EU Strategy for the Adriatic and Ionian Region
EUSAIR

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Thematic Steering Group of EUSAIR

Pillar 2 – Connecting the Region

Master Plan of Energy Networks for the Adriatic-Ionian Region

Executive Summary

June 2023

This document has been produced with the financial assistance of the EU ADRION Programme in the framework of the European Union Strategy for the Adriatic and Ionian Region (EUSAIR). The content of the document is under the sole responsibility of NE Nomisma Energia, Italy and South East Europe Consultants, Serbia. The document has been prepared with support from the EUSAIR Pillar 2 – Connecting the Region, Sub-Group on Energy Networks. It has been well-received and shared by the Sub-Group. Analyses, proposals and views as described by the document do not imply any approval or commitment by the European Union or by governments, public administrations and institutions of EUSAIR participating Countries.

NE

South East Europe Consultants

Structure and objectives of the Master Plan

1. This document is the Executive Summary of the study and project named “Master Plan of Energy Networks for the Adriatic and Ionian Region” conducted on behalf of Pillar 2 – Connecting the Region of the European Union Strategy for the Adriatic and Ionian Region (EUSAIR).

2. Objectives, priorities and programmes of the EUSAIR are in the Communication from the European Commission to other European Union Institutions COM (2014) 357 final, while the accompanying Action Plan SWD (2020) 57 final, complements the Communication. Today the EUSAIR participating Countries include four EU Member States (Croatia, Greece, Italy, Slovenia) and six non-Member States (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, San Marino, Serbia).

3. The whole study and project, also referred to in the following as the Master Plan or MP, is available on the website of the EUSAIR (https://www.adriatic-ionian.eu/). The study and project have been awarded by the Regione Marche of Italy to the team formed by Nomisma Energia Srl from Italy and South East Europe Consultants Ltd from Serbia in the framework of the EU ADRION Programme.

4. The study and project intend to provide a comprehensive outlook of energy systems, programmes and policies, notably of electricity and natural gas systems through the EUSAIR participating Countries. The view is at the challenges ahead including the fight against global climate change, security of energy supply, energy affordability and price competitiveness.

5. The study is addressed to national administrations and energy institutions, the European Commission, the Energy Community, to energy regulatory authorities and energy stakeholders and social groups through the Adriatic and Ionian Region. The goals of energy efficiency, clean fuels for transport, options for green energy and decarbonisation are presented while a description is provided of energy systems of each Country of the Adriatic and Ionian Region, of their energy supply and demand, gas and power generation, state of adoption of EU directives, as well as the state of current and planned electricity and gas infrastructures.

6. A key part of the study is dedicated to the EUSAIR Master Plan Scenarios which are developed along two-time horizons, namely the years 2030 and 2050. Three scenarios are elaborated: Current Policies Scenario (CPS) and New Policies Scenario (NPS) based on the data and information on the specific Country policies and scenarios contained in the National Energy and Climate Plans (NECPs) and a Carbon-Neutral Scenario (or the so-called Net Zero Emission - NZE Scenario) in line with the scenarios of the International Energy Agency.

7. Additional three studies, available on the website, have been completed as an integral part of the Master Plan, namely: Power networks and market for a green Adriatic-Ionian Region, Integrated natural gas corridors and market for a green Adriatic-Ionian Region and Development and operation of logistics for direct LNG use as a clean fuel for the Adriatic-Ionian Region.

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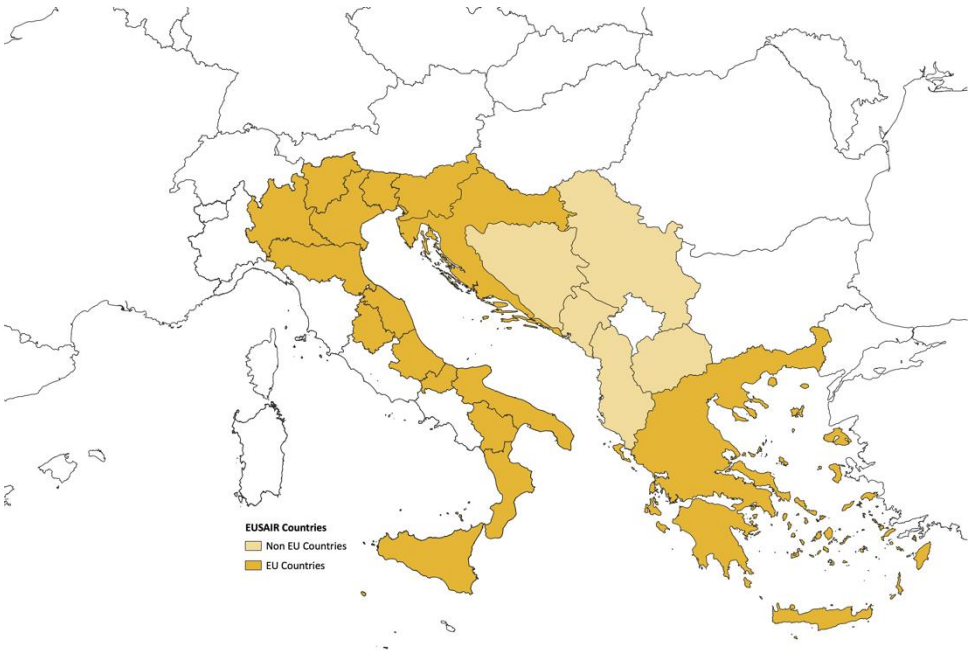

Figure 1 – EUSAIR Participating Countries

Source: Consultant's elaboration

Table of contents

List of abbreviations and acronyms

AL	Albania
BA	Bosnia and Herzegovina
bcm	Billion cubic meters
bcm/y	Billion cubic meters per year
CCUS	Carbon capture use and storage
CEF	Connecting Europe Facility
CF	Cohesion Fund
CPS	Current Policies Scenario
CSE	Central and South East
CY	Cyprus
DSDP	Detailed site development plan
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
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
ERDF	European Bank for Reconstruction and Development
ETC	European Territorial Cooperation
EU	European Union
EU EIP	European Union Economic and Investment Plan for the Western Balkans
EUSAIR	EU Strategy for the Adriatic-Ionian region
FSRU	Floating storage and regasification unit
GDP	Gross Domestic Product
GHG	Greenhouse gas emissions
GR	Greece
GRITA	Power link between Greece and Italy

GW	Gigawatt
HR	Croatia
HVDC	High Voltage Direct Current
IAP	Ionian Adriatic Pipeline
IEA	International Energy Agency
IPA	Instrument for Pre-Accession Assistance
ktoe	Thousand tonnes of oil equivalent
kV	Kilovolt
LNG	Liquified Natural Gas
MONITA	Power link between Montenegro and Italy
MP	Master Plan
Mtoe	Million tonnes of oil equivalent
MW	Megawatt
NECP	National Energy and Climate Plan
NPS	New Policies Scenario
NZE	Net Zero Emission
OHL	Overhead line
PCI	Projects of Common Interest
PECI	Projects of Energy Community Interest
PMI	Projects of Mutual Interest
RES	Renewable Energy Sources
RS	Serbia
SDS	Sustainable Development Scenarios
SS	Substation
STEPS	Stated Policies Scenario
TAP	Trans-Adriatic Gas Pipeline
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Networks for Energy
TPP	Thermal power plant
TS	Transmission station

TSGs	Thematic Steering Groups
TSO	Transmission System Operator
TWh	Terawatt-hour
TYNDP	Ten Year National Development Plan
UGS	Underground gas storage
UNFCCC	United Nations Framework Convention on Climate Change
WAM	With additional measures
WBIF	Western Balkans Investment Framework
WEM	With existing measures
WEO	World Energy Outlook

1. Conclusions and recommendations

Countries through the Adriatic and Ionian Region are confronted in their energy programmes and policies with huge challenges for their future including confrontation of global climate change, enhanced security of energy supplies, widening energy affordability and increasing cost competitiveness. Decarbonisation of the energy systems is the goal to the year 2050.

With a view at The European Green Deal, the EU Strategy for Energy System Integration, the Green Agenda for the Western Balkans, RE Power EU - The Joint European Action for more affordable, secure and sustainable energy the EUSAIR participating Countries are called to cooperate, coordinate and harmonise their energy programmes and policies towards better and more effective energy interconnections and infrastructure, large-scale deployment of renewable energies, increased energy efficiency up to the average European standards, decarbonisation of the energy systems while supporting a sustainable green and digital transition.

Formation and training of skilled human sources, alliances and joint ventures amongst industrial players of the Region are enabling factors while facilitating access to investments and financial resources. Better governance of the energy systems is a must.

With these premises a few recommendations are as in the following.

1. Enhance and facilitate energy interconnections between and amongst Countries from the Adriatic and Ionian Region to grant security of energy supplies while allowing for large-scale deployment of renewable and distributed energy resources:

- Complete the **Trans-Balkan Electricity Transmission Corridor** as a project of significant national and regional relevance because it will provide major electricity connectivity among the Countries of the Region and with the EU. It strengthens already existing regional grids making the power system more connected with the rest of the European Union and within single Countries, namely Bosnia and Herzegovina, Croatia, Montenegro and Serbia;
- Increase effort and investments towards stronger and more interconnected power grids to **accelerate the transition** towards decarbonised energy systems through the EUSAIR participating Countries and contain dependency upon imported fuels while protecting against energy price hikes;
- Focus on natural gas projects with a strong cross-border dimension, 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.

2. Develop flexible, efficient and resilient energy systems through the Adriatic and Ionian Region for delivering clean, accessible and affordable energy services by the use of natural gas as a fuel for the energy transition:

- Reorganise the natural gas systems of EUSAIR participating Countries **to accommodate structural shifts in gas flows** taking into consideration that there is no need of expansion of

existing capacity according to the Master Plan New Policies Scenario while Russia's invasion of Ukraine is raising concerns;

- Promote counterflows and changes in the **direction of gas supplies** to enhance security and adjust the investment projects for different natural gas infrastructures while repurposing for hydrogen transport for the longer term;
- **Develop natural gas storage** as a key component of the gas system providing security of supply and system flexibility while covering peak demand during the Winter season;
- **Integrate LNG facilities and gas networks into the transport sector,** especially that of heavy-duty transport and ships where decarbonisation is more difficult and where transport policies have already been discussed and activated since several years in order to reach this objective.

3. Agree upon a joint strategy for natural gas deployment and investment on new natural gas infrastructure through the Adriatic and Ionian Region:

- **Note that 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 eventually repurposed to carry pure hydrogen;
- Note that priorities by the **European Investment** Bank exclude in principle **investments in gas pipelines and fossil fuels,** encouraging the private sector to use new technologies. Both the European Investment Bank and the EBRD are going to finance projects based on natural gas only as a transitional measure that leaves open the possibilities for gas infrastructures when future transport of hydrogen is foreseen;
- Note that the **REPowerEU Joint European Action** is estimating that limited additional infrastructure (i.e., LNG import terminals, pipelines to connect underutilised LNG terminals and the networks and reverse flows) will require targeted investment estimated at EUR 10 billion by 2030; this is coherent with the Master Plan Scenarios;
- Develop and implement **natural gas infrastructure** already approved under the 4th and 5th PECI/PMI. 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 prospects are more complex;
- Promote natural gas infrastructures 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);
- Invest on **LNG as a key supply source** to re-adjust the EU import due to the Russian pipeline gas imports. In 2022, several Member States, namely Croatia, Greece an Italy, streamlined **the expansion of LNG terminals and leasing of new FSRUs;**

4. Enhance efforts to develop and deploy low-carbon options notably renewable energies through the Adriatic and Ionian Region including biofuels:

- **Build upon the renewable energy potential of the Region notably upon solar and wind energy resources**, which may become increasingly attractive to private companies;
- Focus on renewable energy sources other than hydropower while noting that 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 energy. The proposed hydropower plants are likely to be effective in producing more renewable green energy, but they could conflict with environmental objectives;
- **Develop an agreement** between EUSAIR participating Countries to map the renewable energy potential of the Region;
- Look for **new forms of cooperation** for the deployment of renewable energy sources. Low-carbon energy technologies should be looked for and enacted through the EUSAIR.
- Urgently invest in infrastructures and solutions in the transport sector in order to ease its huge dependency on fossil fuels, especially on oil products, and this creates demand for all possible low-carbon options, such as biofuels, hydrogen, electricity produces from renewable sources.

5. Recognise the roles of all actors and stakeholders in creating an inclusive and participatory environment that incentives and supports energy efficiency:

- **Exploit the huge potentialities of improvements in energy efficiency** in all final consumption sectors, as apparent from the comparison of the high energy content of GDP in the EUSAIR Countries compared to the EU overages;
- Participate in the **Renovation Wave flagship** as an effective means to reduce 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;
- **Promote 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.

6. Design energy programmes and projects in the Adriatic and Ionian Region clearly aimed towards achieving climate neutrality as in the Carbon-Neutral Scenario and sustainability without leaving anyone behind:

- **Support decarbonisation which** is going to be costly for EUSAIR participating Countries that rely heavily on coal for industrial production, electricity generation and heating; and it should be supported by the EU in the same way as within the EU.
- Explore the possibility of **using other energy sources to replace coal** for the medium term, cope with stranded costs and differences in energy competitiveness as they are resulting from

an accelerated transition towards decarbonised energy systems should be addressed and find recognition;

- **Invest on hydrogen use and hydrogen economy** as a 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;
- **Allow for blending** 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;
- **Invest in carbon capture and storage** as a key option for scaling up renewable and other low-carbon energy options.

7. Support a coordinated combination of policies, measures and instruments to shape an effective and consistent energy governance and just regulatory system with a view at the EU enlargement:

- Exploit different endowments of energy resources and facilities of EUSAIR participating Countries as 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;
- Reverse **weak governance and low administrative capacity** of governments to absorb EU funding and finance projects. 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.
- Invite Western Balkans governments to urgently prepare and implement the necessary measures, including the **elimination of state subsidies** to large energy enterprises and other polluting industries that are continuing use of fossil fuels;
- Achieve the ultimate objective of decarbonising and accelerating the Region's economic growth and convergence towards the European Union energy 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**.

In conclusion, future infrastructure developments shall contribute to the decarbonising EUSAIR economies to deliver a clean, secure and affordable environment for their citizens. This is the direction to be followed to avoid overcapacity and stranded assets for all the project promoters. Strengthening energy interconnections cohesion is a priority for facilitating the integration and the effective transmission of renewable energy sources and in this way also to developing the hydrogen economy.

2. European and international energy framework

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 the European Union to reconsider also the issue of energy security, energy access 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 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.

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.

2.1 Main challenges

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 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.

The Strategy and the EUSAIR Action Plan were approved and launched in 2014 and formulated during

[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

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:

- 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; and
- 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

- The projects which are given or deserve the EUSAIR-label;
- The Flagship Projects; and
- 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.

3. Energy system in the Adriatic-Ionian Region

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).

3.1Energy supply and demand in EUSAIR area

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.

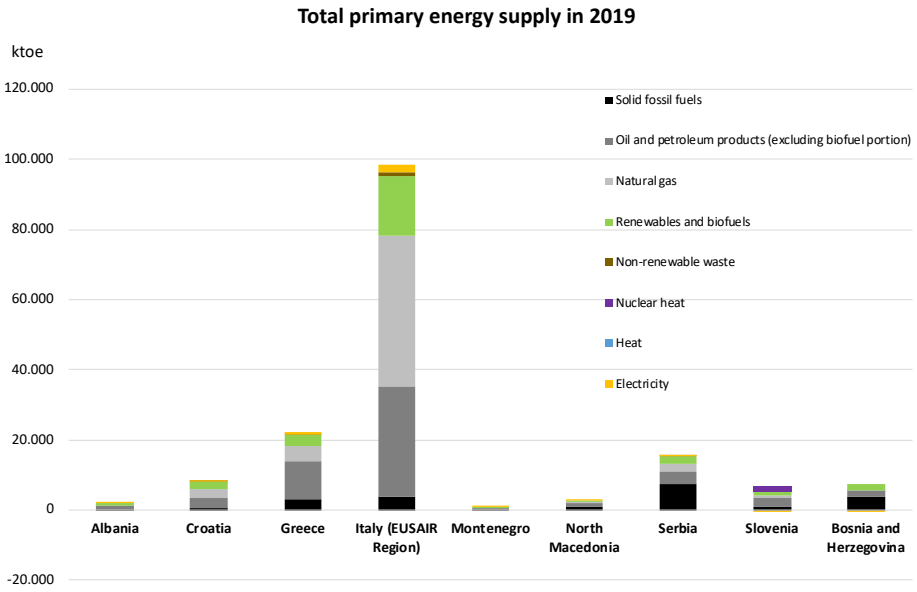

Figure 2 – Total primary energy supply per Country in EUSAIR area in 2019 (ktoe)

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.

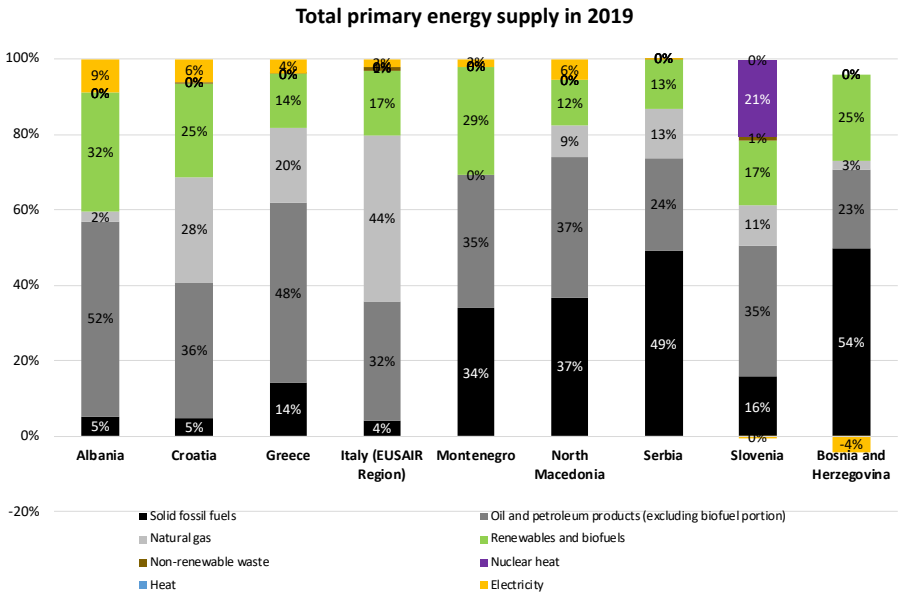

Figure 3 – Total primary energy supply per Country in EUSAIR area in 2019 (%)

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.

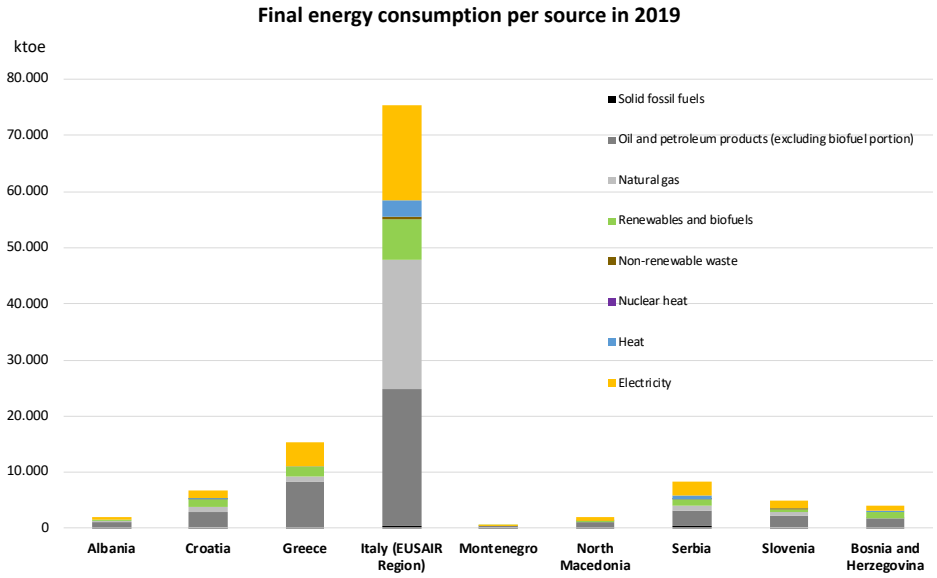

Figure 4 – Final energy consumption per Country and source in EUSAIR area in 2019 (ktoe)

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%.

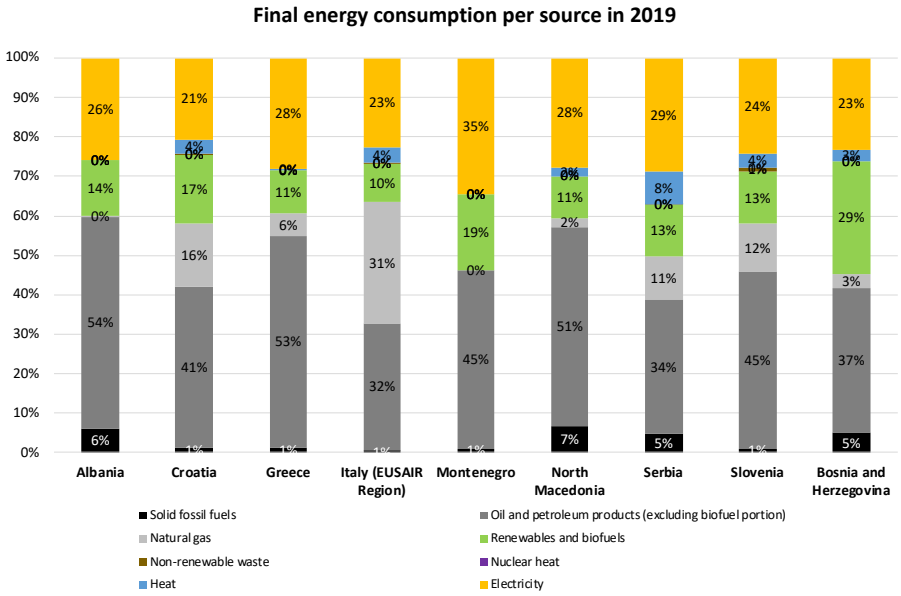

Figure 5 – Final energy consumption per Country and source in EUSAIR area in 2019 (%)

Source: Consultant's elaboration on Eurostat data

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.

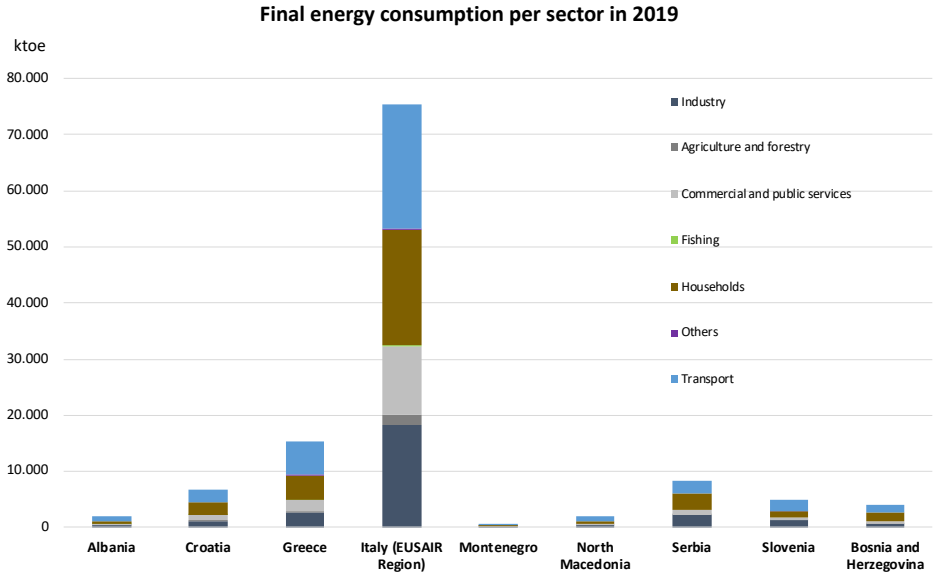

Figure 6 – Final energy consumption per Country and sector in EUSAIR area in 2019 (ktoe)

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%).

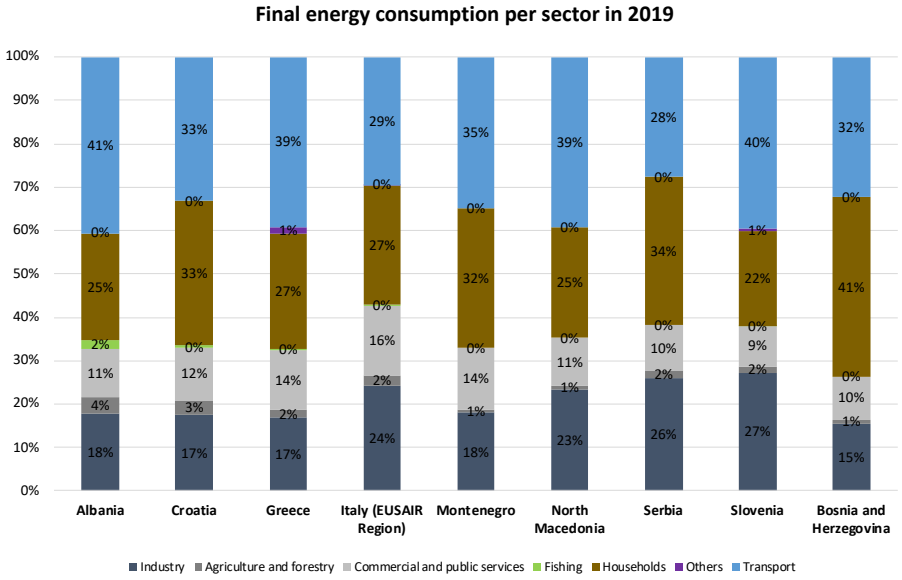

Figure 7 – Final energy consumption per Country and sector in EUSAIR area in 2019 (%)

Source: Consultant's elaboration on Eurostat data

3.2Electricity sector and power generation in EUSAIR area

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.

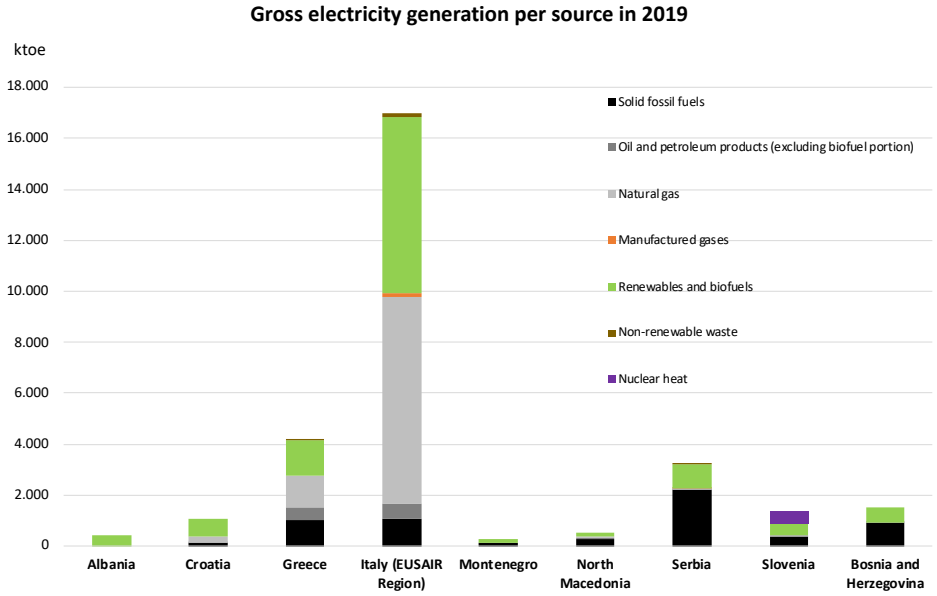

Figure 8 – Gross electricity generation per Country and source in EUSAIR area in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

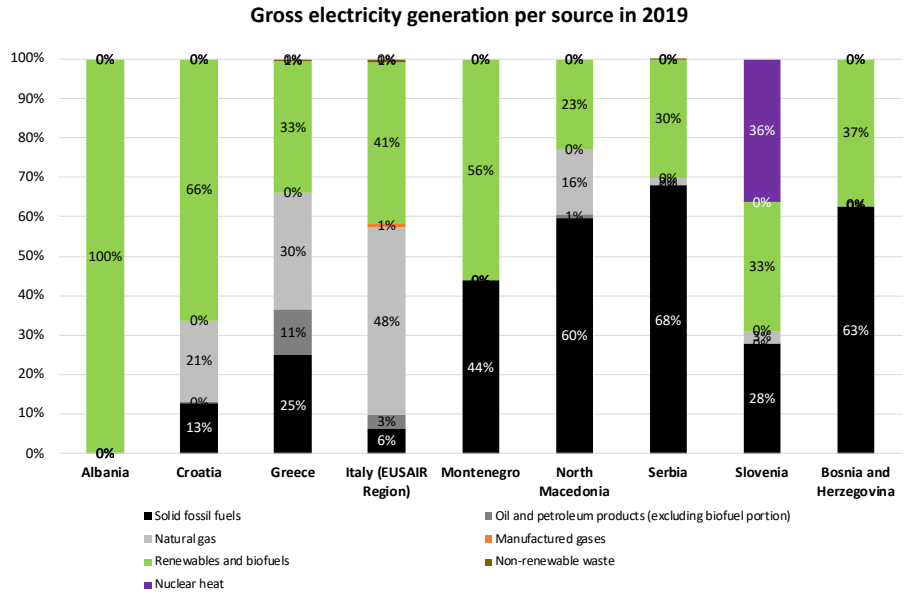

Figure 9 – Gross electricity generation per Country and source in EUSAIR area in 2019 (%)

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).

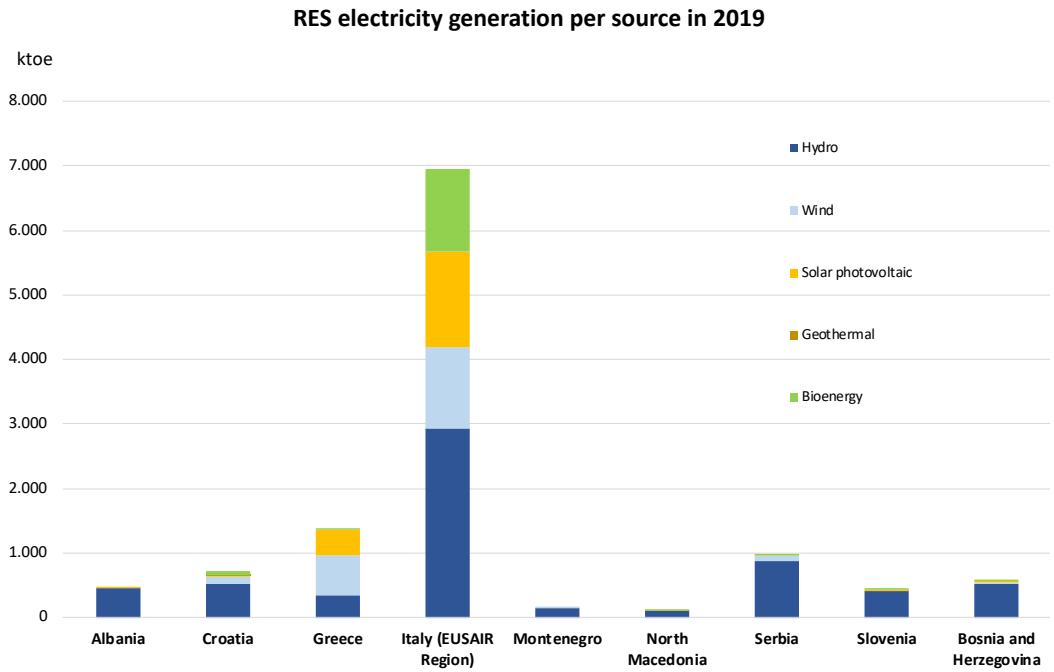

Figure 10 – RES electricity generation per Country and source in EUSAIR area in 2019 (ktoe)

Source: Consultant's elaboration on Eurostat data

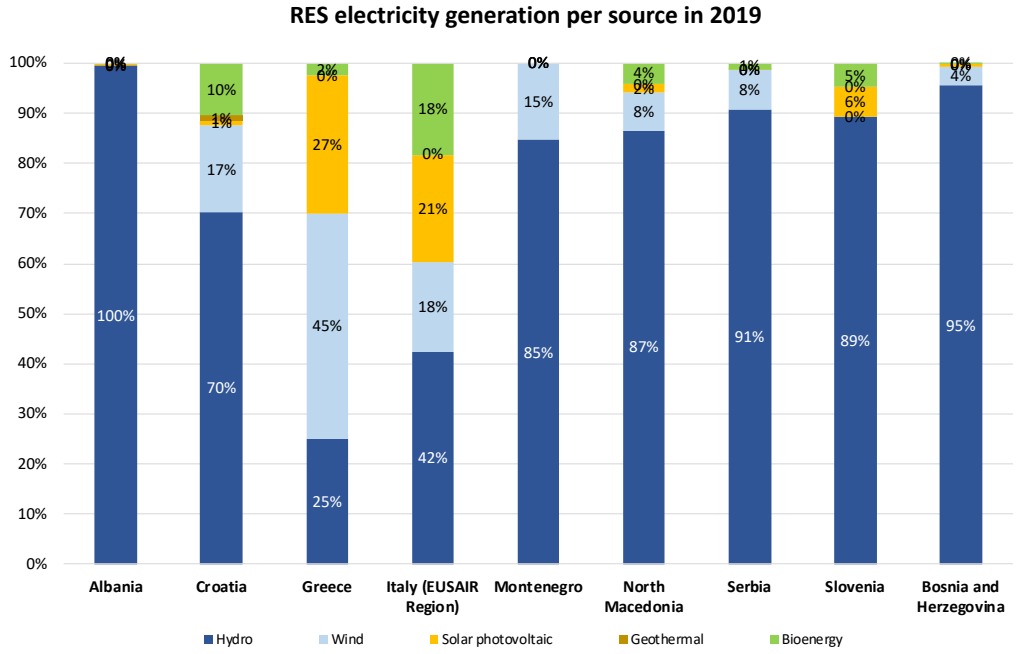

Figure 11 – RES electricity generation per Country and source in EUSAIR area in 2019 (%)

Source: Consultant's elaboration on Eurostat data

3.3State of adoption of EU directives and state of NECPs

By signing the Energy Community Treaty, Western Balkans countries – members of EUSAIR made legal commitments to harmonize their national legislation with the legislation of the EU (Acquis Communautaire) in all the agreed areas of harmonization.

The state of adoption of EU directives and regulations for each sector has been compiled in the Master Plan, based on the assessed implementation performance by the Energy Community Secretariat as of 1 November 2021.

The following table summarizes the current status in EUSAIR countries with regard to preparation of National Energy and Climate Plans (NECPs).

Country	Status	Period of the NECP	Date of adoption	Remarks
Albania	adopted	2021-2030	December 2021	-
Bosnia and Herzegovina	under preparation; Policy section (A) drafted, Analytical section (B) drafted	until 2030	-	Preliminary draft adopted; informal comments provided by the Energy Community Secretariat (EnCS) in July 2021; Publicly presented in April 2023; Planned to be submitted by July 2023
Croatia	adopted	2021-2030	December 2020	-
Greece	adopted	until 2030	December 2019	-
Italy	adopted	until 2030	December 2019	-
Montenegro	under preparation; Policy section (A) drafted, Analytical section (B) drafted	until 2030		Informal comments on the preliminary draft provided by EnCS in July 2021; Obligation towards EnC to submit it by June 2023, adoption planned for July 2024
North Macedonia	adopted	until 2030	May 2022	-
Serbia	under preparation	2021-2030 with a vision until 2050	-	Several scenarios analysed and public ocnsultations on the scenarios held; Obligation towards EnC to submit it by June 2023

Table 1. NECP status in the countries of the Adriatic-Ionian Region

Source: Consultant's elaboration

4. Power and gas scenarios up to 2030 and 2050

4.1 Description of the methodology used for the scenario building

The Master Plan developed and assessed **three scenarios for each EUSAIR Country** taking into account the specific country policies and scenarios contained in NECPs and other institution forecasts, namely International Energy Agency (IEA) scenarios.

Here below the list and in the yellow square the relevant cases for Master Plan scenarios.

Master Plan Scenarios	NECPs	European Commission (PRIMES Scenario)	ENTSOs TYNDP 2022 Scenarios	IEA WEO scenarios
Current Policy Scenario (2030)	**With existing measures (WEM)**	EU Reference Scenario 2020	National Trends	Stated Policies Scenario (STEPS)
Policy Scenario (2030)	**With additional measures (WAM)**	Fit for 55 (MIX Scenario)		Sustainable Development Scenario (SDS)
Carbon Neutral Scenario (2050)	n.a.	EU climate-neutral vision[5]	Distributed Energy Global Ambition	**Net Zero Emissions by 2050 Scenario (NZE)**

Table 2 - Summary of Master Plan scenarios definitions

Source: Consultant's elaboration

The two scenarios assessed for each EUSAIR Country up to 2030 are based mainly on the information contained in National Energy and Climate Plans (NECPs):

- the **Current Policy Scenario** (**CPS**) is 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**) has been 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.

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

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

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

For **power generation**, were exploited the RES development scenarios and the evolution of the electricity generation plants over the time horizon of the NECPs.

When NECPs did not provide enough details, the CPS and NPS scenarios were created by processing additional information, also starting from the reference data of **2019 base year**.

If the NECP information were not available for some EUSAIR countries[6], the CPS and NPS scenarios were defined using respectively the Stated Policies Scenario (STEPS[7]) and the Sustainable Development Scenario (SDS[8]) of the IEA World Energy Outlook 2020 (WEO 2020[9]), **both starting from 2019 as the reference year**. In this case, according to regional groupings in WEO, the scenarios were related to:

- "**European Union**" for Italy, Slovenia, Croatia and Greece
- "**Europe**" for Albania, Bosnia and Herzegovina, North Macedonia, Montenegro and Serbia.

For the **carbon neutral scenario by the year 2050**, for each EUSAIR Country were used as main reference the **IEA "Net Zero Emission" Scenario** (the so-called "**NZE**" scenario), defined as the scenario which 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 CO_2 emissions by 2050**.

Thus, in the Master Plan for:

- each **Country**,
- each **sector** (industry, buildings, transport, etc.),
- and each **energy source** (gas, oil, renewables, coal, etc.)

[6] NECPs of Bosnia and Herzegovina, Montenegro and Serbia are currently still in different phases of development and approvals, thus not available.

[7] 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.

[8] 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.

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

were developed scenarios with specific trajectories based on those contained in the IEA Net Zero Scenario.

4.2Electricity demand forecasts

Starting from the scenario results at 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 is expected by 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.

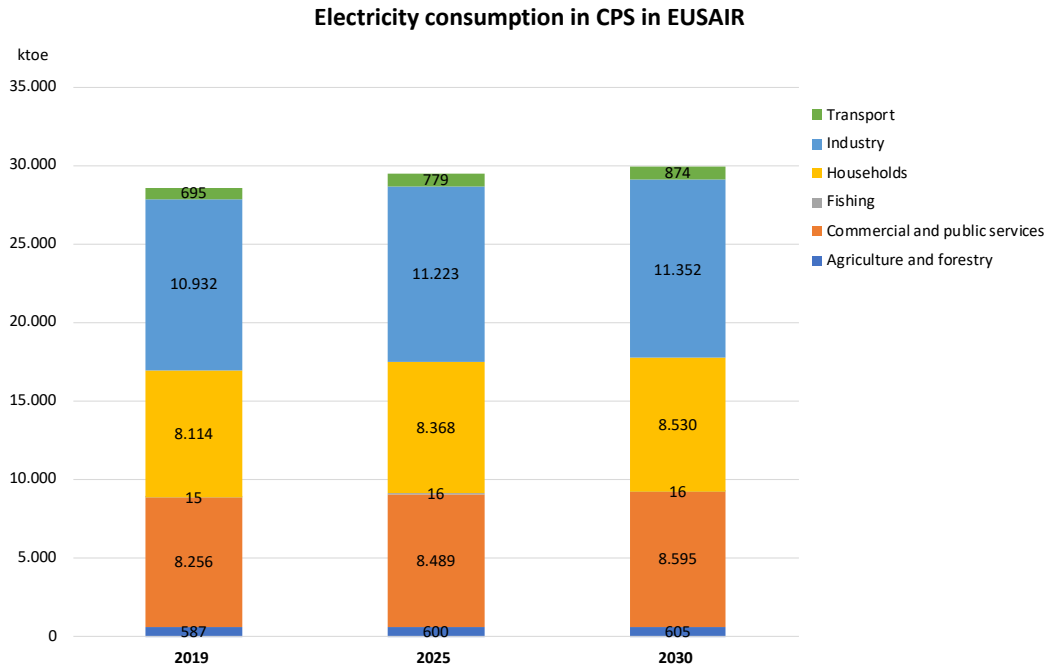

Figure 12 – Electricity consumption in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

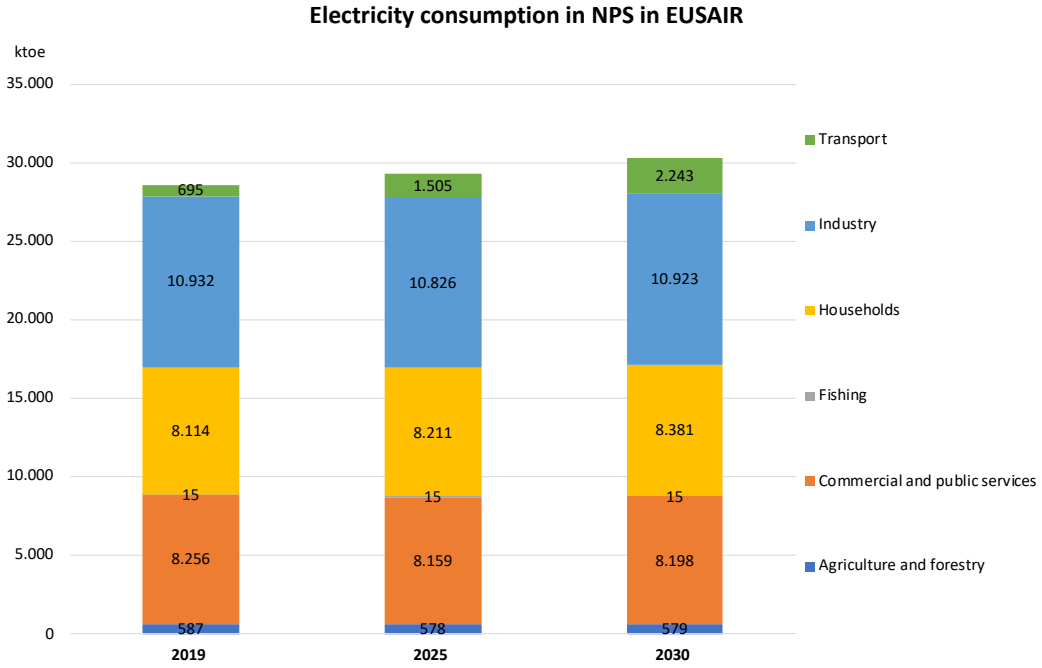

Figure 13 – Electricity consumption in NPS in EUSAIR

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 3 - Summary of electricity consumption scenarios in the EUSAIR area by 2030 (ktoe)

Source: Consultant's elaboration on NECP, European Commission, Eurostat and IEA 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.

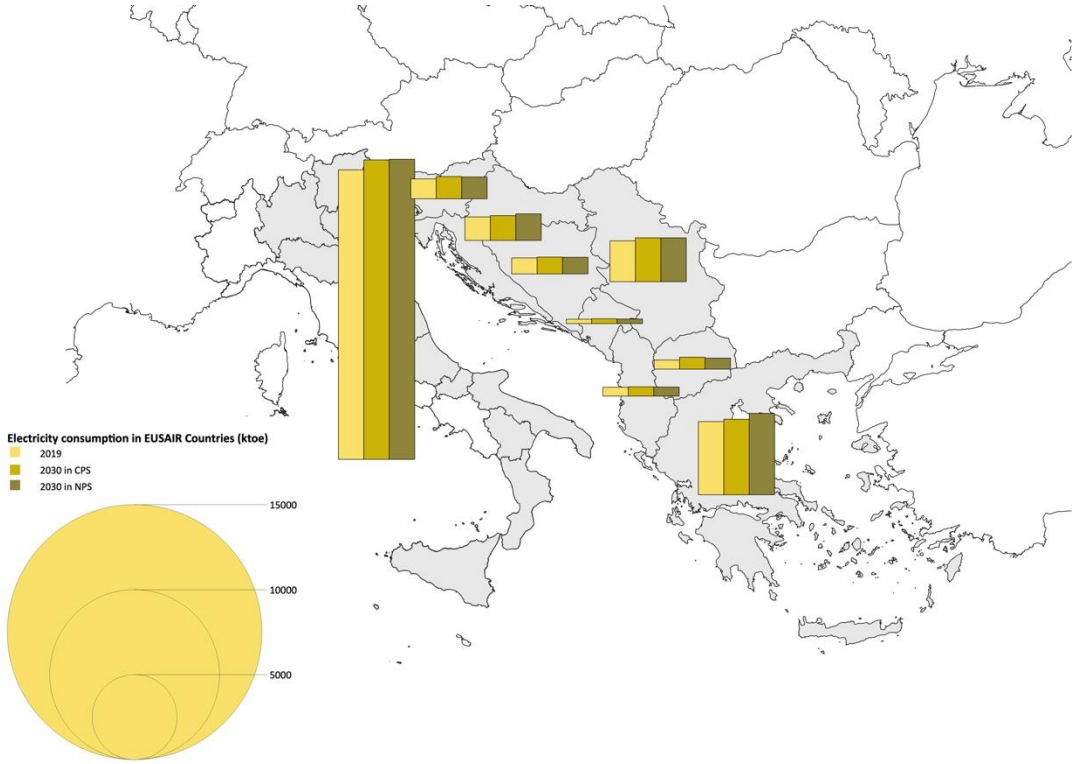

Figure 14 – Electricity consumption in CPS and NPS EUSAIR Scenarios by 2030

Source: Consultant's elaboration on Eurostat, NECP and IEA data

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.

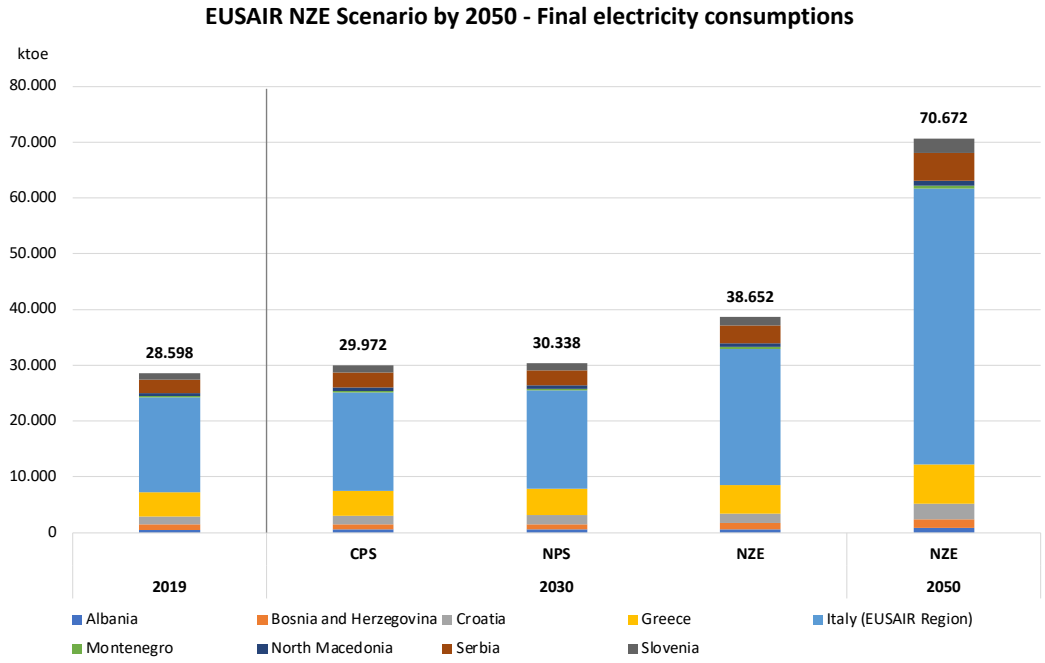

Figure 15 – EUSAIR NZE Scenarios by 2050 - Final electricity consumptions

Source: Consultant's elaboration on Eurostat, NECP and IEA data

4.3Natural gas demand forecasts

Starting from the scenario results at 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.

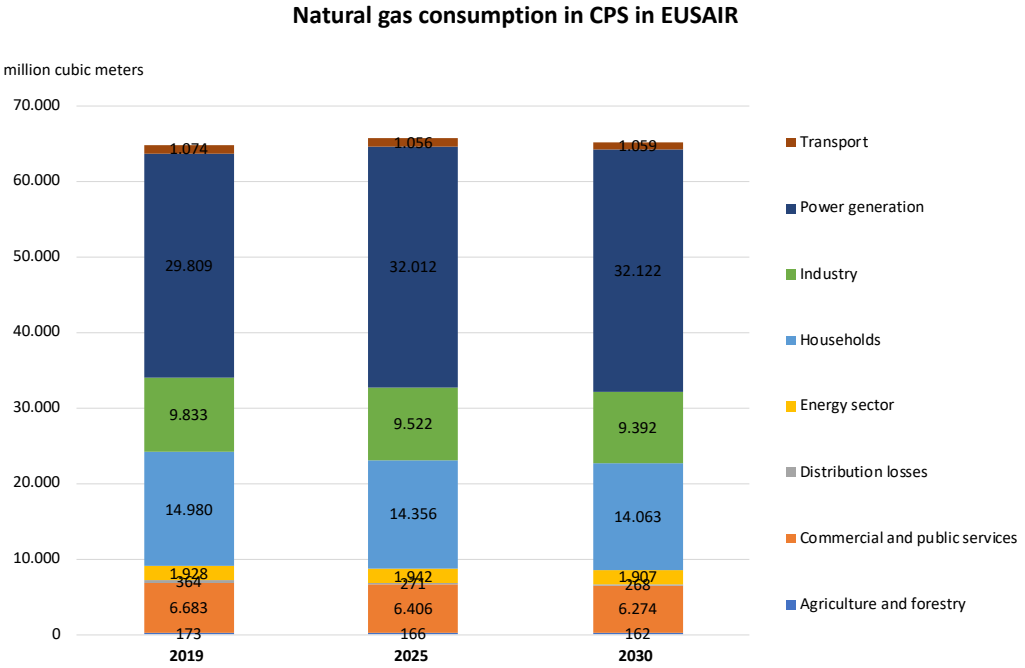

Figure 16 – Natural gas consumption in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

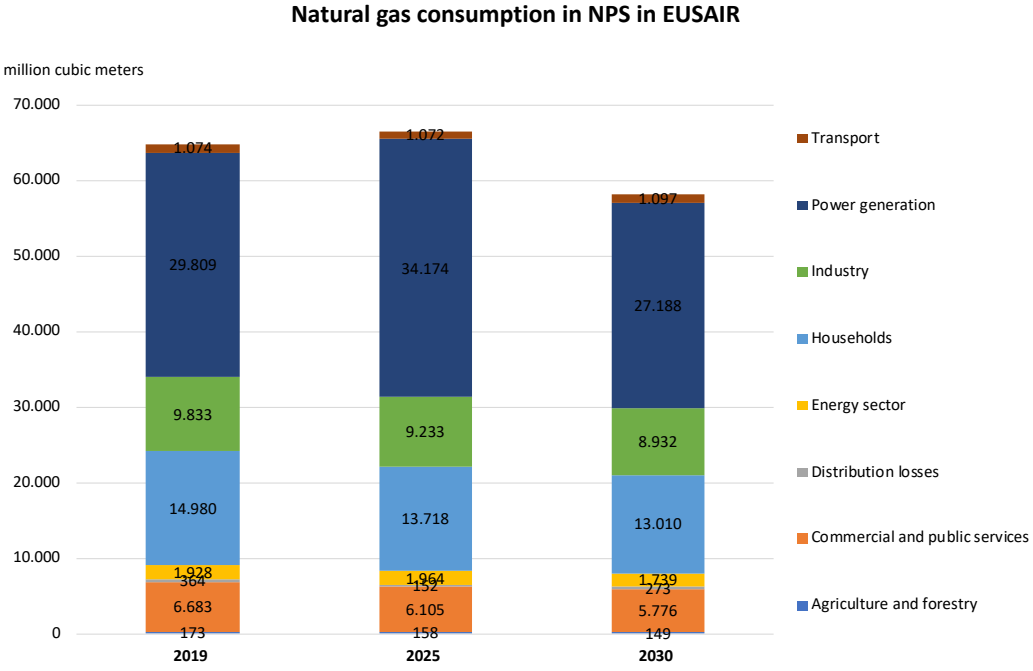

Figure 17 – Natural gas consumption in NPS in EUSAIR

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 4 - Summary of natural gas consumption scenarios in the EUSAIR area by 2030 (million cubic meters)

Source: Consultant's elaboration on NECP, European Commission, Eurostat and IEA 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.

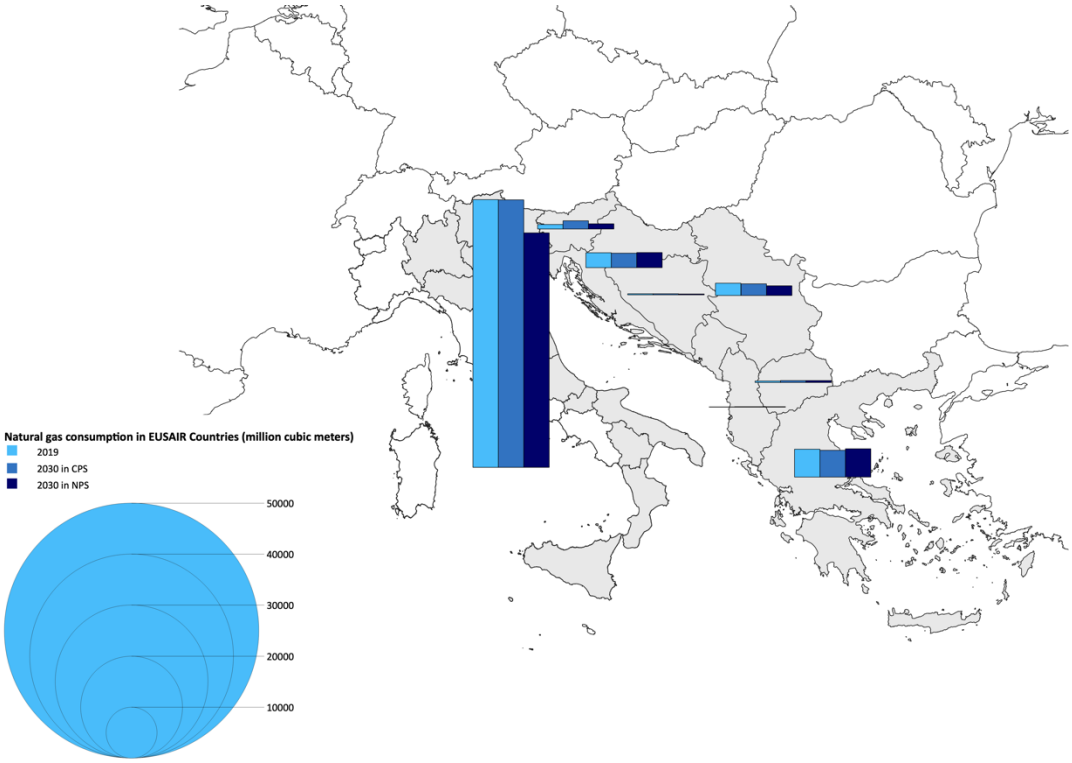

Figure 18 – Natural gas consumption in CPS and NPS EUSAIR Scenarios by 2030

Source: Consultant's elaboration on Eurostat, NECP and IEA data

The **NZE scenario** by 2050 envisages a very sharp drop in gas consumption as early as 2030 and then **substantially zeroing, except in Italy, in 2050**.

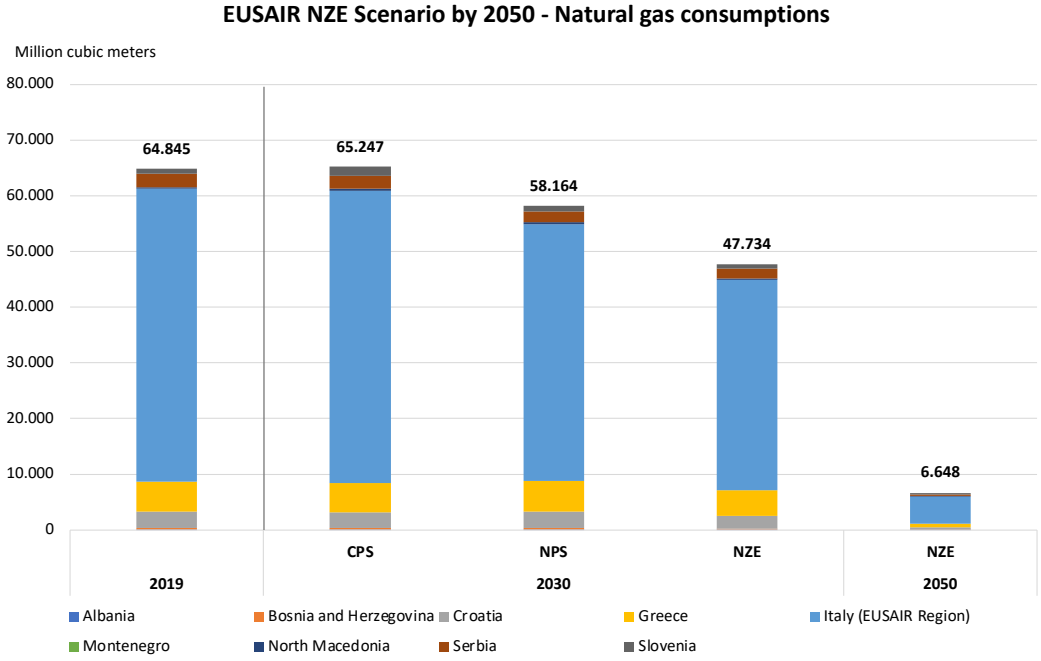

Figure 19 – EUSAIR NZE Scenarios by 2050 – Natural gas consumptions

Source: Consultant's elaboration on Eurostat, NECP and IEA data

4.4Power generation forecasts

In the mid-term, a stable level of power generation 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.

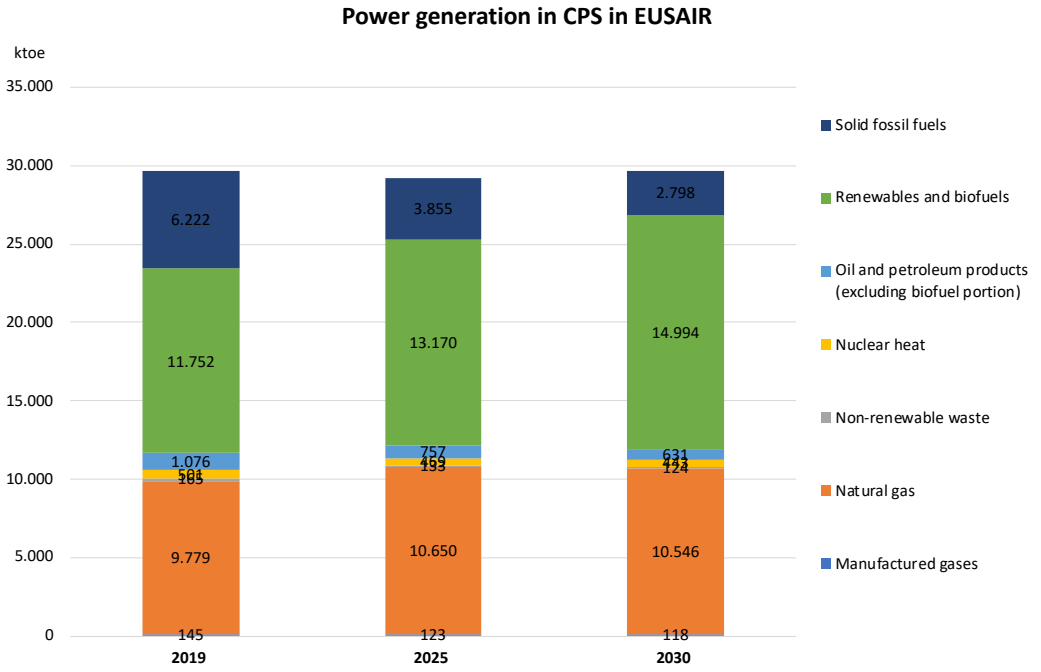

Figure 20 – Power generation in CPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

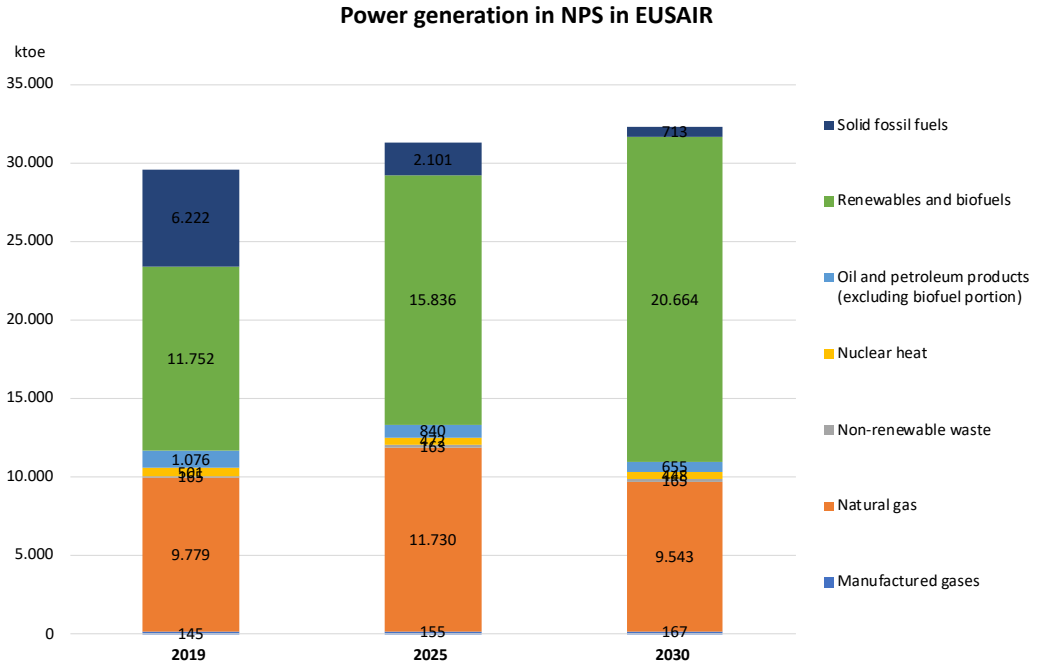

Figure 21 – Power generation in NPS in EUSAIR

Source: Consultant's elaboration on NECP, Eurostat and IEA data

The **NZE scenario** by 2050, on the other hand, strongly pushes 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.

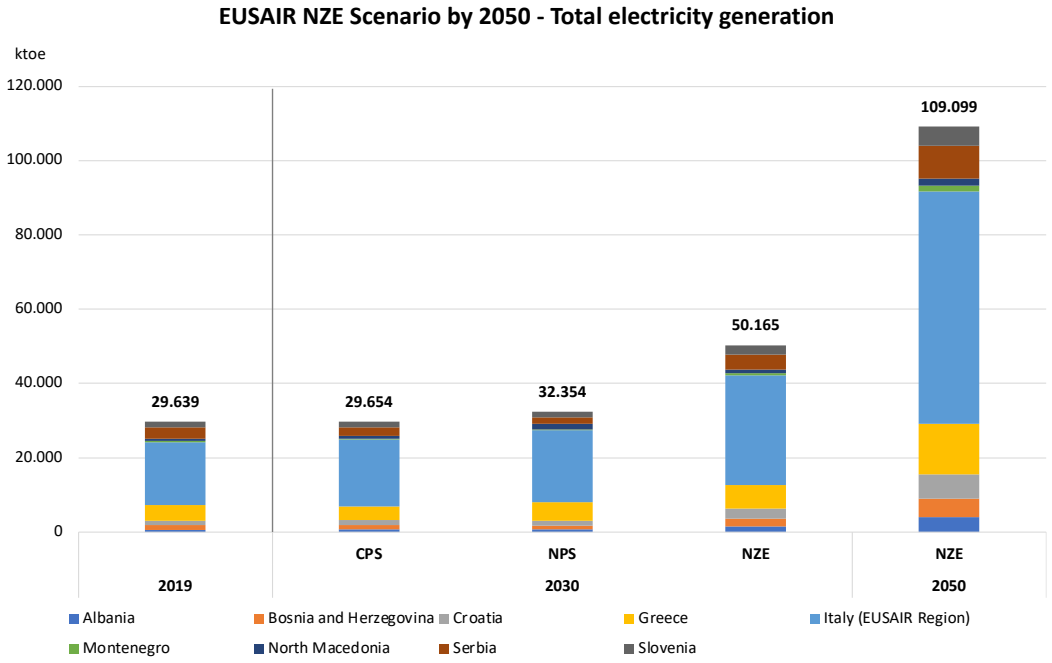

Figure 22 – EUSAIR NZE Scenarios by 2050 – Total electricity generation

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, in the EUSAIR area 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.

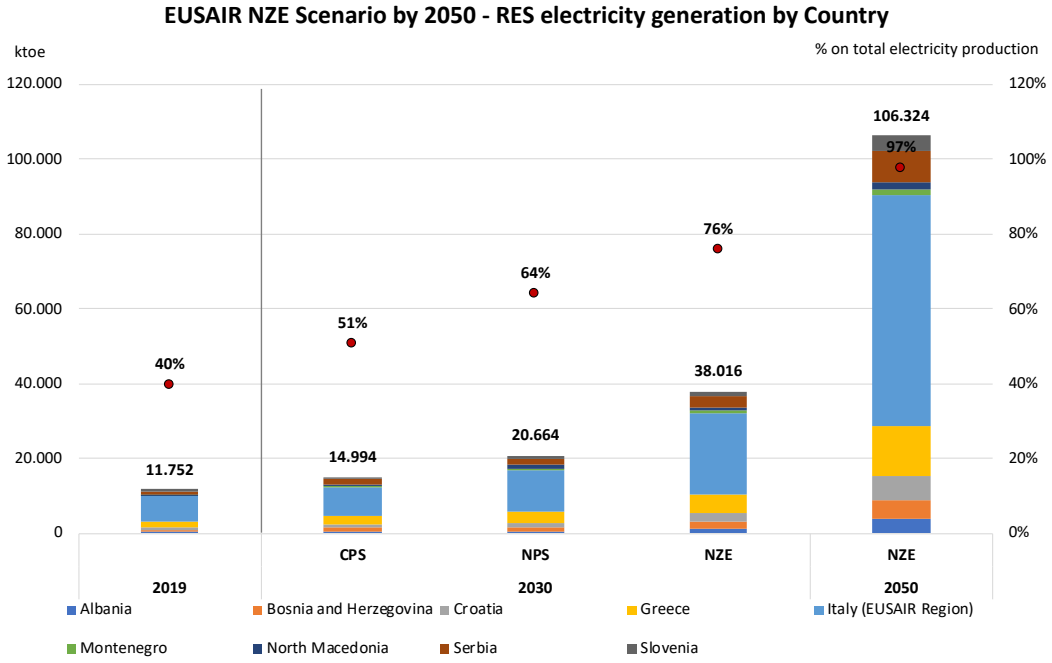

Figure 23 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by Country

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).

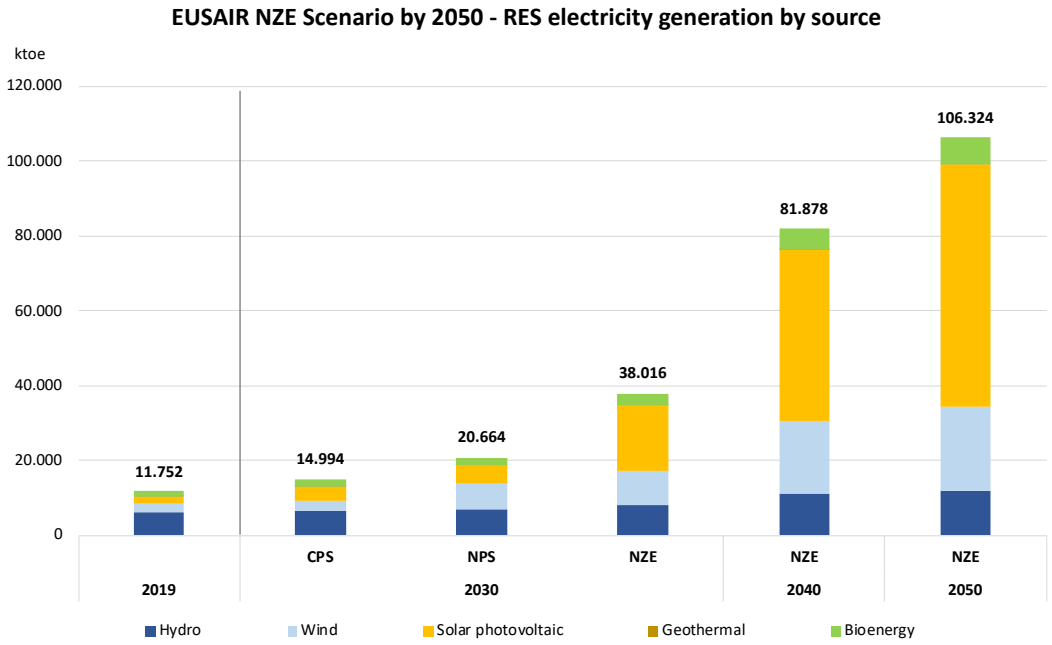

Figure 24 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by source

Source: Consultant's elaboration on Eurostat, NECP and IEA data

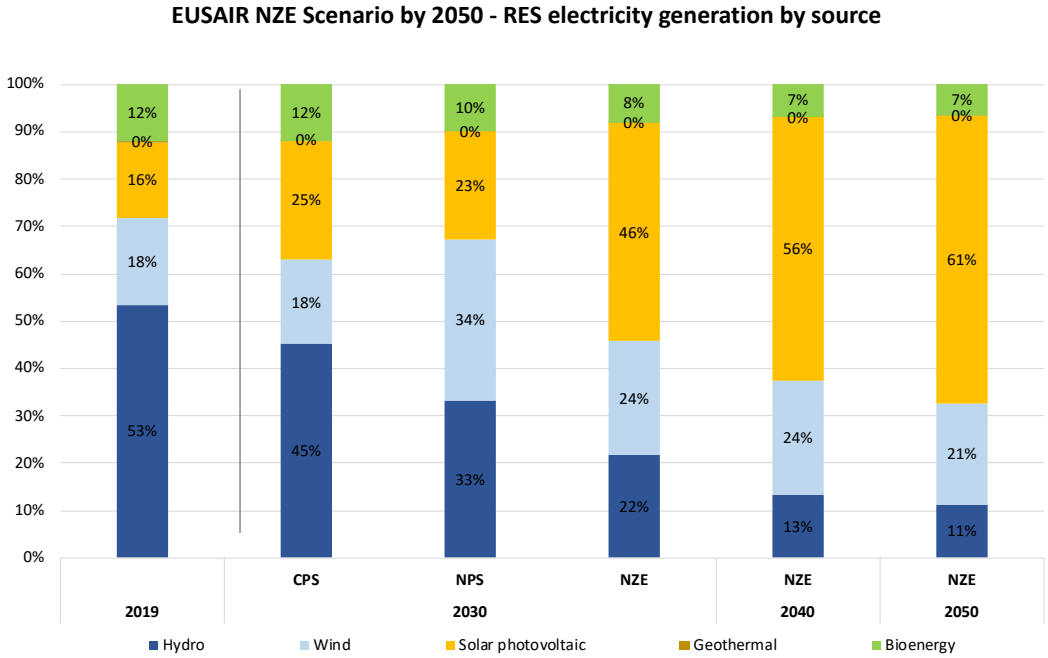

Figure 25 – EUSAIR NZE Scenarios by 2050 – RES electricity generation by source (%)

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.

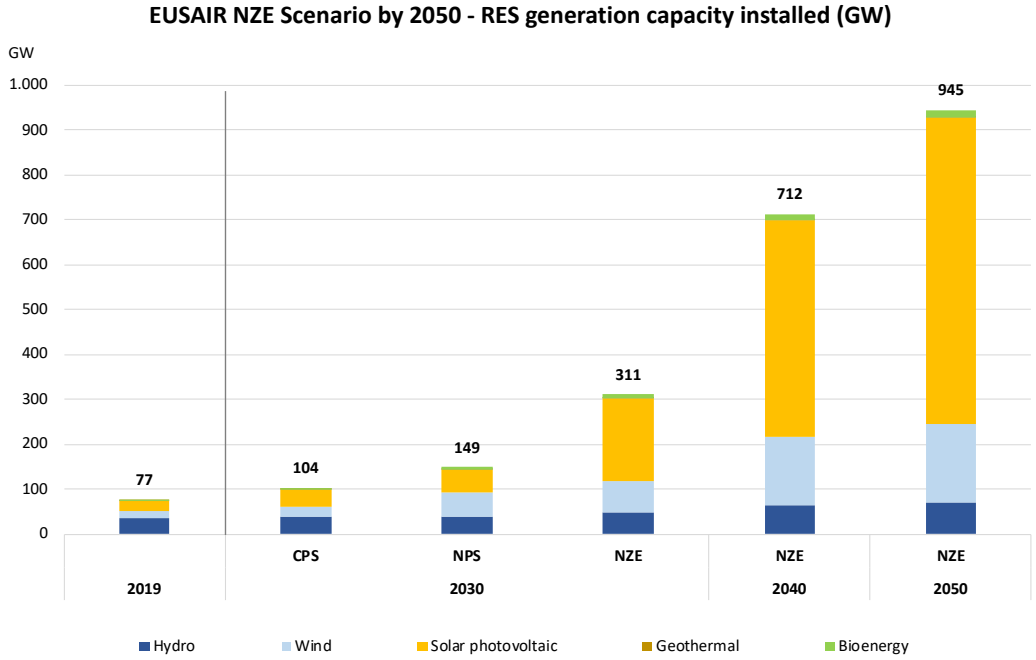

Figure 26 – EUSAIR NZE Scenarios by 2050 – RES generation capacity installed (GW)

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.

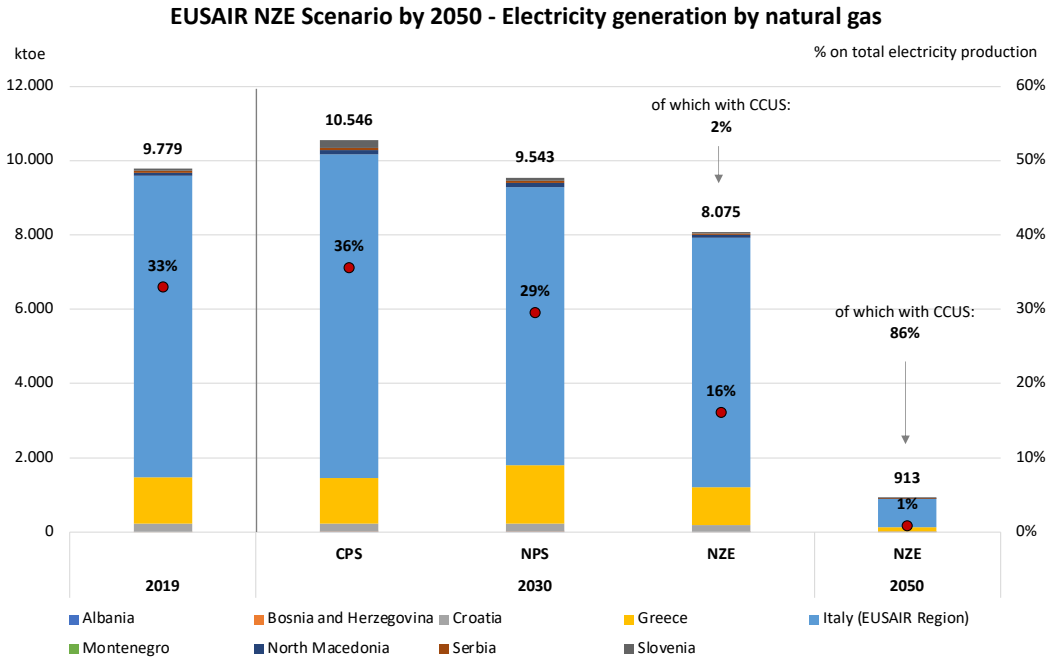

Figure 27 – EUSAIR NZE Scenarios by 2050 – Electricity generation by natural gas

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.

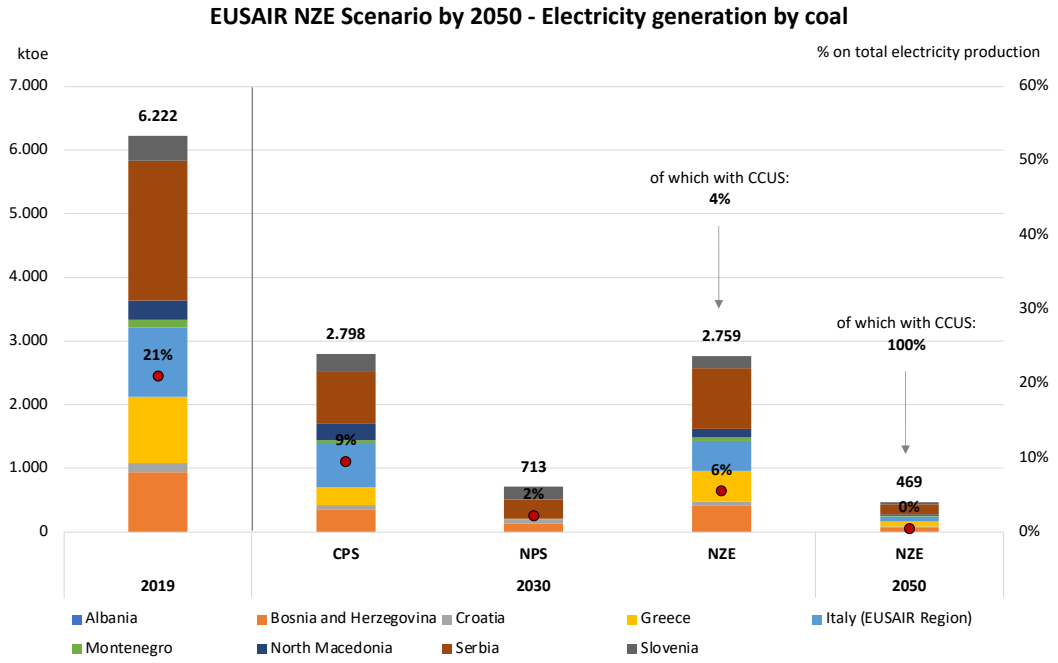

Figure 28 – EUSAIR NZE Scenarios by 2050 – Electricity generation by coal

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.

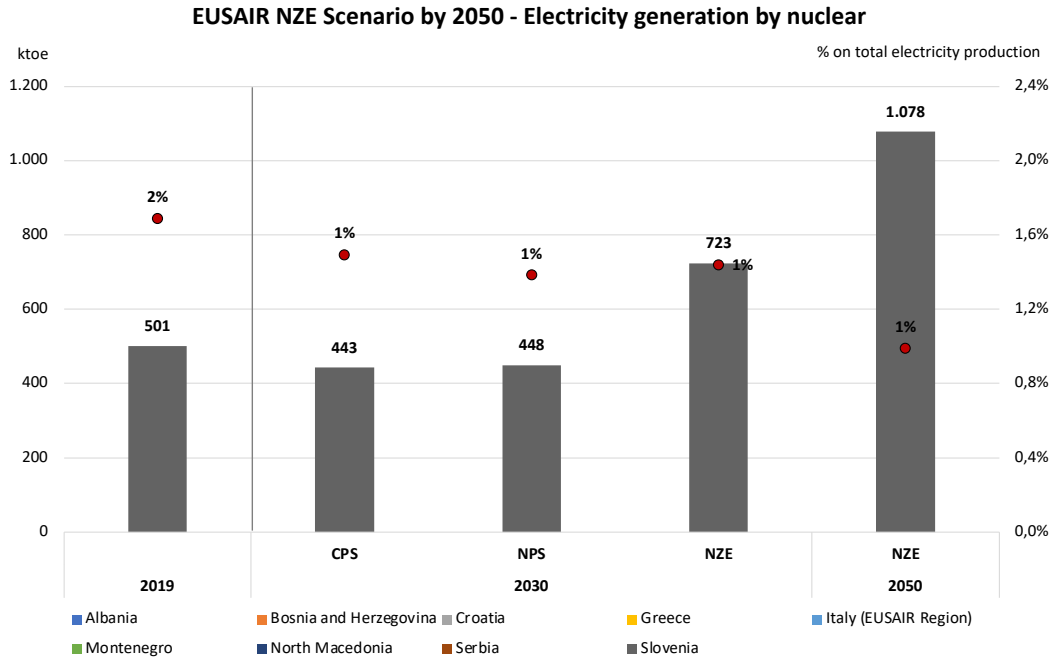

Figure 29 – EUSAIR NZE Scenarios by 2050 – Electricity generation by nuclear

Source: Consultant's elaboration on Eurostat, NECP and IEA data

5. Electricity and gas networks and projects and how they contribute to mid-term scenario at 2030

5.1 Electricity networks and level of implementation of electricity interconnectors projects

The interconnector projects relevant to the Adriatic-Ionian Region are presented in Figure 30.

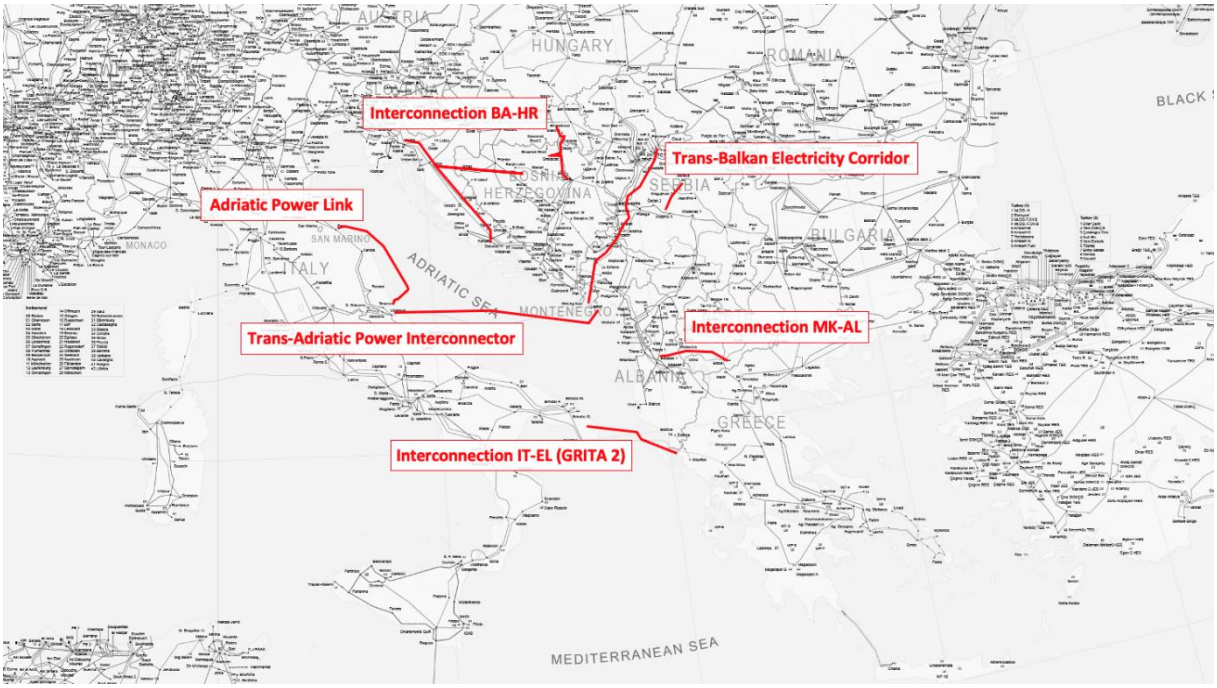

Figure 30 – Main electricity infrastructures labelled projects in EUSAIR area

Source: Consultant's elaboration on ENTSO-E and Energy Community data

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. The following table summarizes the level of implementation of electricity interconnector projects in the Adriatic-Ionian Region.

No.	Interconnector	TYNDP	Status	Expected completion	Remarks
1	**Trans-Balkan Electricity Corridor**	227	Sections completed, for details please refer to Table 6	Expected completion of the whole corridor in 2027	Outstanding sections: Interconnection SER-BiH-MNE - sections in all three countries; Section Obrenovac-Bajina Bašta in Serbia; For details on Phase 2 of the corridor in Serbia, please refer to Table 6
2	**Interconnection projects between North Macedonia and Albania**				
2.1	400 kV OHL Bitola (NM) - Elbasan (AL)	350	Under construction	December 2023	-
3	**Interconnection projects between Bosnia and Herzegovina and Croatia**				
3.1	400 kV OHL Banja Luka (BA) - Lika (HR)	343	Planned	2033	Feasibility study in progress
3.2	Upgrading of Existing 220 kV Lines between HR and BA to 400 kV Lines	241	Planned	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	28	Under construction	December 2026	Linked to the Trans-Balkan (227) and Mid-Continental East (144) corridors
4.2	GRITA 2 – New HVDC Power Link between Italy and Greece	1112	Planned	December 2031	-
4.3	Adriatic Power Link: New Underwater Power Line that through Abruzzo and Marche Regions	338	Planned	December 2028	-

Table 5. Level of implementation of interconnector projects in the Adriatic-Ionian Region

Source: Consultant's elaboration

The current status, as well as planned completion, of individual sections of the Trans-Balkan corridor, are summarized in Table 6.

Section	Description	Expected completion
Serbia		
Phase 1 (TYNDP - 227)		
Section 1	Romania (Resita) - Serbia (Pančevo)	Completed
Section 2	TS Kragujevac 2 - TS Kraljevo 3, with voltage level upgrade in TS Kraljevo 3 to 400 kV	Completed
Section 3	TS Obrenovac - TS Bajina Bašta, with voltage level upgrade of TS Bajina Basta to 400 kV	September 2025 (planned), delayed - expected in August 2026
Section 4	Interconnection to Montenegro and Bosnia & Herzegovina (TS Bajina Bašta - TS Pljevlja (MNE) - TS Višegrad (BiH))	2027
Phase 2		
Section 1 – North CSE (Continental South-East) corridor (TYNDP - 341)	TS 400/110 kV Belgrade West, OHL 400 kV Belgrade West – Wind Farm (WF) Čibuk 1, Extension of 400 kV interconnection with Romania (Đerdap – Porţile De Fier)	September 2029 (TS+OHL: 2028, Interconnection: 2029)
Section 2 – Central Balkan corridor (TYNDP - 342)	Upgrading 220 kV OHL SY Požega - Vardište to 2x400 kV; Conductoring second circuit on 400 kV OHL TS Bajina Bašta - TS Pljevlja from Vardište to TS Pljevlja; Conductoring second circuit on 400 kV OHL SS Bajina Bašta - TS Visegrad from Vardište to TS Višegrad; Upgrade of existing OHL 220 kV to 400 kV TS Kraljevo - swtitchyard Požega; New 400 kV switchyard Požega; Upgrade of existing OHL from 220 kV to 400 kV TS Kraljevo 3 – TS Kruševac 1; Upgrade of existing 220 kV OHL to 400 kV TS Kruševac 1 – TS Niš 2, including upgrade of voltage level in TS Kruševac 1 to 400 kV; 400 kV interconnecting line TS Niš – TS Sofia West	September 2034
Section 3 – 400 kV interconnecting line between Serbia and Croatia (TYNDP - 243)	Construction of new 400 kV interconnection line Sombor (RS) - Ernestinovo (HR)	September 2035
Section 4 – OHL 400 kV TS Jagodina 4 – TS Požarevac (TYNDP - 342)	-	September 2027
Montenegro		
Part I		
Lot 1	Construction of TS 400/110/35 kV Lastva and extension of existing TS 400/220/110 kV Pljevlja	Completed
Lot 2	Construction of OHL 400 kV Lastva-Čevo	

Section	Description	Expected completion
Lot 3	Construction of OHL Čevo-Pljevlja	
Part II		
Component 1	Replacement of HV equipment and other equipment in several HV substations	Completed
Component 2	Reconstruction of control and protection systems and the integration of several existing substations into SCADA communication	
Component 3	Replacement of the existing 220 kV OHL with new 400 kV OHL Pljevlja 2 - border with Serbia + extension of the 400 kV switchyard in TS Pljevlja 2	2026 (planned), currently on hold due to delayed adoption of the spatial plan
Component 4	Integration of TS 110/35 kV Brezna and associated transmission line into the public transmission grid	Completed
Bosnia and Herzegovina		
Section	Interconnection to Serbia and Montenegro (TS Bajina Bašta - TS Pljevlja (MNE) - TS Višegrad (BiH))	2026-2027 (planned)

Table 6. Current status and planned completion of the Trans-Balkan electricity corridor

Source: Consultant's elaboration

The **Trans-Balkan electricity corridor (project 227)** 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 Pančevo – Resita was marked by EC as a PCI (Project of common interest) and its realization was monitored by EC. On the other hand, the 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).

The **interconnection between North Macedonia and Albania** (**project 350**, Bitola-Elbasan 400 kV OHL, with substation in Ohrid) 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).

The **interconnection between Croatia and Bosnia and Herzegovina** (**project 343,** Banja Luka – Lika 400 kV OHL) 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 Bosnia-Herzegovina to major consumption areas in Italy (through Slovenia) and north Croatia. The increased transfer capacity will support market integration (particularly between 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.

The **upgrading of existing 220 kV lines between SS Đakovo (HR) and SS Tuzla/Gradačac (BA) to 400 kV lines (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 is in initial planning stages, requiring a pre-feasibility study.

The **MONITA 2 project (project 28)** 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 is financing the project 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 enabling the usage of an increased transmission capacity between Italy and South-Eastern European Countries (especially Romania and Bulgaria).

The **GRITA 2 project (project 1112)** concerns the development of a new HVDC link between Italy and Greece with the capacity of 1000 MW, 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 towards Eastern Europe (Export) or providing adequate load coverage and reserve margins for the southern zone (Import). The concerned TSOs, IPTO and Terna, work towards an agreement on the development of the project.

Finally, the **Adriatic Power Link project (project 338)** envisages the construction of an electrical connection (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.

5.2 Gas networks and level of implementation of gas interconnectors projects

It is generally assumed that the gas sector will grow faster in the EUSAIR countries mainly as a key driver for power generation and as transition fuel towards decarbonisation. 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 bcm/y to 110 bcm/y. 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/y 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/y 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 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.

The development scenario of the gas transport network starting from the project list of interconnectors, takes into account the assumptions reported below for each EUSAIR country.

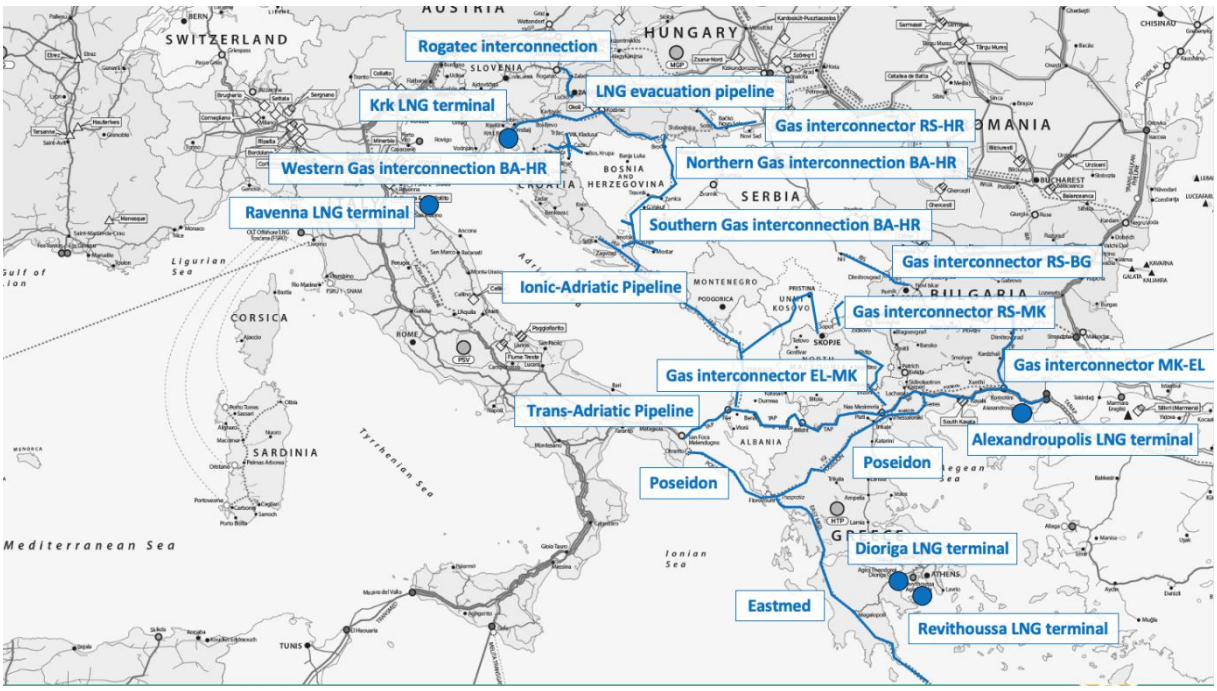

Figure 31 – Main gas infrastructures labelled projects in EUSAIR area

Source: Consultant's elaboration on ENTSO-G and Energy Community data

For **Albania** it is assumed that all future gas demand will be supplied mainly through:

- IAP
- 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.

For **Bosnia and Herzegovina,** it is assumed that the future gas demand will be covered mainly by:

- IAP and LNG Krk terminal through Southern, Western and Northern Interconnection with Croatia that will help to establish new supply route for the country providing reliable and diversified natural gas supply increasing security of supply. The most likely to happen first is the Southern interconnection from Split.
- LNG terminal in Alexandroupolis in northern Greece. In order for that gas to reach the users in BA, it is necessary, among other things, to complete the construction of the gas interconnection between Serbia and Bulgaria.
- the current supply to two cities, Sarajevo and Zenica, and the surroundings comes from Russia through the Turkish Stream which goes from Russia through the Black Sea through Turkey

For **Croatia**, LNG Krk terminal, started operations in January 2021 brought diversification not only for its own market but also for the region. The gas will be exported:

- The Omišalj-Zlobin gas pipeline, which will connect the LNG terminal on the island of Krk to the existing transmission system.
- 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 bcm/y.
- 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.

For **Greece** it is foreseen an important development of LNG production and an increase of board interconnector:

- 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 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 it to Bulgaria as well as transit gas to Italy.
- Interconnector Greece-Bulgaria that will enable has entered commercial operations in October 2022 with the capacity of 3 bcm/y with potential to expand its capacity to 5 bcm/y.
- 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 1.5 bcm/y, could be doubled, depending on demand by 2025.
- The East Med pipeline.
- The Alexandroupolis terminal in northern Greece and close to the Bulgarian border

- Three other FSRUs are expected to cater for the domestic and regional markets.

For **Italy the** future gas demand will be covered mainly from:

- the use of LNG import capacity in terminals;
- 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 doubling of its capacity to 10 bcm/y (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.

For **Montenegro** the entire demand will be covered by IAP as no alternative gas supplies exists.

For **North Macedonia** demand will be covered by interconnection of its natural gas system with Albania, Greece and Serbia toward a fully integrated gas network.

For **Serbia** the future gas demand will be covered mainly from:

- the Serbia-Bulgaria gas interconnector Projected capacity of this new gas pipeline will allow flow of 1.8 bcm/y. 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.
- The interconnection of Croatia and Serbia is planned on the route Slobodnica - Sotin - Bačko Novo Selo. will also provide Serbia with the access to the Croatian LNG terminal.

Finally, **Slovenia** depends entirely on imports. Future demand will be covered by the gas from LNG Krk terminal as well as from the IAP through the Upgrade of Rogatec Interconnection between Slovenian and Croatian Gas Systems (M1A/1 Interconnection Rogatec) which will increase the transmission capacity and enable bidirectional operation.

The following table shows a summary of the main interconnection projects under construction and the comparison between the planned gas transport capacities with the expected consumption by 2030 in the individual EUSAIR countries (in NPS Master Plan Scenario).

As can be seen, these are gas transportation capacities that often largely cover the gas demand of individual countries.

These greater volumes available and the possibility of cross-border gas exchanges could therefore favor the development of a more interconnected gas market between the EUSAIR countries, especially in the Balkan area.

Gas infrastructure pipeline	Promoting country	Completion year	Gas flow (bcm/y)	Reverse flow	Expected 2030 annual consumption in NPS Master Plan Scenario (bcm/y)								
					Albania	Bosnia and Herzegovina	Croatia	Greece	Italy (EUSAIR Region)	Montenegro	North Macedonia	Serbia	Slovenia
Gas Interconnector Serbia-Bulgaria	RS - BG	2023	1.8	Yes								1.9	
North Interconnection BA-HR Gas Pipeline Project Slobodnica (HR) - Brod (BA) - Zenica (BA)	BA - HR	2026	1.3	Yes		0.18	3.0						
Western Interconnection Gas Pipeline BA-HR (Licka Jesenica-Trzac-Bosanska Krupa with branches to Bihac and Velika Kladusa)	BA - HR	2026		Yes		0.18	3.0						
Gas Southern Gas Interconnection Pipeline BA - HR (Split-Zagvozd-Posusje-Novi Travnik with a Main Branch to Mostar)	BA - HR	2024	1.5	Yes		0.18	3.0						
Interconnecter Serbia-Croatia	RS - HR	2030	1.8	Yes			3.0					1.9	
Interconnection Croatia/Slovenia (Lučko - Zabok - Rogatec)	HR - SI	2026	1.5 up to 5	Yes			3.0						1.0
Interconnector Greece-Bulgaria (IGB Project)	GR - BG	2022	3 up to 5	Yes				5.6					
Ionian Adriatic Gas Pipeline (IAP)	GR - HR - ME - AL	2025	5	Yes	0.1		3.0	5.6		0.0			

Trans Anatolian Pipeline (TAP)	GR-		10 up to 20										
EastMed Pipeline	GR	2027	11 up to 20	Yes				5.6					
Poseidon Pipeline	GR - IT	2025	12 up to 20	Yes				5.6	46.0				
Interconnection between Gas Transmission Systems of Serbia and North Macedonia	MK - RS	2026	1.4	Yes							0.4	1.9	
Interconnection between the Natural Gas Transmission Systems of Greece and North Macedonia	MK - GR	2025	2.9 up to 3.8	Yes				5.6			0.4		
Interconnection between the Albanian and Macedonian Natural Gas Transmission Systems	MK - AL	2023	2.2	Yes	0.1						0.4		

Table 7 - Summary of main interconnection projects and the comparison between the planned gas transport capacities with the expected gas consumption by 2030 in NPS Master Plan Scenario