EPCG granted concession to develop 172-MW Komarnica hydro plant in Montenegro, published on 9 February 2020.

[281] Reuters, Germany's WPD to invest $578 mln in North Macedonia wind park, published on 12 October 2021.

b) Completion of the gas-interconnector linking Bosnia and Herzegovina with Croatia will complement this diversification of the gas distribution system.
c) Gas links between North Macedonia and Kosovo* will extend the North Macedonia – Greece interconnector.
d) The gas interconnector between North Macedonia and Serbia will be prepared for construction.
e) 250MW CHP gas/H2 power plant in Bitola[282]
f) The Trans-Balkan Electricity Transmission Corridor in Serbia will be completed to provide the backbone for electricity distribution throughout the whole region and towards the EU. The project will provide investment of EUR 40.8 million for constructing 84 km of double overhead transmission line from Bajina Bašta in western Serbia to Bosnia and Herzegovina together with Montenegro, further connecting electricity transmission systems from Western Balkan countries to the EU. Almost 70 % of the total costs of the project is financed through a KfW loan and another 25 % by current and previous EU grants. Trans-Balkan Electricity Transmission Corridor is a project of significant national and regional relevance because it will provide major electricity connectivity among the countries in the region and with the EU. The Corridor includes the electricity markets of Romania, Serbia, Bosnia and Herzegovina, Montenegro and Italy. The first phase in Serbia was finished in December 2017, while Romania deployed its section of the corridor in May 2018[283].

Flagship - Renovation Wave

This flagship proposes expansion of the EU Renovation Wave to the Western Balkans. Its objective is to refurbish and improve the building stock aimed at assisting transition towards decarbonised and cleaner energy systems. The Flagship's main objectives are:

a) Triple the renovation rate of existing buildings.
b) Triple energy savings in existing buildings.
c) Achieve nearly zero energy consumption in new buildings.

The Western Balkans building sector, comprising all public and private buildings, is the largest final energy consumer with approximately 43 % of total energy consumption[284]. Renovating public and private buildings to meet minimal energy performance standards is expected to make a very significant contribution to the reduction of greenhouse gas emissions, boost the living standards of citizens and improve the population's health generally. A building renovation wave implemented with the help of the Energy Community will assist the Western Balkans in decarbonisation of public and private buildings, with a strong emphasis on digitalisation and taking into account energy poverty. At the

[282] link:https://www.esm.com.mk/wp-content/uploads/2022/01/20220622_Kapitalni-proekti-ESM_eng.pdf

[283] V. Spasić, EMS signs EUR 6.5 million contract for second phase of Trans-Balkan corridor, Balkan Green Energy News, published on 4 September 2020.

[284] Energy Community Secretariat, 2021

February 2022 WBIF meeting, only one project has been endorsed for this flagship, namely a EUR 40 million scheme to introduce an advanced remote meter reading system in Serbia.

10.3 Conclusions and challenges

The EUSAIR strategy aims at achieving a growth based on improved energy and transport infrastructure; major use of renewables; decarbonisation; stronger economic competitiveness; development of the private sector; as well as sustainable green and digital transition.

Some key findings emerging from this Master Plan are here as follows:

- Russia's invasion of Ukraine and a substantial reduction of available pipeline gas **require a reorganisation of the EUSAIR gas system to accommodate structural shifts in gas flows** taking into consideration that there is no need of expansion of existing capacity according to this Master Plan scenarios;
- Changes in the **direction of gas flows** due to the geopolitical situation have shown the need to adjust the investment projects for different natural gas infrastructures to repurposed to hydrogen transport;
- Over the last decade, substantial progress has been made in **increasing gas interconnectivity,** particularly in Central and South-East Europe;
- **LNG is becoming a key supply source** to re-adjust the EU import structure due to a phase-out of Russian pipeline gas imports. In 2022, several Member States, namely Croatia, Greece and Italy, streamlined **the expansion of LNG terminals and leasing of new FSRUs;**
- **Gas storage** is a key component of the gas system providing security of supply and system flexibility covering peak demand during the winter season;
- **Natural gas infrastructure** will no longer be eligible for EU funding under the revised TEN-E regulation but it allows for support of transitional infrastructure projects that can be used by 2030 for natural gas before being repurposed. Repurposed infrastructure must be fit to carry pure hydrogen;
- Investments in gas infrastructure only for making these **ready for hydrogen and low-carbon gases.** It is essential that the new gas pipelines are constructed in such a way that they can easily switch to green hydrogen once fossil gas is eliminated and replaced by green hydrogen (in the EU presumably by 2040)[285];
- **Blending** is only allowed with the purpose of creating dedicated hydrogen pipelines and as a technical necessity in a provisional timeframe to allow switching existing pipelines to 100% hydrogen pipelines;

[285] M. Vujasin, Expansion of green hydrogen changing geopolitical relations – IRENA, Balkan Green Energy News, published on 18 January 2022.

- **Natural gas infrastructure** already approved under the 4th and 5th PECI/PMI list can be developed. There are some older projects, such as the gas interconnections between Serbia and Bulgaria as well as between Greece and North Macedonia, that will be financed while for IAP and TAP 2 the picture is more complex;
- Projects with a strong cross-border dimension should be privileged, like IAP, TAP2 and the Balkan Natural Gas Ring. In the light of the current geopolitical environment **gas storage facilities, gas counterflows, and larger LNG imports** should be promoted.
- EIB's current priorities with green transition in principle **exclude investments in gas pipelines and fossil fuels,** encouraging the private sector to use new technologies. Both the EIB and the EBRD are going to finance projects based on gas only as a transitional measure that leaves open the possibilities for gas infrastructures when foresee the future transport of hydrogen;
- **The RepowerEU Plan** estimates that limited additional infrastructure (i.e., LNG import terminals, pipelines to connect underutilised LNG terminals and the network and reverse flows) will require targeted investment estimated at EUR 10 billion by 2030; this is coherent with the Master Plan scenarios;
- **Carbon capture and storage** is important for scaling up renewable and low carbon gas;
- The power grid of the EUSAIR Region is already well developed, differently form that of gas, thanks to the planning and the investments of the past; on this structure the future developments will take place also because of the strong production of RES and the electrification of final consumption;
- Completion of the **Trans-Balkan Electricity Transmission Corridor** is a project of significant national and regional relevance because it will provide major electricity connectivity among the countries in the region and with the EU; it strengthens already existing regional grids making the system more connected with the rest of Europe and within single countries namely Bosnia and Herzegovina, Croatia. Montenegro and Serbia;
- A stronger and more interconnected power grid will **accelerate transition** towards decarbonised energy systems throughout the EUSAIR Region and contain dependency upon imported fuels, and protect against price hikes;
- **New forms of cooperation for the deployment of renewable energy** sources and low-carbon energy technologies should be looked for and enacted through the EUSAIR;
- **Hydrogen use and hydrogen economy** are the long-term a goal requiring immediate commitment and developments on hydrogen-ready gas infrastructure, hydrogen storage and logistics. The experience of the hydrogen valleys should be continued and expanded through the EUSAIR, notably in the Western Balkans Region;
- **Decarbonisatio**n is going to be costly for countries that rely heavily on coal for industrial production, electricity generation and heating;

- Western Balkans governments need urgently to prepare and implement the necessary measures, including the **elimination of state subsidies** to large energy enterprises and other polluting industries that continue to use fossil fuels;
- The possibility of **using other energy sources to replace coal** should be explored for the medium term, options that may be able to avoid relying primarily on gas pipelines; **s**tranded costs and differences in energy competitiveness as they are resulting from an accelerated transition towards decarbonised energy systems should be addressed and find recognition.
- The EUSAIR Member Countries have different endowments of energy resources and facilities though they have **a great potential for economic and energy development** which should be fully exploited and deployed. Harmonisation of forms of **governance for the energy transition** should be sought.
- Although current EU financial commitments to support economic development in the Western Balkans are likely to be higher than during the previous period, **the EU financial package may still prove to be insufficient** to achieve the ultimate objective of accelerating the region's economic growth and convergence towards the EU;
- The **Renewable Energy flagship of EU EIP** for Western Balkans is **putting emphasis primarily on hydropower**, while underestimating other renewable energy sources such as solar and wind sources. The proposed hydropower plants are likely to be effective in producing more renewable green energy, but they could conflict with environmental objectives;
- **The region's potential must be taken into account regarding solar and wind energy**, which may become increasingly attractive to private companies;
- The **Renovation Wave flaghsip** is likely to be effective in reducing carbon emissions from buildings, but only in the medium-to-long term, given that such projects are extremely costly, while it is not clear how they will be financed;
- **Huge potentialities of improvements in energy efficiency** in all final consumption sectors, evident from the comparison of the high energy content of GDP in the EUSAIR Countries compared to the EU;
- **New projects and measures for increasing energy** end-use efficiency, developing and digitalising power and natural gas networks, expanding electrification should be defined and implemented to contribute to the energy transition;
- **Weak governance and low administrative capacity** of the governments to absorb EU funding Implementation. Reforms of the public administration have progressed slowly, especially at sub-national levels and within local municipalities, governments may not be able to prepare and offer mature projects which can be accepted for funding.

All in all, all future infrastructure development shall contribute to the decarbonising EUSAIR economies to deliver a clean, but also secure and affordable environment for citizens.

This is the direction to be followed to avoid overcapacity and stranded assets for all the project promoters.

Strengthening energy interconnections integration and cohesion is a priority for facilitating the integration and effective transmission of renewable energy sources and in this way also to developing the hydrogen economy.

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