Background Paper

for the "Decarbonisation Policies in South East Europe" conference jointly organised by the IENE and ROEC

Decarbonisation Issues in SE Europe

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BACKGROUND PAPER

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Introduction

This Background Paper has been prepared on the occasion of the one day conference on "Decarbonization Policies in South East Europe –Between Climate Change and War", which is jointly organised by the IENE and ROEC.

Before looking at SE Europe's core 15 countries and peripheral ones, as defined by IENE **(1)**, it is important to consider the big picture and become acquainted with the key issues that confront the region's energy sector. These include the relatively high dependence of the majority of the countries on solid fuels, mostly used for power generation, the high dependence on imported oil and gas, the lack of adequate gas supply routes and interconnections (especially relevant for the main Balkan block), slower than anticipated penetration of renewables (RES) and slow progress on energy efficiency improvement.

Map 1: The SE European Region as Defined by IENE

Source: IENE

The slow differentiation of the regional energy mix, which in spite of the consistent rise of RES and gas penetration remains bound to high solid fuel consumption and sizeable oil and gas imports, is no doubt a prime point of reference. The large amounts of indigenous coal and lignite deposits provide relatively cheap and easily accessible energy supplies for most countries of the region and hence are seen as preventing a determined move, by the European Commission and certain governments, towards greater decarbonisation. Hence, we have here

a major policy challenge, which governments and the EC will have to address. Simply put, there is a huge incompatibility between stated and adopted EU goals for decarbonisation and many countries' silent commitment to continuing large-scale solid fuel use.

Although several countries in the region appear determined to exhaust their coal/lignite deposits, they are in parallel developing renewables and other carbon free resources such as nuclear power. Given the financial and legal constraints in most countries, the rise of RES, especially for electricity generation, over the last five years appears impressive. Yet because of the intermittent nature of power generation from RES and undeveloped large-scale energy storage, their contribution to electricity production of the different countries appears limited. However, given the strong market dynamics of the RES sector, the introduction of viable large-scale storage schemes in the mid-term and hydrogen in the long- term are distinct options in the years ahead.

1. The Region's Inflexible Energy Mix

A key observation regarding the region's energy situation is related to its energy mix, taking into account all 14 countries (i.e. EU Member States, WB6 and Turkey). SE Europe's energy mix, with and without Turkey, is changing, albeit very slowly. In summary, between 2011 and 2021 (see Figures 1-4), there is lower use of coal (lignite) and nuclear as well as more gas, RES and oil, given the different total gross inland consumption. In a sense, this is disappointing given the huge emphasis placed over the past years on RES and the lowering of oil use.

Examining closer the regional energy mix between 2011 and 2021, a number of useful observations can be made:

(a) Over the last 10-year period, only a minor differentiation of the region's energy mix has taken place, both in the case where this includes Turkey and in the other that it does not.
(b) The most noticeable change is the increased contribution of renewables in both cases.
(c) The contribution of nuclear, although higher in both cases, remains marginal.
(d) There is clearly less use of solid fuels in both cases, but the retreat is not as big as anticipated so as to advance EU's decarbonisation agenda.
(e) Oil has an almost constant contribution to the overall energy mix as it covers almost 100% of transportation needs in all countries.

Figure 1: Gross Inland Consumption (%) in SE Europe, including Turkey, 2011 (Total=265.7 Mtoe)

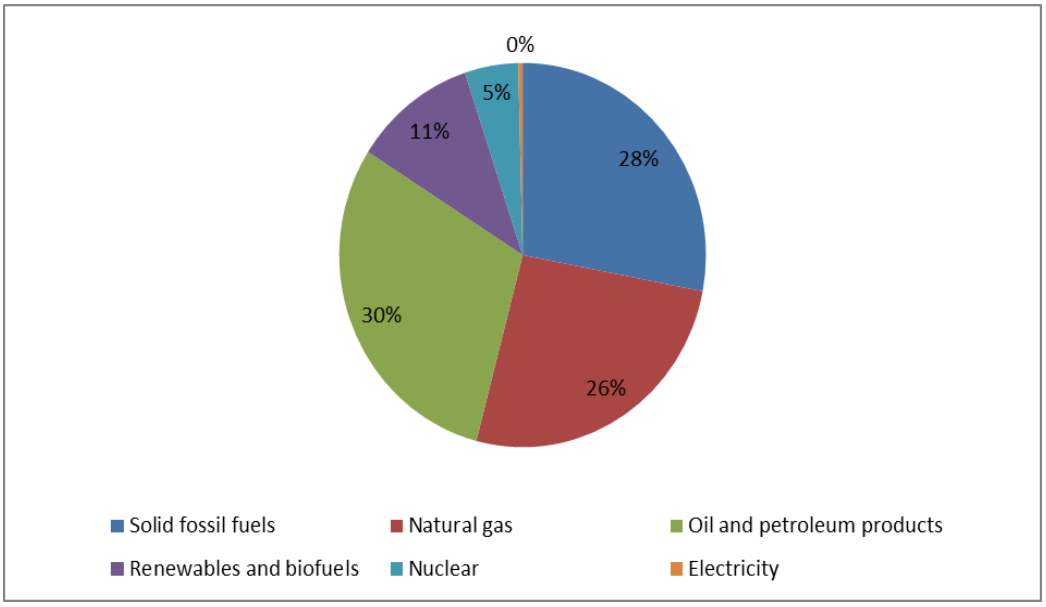


Figure 2: Gross Inland Consumption (%) in SE Europe, without Turkey, 2011 (Total=152.9 Mtoe)

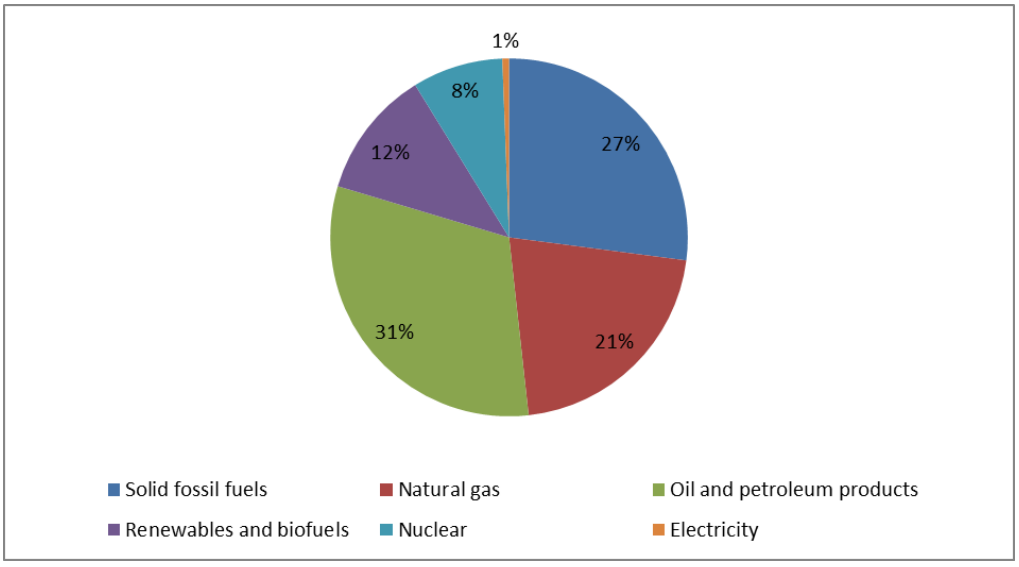


Figure 3: Gross Inland Consumption (%) in SE Europe, including Turkey, 2021 (Total=312.6 Mtoe)

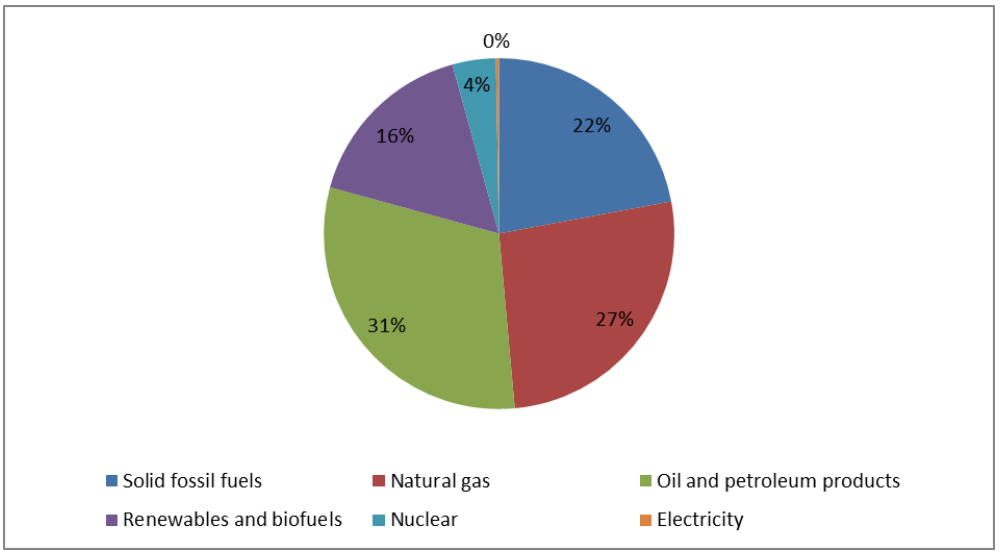
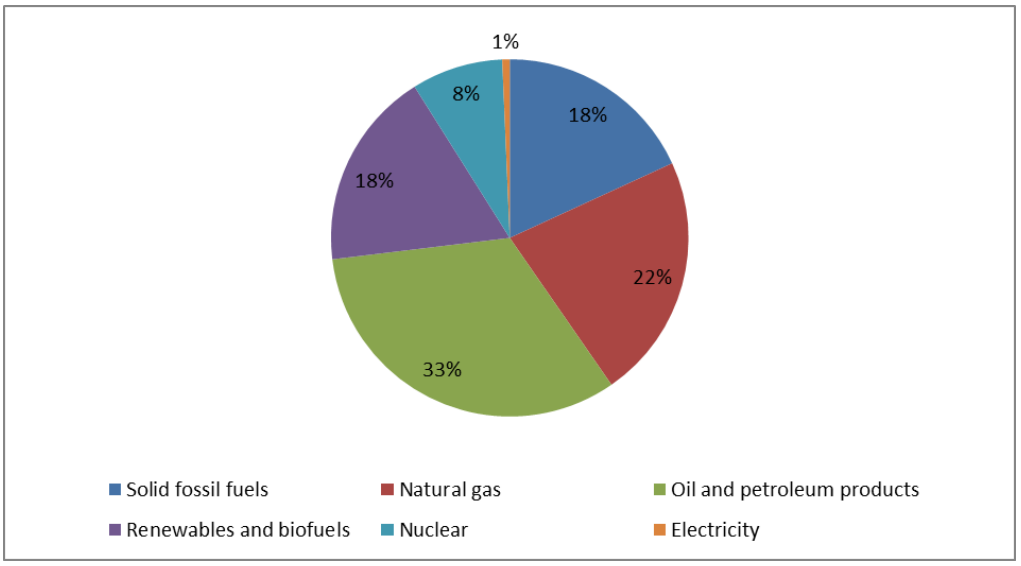


Figure 4: Gross Inland Consumption (%) in SE Europe, without Turkey, 2021 (Total=151.8 Mtoe)



Sources: Eurostat, IENE

2. The Key Elements and Challenges of Decarbonisation

In view of high-energy security requirements, the issue of decarbonization acquires a new

dimension. The key issue, which emerges in the present situation, is how to be able to reconcile increased energy security demands with the need to advance at the same time decarbonization policies.

As the EU moves towards committing to the decarbonisation of its economy to net-zero greenhouse gas (GHG) emissions by 2050, the SE European EU member states are still struggling with dysfunctional energy markets, blatantly inadequate long-term planning capabilities and an overwhelming dependence on fossil fuels. Combined, these factors represent significant impediments to decarbonisation objectives. The successful transition towards a low-carbon future in the EU relies on the resolution of these problems and the acknowledgement of the different starting points of the SEE EU member states in the decarbonisation process.

The New Energy Framework

With the "Clean energy for all Europeans" package, the Regulation on the Governance of the Energy Union introduced a new cooperation framework between member states and the European Commission, which requires rigorous and standardised national energy and climate planning. A novelty of this package is that binding targets can only be set at the EU level. Under this mechanism, each member state is required to produce an integrated National Energy and Climate Plan (NECP) for 2021-2030, which will be updated once by June 30, 2024. Member states will also be obliged to consider the long-term 2050 perspective. The long-term strategies should be revised every five years and updated every ten years.

This framework provides both opportunities and challenges for all SEE countries. While the absence of binding national targets means that this governance framework represents a "softer" mechanism, it is not any less robust. The NECPs depend on national initiative and management of commitments, which can provide the needed flexibility for tailoring individual solutions. Moreover, by providing a binding template, the governance framework can trigger the development of rigorous national energy and climate planning, which has often been lacking in SE Europe.

At the same time, however, this system may also lead to tensions between SE Europe, generally reluctant to take on aggressive decarbonisation, and the Northern and Western member states. If SE European countries perceive their energy systems and security of supply to be vulnerable, they are likely to adopt very defensive positions at the EU level to maintain strict control over their national energy mixes. This can lead to insufficiently ambitious NECPs, which may prove difficult to correct at a later stage. Hence, if the governance framework is to deliver on its objectives, the concerns of SEE member states cannot be ignored.

While more than half of the electricity generation capacity in SE Europe currently relies on thermal coal and lignite, a power system with a much higher RES deployment has been shown to be realistic **(2)**. However, this will require drastic changes in the status quo. While the need for strategic planning is evident, the energy transition will also rely on a mix of rigorous and ambitious policy design, access to diverse financial instruments for investments, as well as functional and transparent energy markets, accompanied by effective social protection for vulnerable energy consumers.

Under these circumstances, one condition for a successful decarbonisation of the European economy is to understand the particularities of the EU member states in the SEE region as well as the Western Balkan countries in order to address specific problems with targeted policy and financial interventions. This requires increased attention and cooperation from both EU institutions and other member states.

Facts that Hinder Energy Transition

Based on a recent study **(3)**, the main key factors identified that hinder a sustainable energy transition vary for each country, but regionally we assess them as follows, starting with the most important:

- **State capture, geopolitics, lack of rule of law and accountability**. This broad set of issues encompasses energy sector decision-making that puts special interests ahead of the public interest. It includes everything from state-owned utilities' excessive influence on policymaking, to non-transparent energy deals with Russia and China and RES incentives schemes that benefit businesses close to governments.
- **Outdated view of the energy system, false solutions and lack of understanding of the speed of change**. It is often difficult to tell whether poor decisions on energy policy result from serving special interests or a lack of knowledge and analysis of the current state of the sector.
- **Incomplete transposition and implementation of EU rules affecting the energy sector.** EU environment, climate, energy and State aid rules, although not perfect, drive energy transition. The EU's environmental legislation also helps prevent destruction of sensitive areas, e.g. by energy and transport infrastructure. Though the countries vary in their adherence to EU law, pollution control, air quality, State aid and biodiversity protection remain problems in most cases.
- **Lack of political courage to tackle mine closure and introduce just transition.** Direct political pressure from coal mining unions is not as high in some of the countries as might be expected, but indirect pressure exists. The governments count on public utilities' employees and subcontractors for political support in elections, again raising the issue of state capture. This, together with the fact that most governments have developed no plans to mitigate the social impacts of the transition in coal regions and other fossil fuel-dependent areas, makes many decision makers reluctant to commit to a coal or wider fossil fuel phase-out.
- **Lack of political will to open markets, cooperate and realise regional synergies.** Opening markets and moving to cost-reflective energy tariffs is a major political difficulty in several countries. People are used to low, regulated prices and many cannot pay more, due to a vicious circle of energy inefficiency and energy poverty. Political barriers between certain countries clearly exist, but experience shows that national authorities can mostly cooperate with their neighbours when they want to, they just do not always prioritise it.
- **Political instability and lack of institutional capacity.** In countries like Montenegro, North Macedonia and Croatia, which are politically in favour of energy transition, a shortage of experienced staff at the central and local government levels is emerging as a key issue preventing better progress. It is also an issue in the other countries, but other factors such as state capture seem to play a stronger role at the moment.

According to IENE estimates, the share of solid fuels in power generation is anticipated to increase in three countries of the region (most notably in Serbia, Bosnia and Herzegovina and Turkey) over the next 10-15 years, as shown in the following Table.

Table 1: Under Construction and Planned Coal Plants in SEE Countries (MW)*, as of January 2024

Country	Announced	Pre-permit	Permitted	Announced + Pre-permit + Permitted	Construction	Shelved	Operating	Mothballed	Cancelled 2010-2023	Retired 2000-2023
Albania	0	0	0	0	0	0	0	0	800	0
Bosnia and Herzegovina	0	1.350	0	1.350	0	350	2.090	0	3.500	0
Bulgaria	0	0	0	0	0	0	4.569	540	2.660	1.380
Croatia	0	0	0	0	0	0	217	125	1.300	0
Greece	0	0	0	0	0	0	2.885	0	1.250	3.053
Hungary	0	0	0	0	0	0	944	250	3.080	515
Kosovo	0	0	0	0	0	0	1.290	0	830	190
Montenegro	0	0	0	0	0	0	225	0	1.664	0
North Macedonia	0	0	0	0	0	0	824	0	730	0
Romania	0	0	0	0	0	0	2.310	645	5.705	4.780
Serbia	0	0	0	0	350	1.350	4.435	32	1.445	0
Slovenia	0	0	0	0	0	0	1.069	0	0	535
Turkey	1.000	888	2.920	4.808	145	4.820	20.473	400	89.068	0

***Note:** Includes units 30 MW and larger

Sources: EndCoal (4), IENE

Pursuing Decarbonisation Policies

By and large, effective climate change policies in SE Europe have not been implemented so far, but there is still room for change in order to avoid becoming further "locked in" to the use of fossil fuels. In SE Europe, economic development, largely based on the utilization of indigenous lignite/coal resources, will have to be reconciled with COP 28 commitments. Therefore, the planning of clean-cut and compatible long-term energy and economic strategies becomes a real challenge. A lot more analytical and assessment work (e.g. examine CCS/CCU options) needs to be undertaken before introducing realistic policies for decarbonisation.

The decarbonisation in the region can be pursued in two parallel streams:

- through policy, which incorporates the aforementioned energy mix issue and economic assessment through which the rate of decarbonization is determined. The main question arising therefore is how the rate of decarbonization can be related to economic development and what the investment implications are and
- through technology, whose degree of deployment depends on the policies to be implemented and could contribute significantly towards decarbonisation through, for instance, the use of CCS/CCU or dual-fuel power plants.

As yet, there is no agreed regional roadmap towards decarbonisation, while cooperation between the countries in the region currently focuses on energy security. There is an urgent need to introduce latest technologies in order to improve decarbonisation efforts, energy efficiency and upgrade operation of existing networks (e.g. CCUS, solar thermal systems, power electronics, energy storage, etc.).

3. RES as a Key Supply Source

SE Europe's Huge RES Potential

Better interconnections, a higher share of RES and better energy efficiency, are some ways to address SE Europe's energy dependence. In terms of RES, SE Europe has abundant resources, and their use is already part of many people's daily lives. Thanks to considerable installed hydropower capacity and the extensive use of biomass for residential heating, the SEE economies use a higher proportion of RES than the EU average (5).

In fact, despite having an installed hydropower capacity of more than 22 GW, the SEE region still has the largest remaining unexploited hydropower potential in Europe, as its river catchments have remained largely undeveloped. The technical potential of hydropower is estimated to be 522 PJ per year, as shown in Table 2.

While up to 140 large (above 10 MW capacity) greenfield hydropower plants and more than 2,700 small projects (below 10 MW capacity) are in the production pipeline, the sustainability of these projects has sometimes been questioned. In the last couple of years, opposition to the construction of small hydropower plants has been growing, mainly in Albania, Bosnia and Herzegovina, Croatia and Serbia. Local stakeholders and non- governmental organisations (NGOs) have called for a set of principles for sustainable hydropower to be respected, with one of these principles being the prioritisation of investment in rehabilitating existing plants.

Table 2: Technical Potential for Utility-scale Solar PV, Wind and Hydropower in the Electricity Sector in SE Europe (TJ), 2019

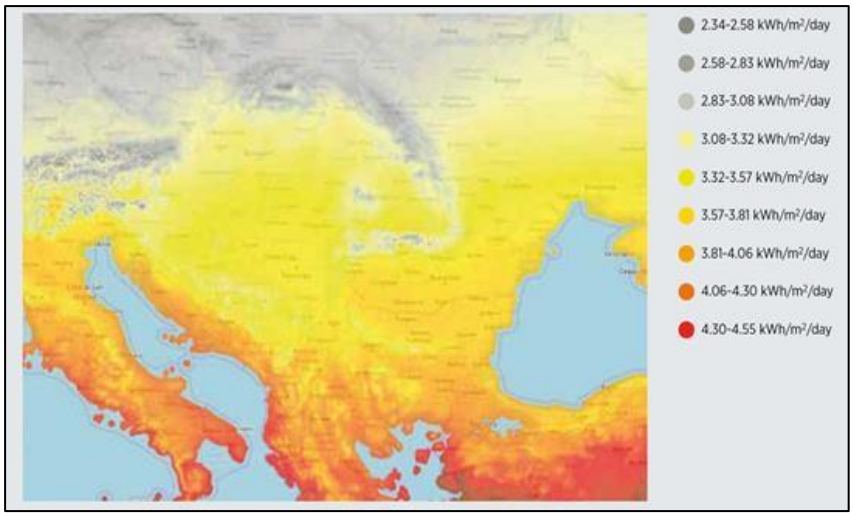
	Utility-scale solar PV	Onshore wind	Hydropower
Albania	13 342	49 154	56 059
Bosnia and Herzegovina	14 886	94 810	88 193
Bulgaria	36 468	190 264	48 071
Croatia	15 682	104 951	30 600
Kosovo*	3 006	13 860	4 853
Montenegro	3 874	23 332	18 079
North Macedonia	8 014	27 558	14 421
Republic of Moldova	21 758	180 450	12 099
Romania	92 902	554 522	136 800
Serbia	33 509	188 590	64 800
Slovenia	1 613	8 266	58 539
SEE	245 052	1 436 156	532 515

TJ = Terajoule

Source: IRENA

Global horizontal irradiance, a key parameter in solar PV installation, is higher in the southern part of the region, where it reaches over 4.5 kWh per square metre per day (kWh/m2/day). Solar resources in the northern part are more modest, down to 3 kWh/m2/day, but in line with or better than other European countries with large PV deployment, such as Germany (see Map 2). The utility-scale solar technical potential of the SEE region is estimated at around 245 PJ (see Table 2).

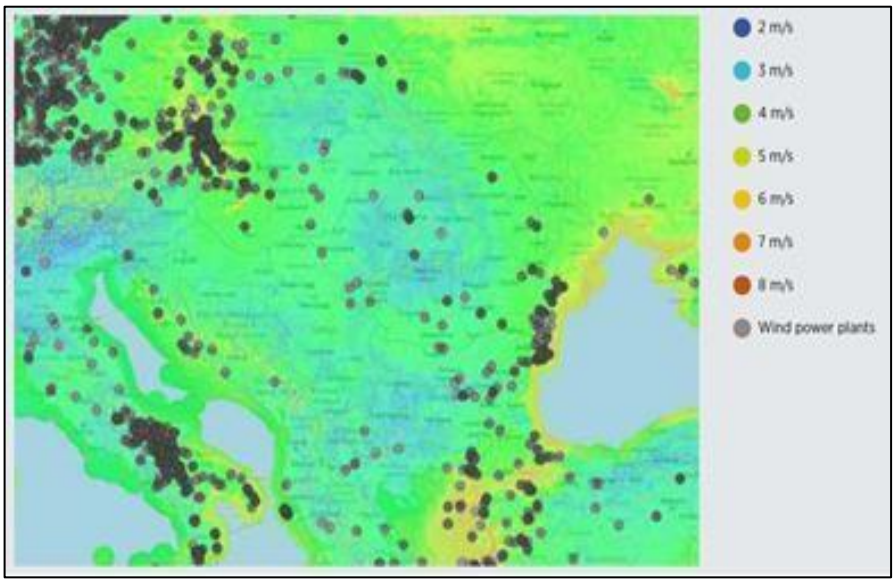
Map 2: Solar Resources in the SEE Region and Surrounding Countries, 2019



Source: IRENA

The whole region is endowed with good wind resources, with wind blowing at average speeds of between 5.5 metres per second (m/s), and 7 m/s at 100 metre height. The mountainous and coastal landscape increases the variation in wind resources across the region, with higher average wind speeds in coastal areas and at high altitudes. The Eastern coast of the region (i.e. Romania) enjoys the best wind, with average speeds of 6-to-7 m/s (see Map 3). The Adriatic coast (i.e. Albania, Bosnia and Herzegovina, Croatia, Montenegro and Slovenia) enjoys similar average wind speeds, but this area is also regularly hit by winds that gust between 150 and 200 kilometres per hour. This puts additional stress on wind turbines. However, wind energy is not harvested at its full potential, as in nearby countries with similar wind resources, with the exception of the EU member states of the region. The technical potential of SEE's wind energy is currently estimated at 1,436 PJ (see Table 2). Notably, the presence of a good technical potential is a necessary but not sufficient condition for deployment. Other aspects to consider are the economic limits to supply, market constraints and the presence of appropriate supply chains.

Map 3: Wind Speed and Wind Power Plants in the SEE Region and Surrounding Countries, 2019



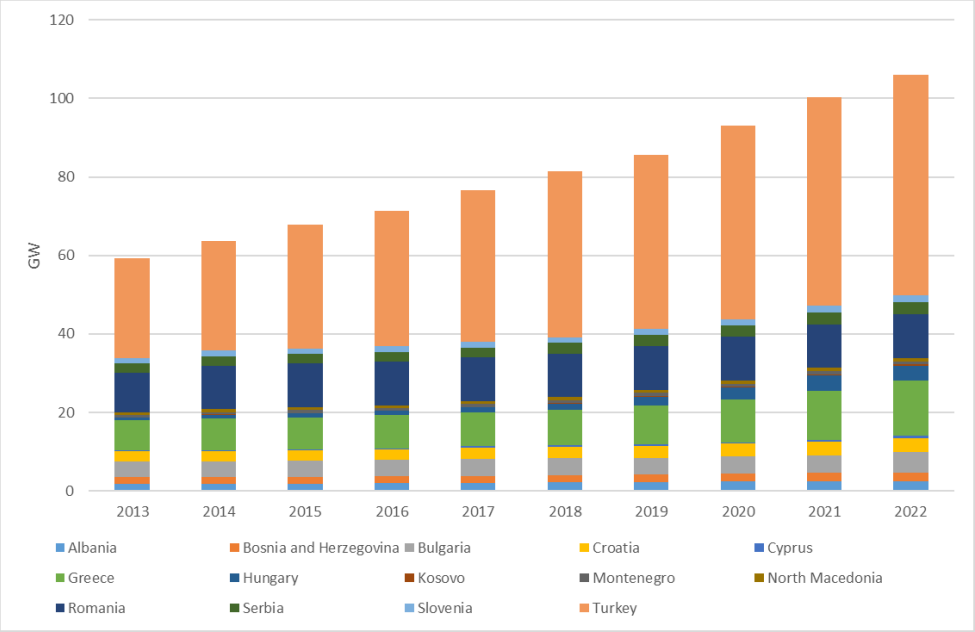
Source: IRENA

RES Increased their Share in SE Europe's Electricity Mix

As SE Europe doubles down on its efforts to decarbonize power generations, the installed capacity of renewable energy systems in the region has almost doubled during the past decade, with local systems reaching 105.9 GW of installed capacity in 2022, according to latest IRENA's data **(6)**. This represents an increase of 78.6% since 2013, when the region counted 59.3 GW of installed RES units. In addition, the power generation from RES, including hydro, has exceeded 234 TWh in 2021, which corresponds to a 49.4% increase over the last decade.

Electricity generation from RES in SE Europe is heavily affected by the hydrologic cycle, which has shown signs of heavy volatility throughout the decade. Most notably the region was affected by drought especially during 2014 and 2017, when it halted the increase of y-y generation from RES, despite the increased deployment of other RES systems, mainly wind and solar. The most affected countries by the hydrologic cycle were Turkey, Croatia, Albania and Bosnia and Herzegovina.

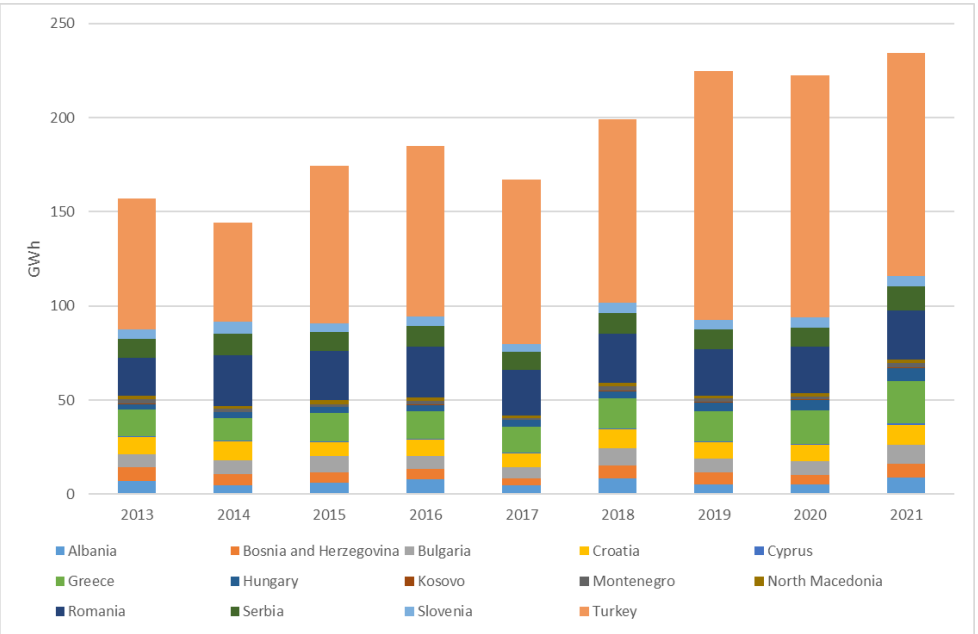
Figure 5: Total Installed RES Capacity (GW) by Country in SE Europe, 2013-2022



Source: IRENA

The most widely deployed renewables are by far in Turkey, which has an RES fleet that consists mostly of hydro and wind, with a considerable capacity of geothermal energy, which in total exceeded 55.9 GW of installed capacity in 2022. Turkey is followed by Greece and Romania, with installed RES capacity of 13.9 GW and 11.1 GW respectively in 2022.

Figure 6: Power Generation (GWh) from RES, Including Hydro, by Country in SE Europe, 2013-2021



Source: IRENA

As RES are being recognized as one of the most important energy resources in mitigating climate change, the global market is amidst an ongoing ramp up in terms of new installations, with production costs of variable renewables' systems having fallen rapidly during the past decade. Consequently, lower costs have driven an escalation in the deployment of solar PV and wind turbines across the region, making them competitive.

Table 3: Global Weighted Average Total Installed Costs, Capacity Factor and Levelised Cost of Electricity Trends by Technology, 2010 and 2022

	Total installed costs (2022 USD/kW)			Capacity factor (%)			Levelised cost of electricity (2022 USD/kWh)		
	2010	2022	Percent change	2010	2022	Percent change	2010	2022	Percent change
Bioenergy	2 904	2 162	-26%	72	72	1%	0.082	0.061	-25%
Geothermal	2 904	3 478	20%	87	85	-2%	0.053	0.056	6%
Hydropower	1 407	2 881	105%	44	46	4%	0.042	0.061	47%
Solar PV	5 124	876	-83%	14	17	23%	0.445	0.049	-89%
CSP	10 082	4 274	-58%	30	36	19%	0.380	0.118	-69%
Onshore wind	2 179	1 274	-42%	27	37	35%	0.107	0.033	-69%
Offshore wind	5 217	3 461	-34%	38	42	10%	0.197	0.081	-59%

Source: IRENA

The Time to Scale-up RES and Energy Storage in SE Europe is Now

Russia's war in Ukraine and the ensuing global energy market disruption has sent EU countries scrambling for alternatives to secure domestic energy supplies. With its "REPowerEU[1]" Plan, the European Commission aims to accelerate the roll-out of RES technologies (which now rank among the cheapest sources of electricity worldwide) to replace fossil fuels in power generation, industry and transportation.

The fastest way to achieve decarbonisation goals in SE Europe is to accelerate the phase-out of coal and replace it with RES. Every year putting off the coal exit crowds out investments in cleaner and cheaper alternatives, increases the human and health costs of air and water pollution and slows the economic transition to sustainable development.

A cornerstone of a successful energy transition in the region is the accelerated uptake of energy storage technologies. While integrating 10%-20% shares of variable RES like wind and solar into the mix of most countries is achievable without requiring major investments, reaching higher RES penetration of 40% to 50% or more requires a concerted effort to improve power system flexibility. RES investments are growing rapidly in countries across the SE Europe, including Greece, Albania, Kosovo and Montenegro, which raises the need for faster integration of storage technologies.

[1] "REPowerEU" is the European Commission's plan to make Europe independent from Russian fossil fuels well before 2030, in light of Russia's invasion of Ukraine. It is backed by financial and legal measures to build the new energy infrastructure and system that Europe needs.

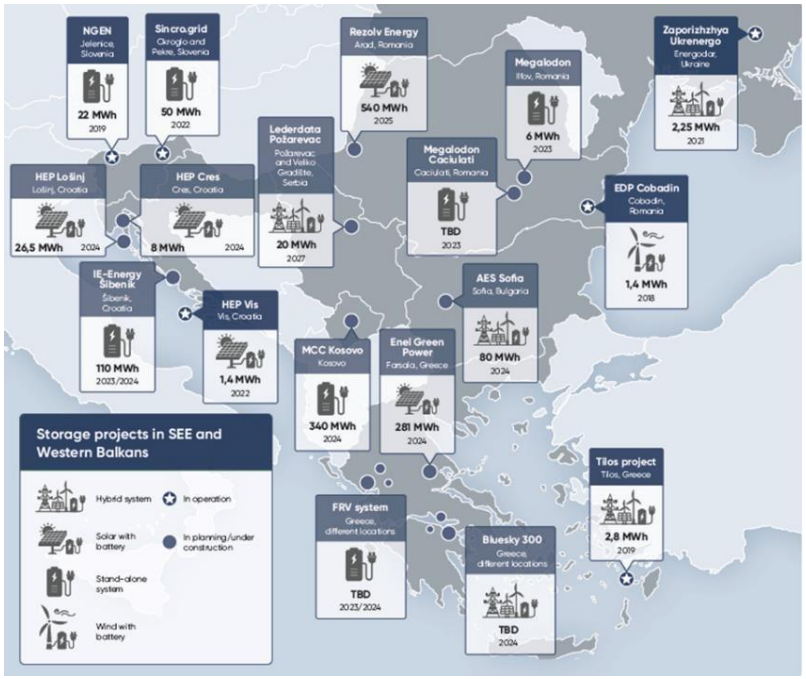
One of the key findings of a new study **(7)**, published by Berlin-based E3 Analytics, in partnership with the European public policy institute Center for the Study of Democracy, is that storage can not only help improve the security of power supply and smooth the path to decarbonisation but can provide utilities with greater confidence as they increase the share of wind and solar power in the system. In addition, battery storage systems are starting to beat fossil gas on both price and performance, undermining one of the main arguments for prolonging countries' reliance on an increasingly unreliable fuel.

EU member states in the SE European region have earmarked considerable public resources from the Recovery and Resilience Facility for power storage investments. Although government support for storage investments is welcome (and is among the recommendations of the aforementioned report), giving out substantial subsidies to large- scale storage projects, such as the 1,500 MW/6,000 MWh RESTORE project in the Bulgarian National Recovery and Resilience Plan, may be wasteful. **(8)**

A smarter approach to incentivise storage uptake would be to follow in the footsteps of Belgium and the UK and improve wholesale electricity market rules for the remuneration of storage services. In fact, investments in grid-scale batteries are already economically viable today in markets with a clear remuneration scheme for the market participation of storage plants. In turn, it may be more useful to focus public resources mainly on promoting battery recycling facilities and encouraging second-life applications.

Large projects are susceptible to corruption and mismanagement and may face implementation delays due to governance deficits. This means that rather than accelerating the transition process, focusing too much on large-scale storage projects may serve to bottleneck it.

Map 4: Energy Storage Projects in SE Europe, 2022



Source: Center for the Study of Democracy

The storage analysis lays out several key steps governments in the region can take:

- National update of wholesale power market rules to allow fairer compensation for storage system owners.
- A long-term strategy including clear targets to increase storage adoption in tandem with variable RES deployment
- Introduction of storage auctions and auctions for hybrid wind, solar and storage projects
- Removal of unnecessary technical and licensing requirements for the integration of storage technologies
- Avoiding putting all eggs in one basket by fostering a range of storage technologies
- Acceleration of the shift toward a circular economy, including investing in local facilities for battery recycling and developing second-life applications.

By harnessing more of the region's abundant RES potential and pursuing a balanced mix of grid-scale and behind-the-meter storage systems, countries in SE Europe can accelerate the phase-out of coal and gas while mitigating numerous energy and climate security risks. With a mild winter and calmer energy markets, there has perhaps never been a better time to unlock investments in a more sustainable and secure future energy system.

4. The Role of Nuclear Power

In SE Europe, there are five countries (Bulgaria, Hungary, Romania, Slovenia and Croatia) that currently operate nuclear power plants (NPPs), while Turkey is expected to build no fewer than 3 NPPs over the next decade. Nuclear power remains a viable option for growth because it offers important baseload capacity and supports the EU's decarbonization policies. The zero emissions from operating NPPs contribute to the region's efforts to curtail GHG emissions. This means that nuclear energy has an important role to play in the SE European energy and electricity mix over the next decades.

Following the tragic accident at Fukushima's NPP in March 2011 and operational security reviews, which have since been conducted by the SEE countries that host NPPs, the use of nuclear power in the region is unlikely to diminish over the next decade. Neither Bulgaria nor Romania nor Hungary are likely to shut down the Cernavoda, Kozloduy 5-6 and Paks 1, 2, 3, and 4 power plants respectively on account of safety concerns.

The same applies for Croatia and Slovenia, which, between them, share the Krško NPP. Both governments are very well aware of the fact that a decrease in the participation of nuclear power in their electricity generated portfolio cannot be easily replaced by renewables or be compensated by an increase of coal generated electricity due to the equally burdensome environmental costs. If they are to reduce the participation of nuclear power in their total electricity mix, both states have as an alternative the increase of imported gas, magnifying their already high dependence on gas.

Theoretically, the participation of nuclear generation in the regional electricity mix is set to diminish significantly as the rising demand of Bulgaria and Romania will be covered by

increased volumes of natural gas and, to a lesser extent, RES. However, this might change as both Romania and Turkey are definitely going ahead with plans to increase their nuclear installed capacity, which will result in two major nuclear power generation complexes with 6 GW of new installed capacity to be operated by 2030.

In the cases of Bulgaria (Units 5, 6 and 7 of Kozloduy NPP) and Turkey (the Akkuyu site), Russia might have a role to play. However, it should be recalled that strategic investments have two substantial characteristics in the energy sector. They need many years to be implemented but they last for decades. Such long-term planning should not be subverted by short-term political priorities against regional, economic and safety considerations.

In this sense, the Fukushima anti-nuclear rationale does not appear to hold in the case of SE Europe. For countries already involved in nuclear power development (i.e. Bulgaria, Romania, Hungary, Croatia/Slovenia, Turkey), the road ahead is unlikely to be obstructed by revised risk assessments.

Developing further nuclear power generation in the region will be a real challenge as not all countries favour this option. Detailed studies need to be undertaken to identify the real potential pitfalls of nuclear energy and to assess the compatibility of nuclear and RES power in the context of decarbonization. A great example is the case of Romania, which has a more diverse and balanced energy mix, compared to the other SEE countries, including coal, natural gas, oil, nuclear and RES.

Table 4: Operational Nuclear Power Plants in SE Europe

Country	Name	Type of reactor	Capacity (MWe)	Operation since
Bulgaria	Kozloduy 5	PWR	1003	1987
	Kozloduy 6	PWR	1003	1991
Hungary	Paks 1	PWR	479	1982
	Paks 2	PWR	477	1984
	Paks 3	PWR	473	1986
	Paks 4	PWR	473	1987
Romania	Cernavoda 1	PHWR	650	1996
	Cernavoda 2	PHWR	650	2007
Slovenia/Croatia	Krsko	PWR	688	1981

Note: Cernavodă NPP in Romania has the only PHWR CANDU reactors operating in Europe. Total capacity stands for 5,896 MWe.

Source: World Nuclear Association

It is worth noting that the European Commission has already launched the Small Modular Reactor (SMR) Alliance to accelerate the development and deployment of SMRs in Europe by the early 2030s. With SMRs expected to represent the next generation of nuclear technology and a considerable research effort well under way, the Alliance is intended to help coordinate further developments with closer cooperation among the involved stakeholders to deliver the technology in the fastest and most efficient way (9).

The technology is still largely unproven, but several projects are planned around the world. US company NuScale Power has an agreement with Romania's Nuclearelectrica to build a

cluster of six SMRs on the site of a former coal plant, which could be deployed in 2029. Those plans are part of Project Phoenix, a US plan to replace coal-fired power plants with SMRs, with projects in Czechia, Slovakia and Poland also in line to receive support for feasibility studies. Hence, Romania will be the first country in (SE) Europe to get this new nuclear energy technology **(10)**. It remains to be seen whether the SMRs will be developed in other SE European countries and at what extent.

5. Energy Efficiency as a Champion Energy Source

On October 10, 2020, the European Commission adopted "An Economic and Investment Plan for the Western Balkans" **(11)**, which identified flagship initiatives related to clean energy and the transition from coal. An overall budget of €9 billion during 2021-2027 is proposed for the Plan's implementation, of which a fair share is expected to finance building renovation and decarbonisation of the heating and cooling sectors.

The Plan relies on support from the Energy Community Secretariat to implement the Renovation Wave. In this respect, its role may be manifold. The Secretariat offers its assistance to the Western Balkan Contracting Parties in improving the legal framework and removing regulatory barriers in the building sector; facilitating information sharing and exchanging best practices; and serving as a bridge between the providers of technical and financial assistance and beneficiaries.

In contrast to the Western Balkan countries, the EU has already acquired extensive experience in implementing financial and fiscal instruments to support building renovations. These instruments have different sources of finance, delivery mechanisms and approaches, and are available to more sectors, including residential, commercial and Small and Medium sized Enterprises (SMEs).

In the EU, only in the last four years, the Joint Research Centre **(12)** identified a total of 129 ongoing public financial and fiscal schemes supporting energy renovations, of which around 61% are in the form of grants and subsidies, 19% are soft loans, 10% are tax incentives and the remaining 10% a combination of the above. The same study showed that around €15 billion are being spent annually across the EU for energy efficiency in public and non-public buildings. The majority of the instruments applied in the residential sector in the EU Member States are based on grants and subsidies, traditional loans and soft loans and fiscal incentives.

Despite the many instruments at hand, the renovation of buildings in the EU has proved to be very difficult and quite slow, compared to expectations. Presently only 1% of buildings undergo energy efficient renovation every year, while about 75% of the building stock is considered energy-inefficient. In the Energy Community, the renovation process is even less advanced.

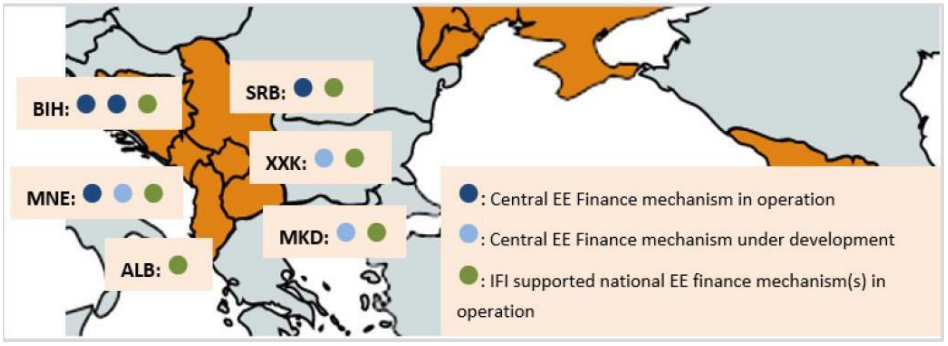
In the Western Balkans, it is estimated that approximately €1.06 billion were invested in energy efficiency projects in all building categories between 2010 and 2020, based on Energy Community Secretariat calculations **(13)**. The figure is significantly lower in the residential sector, which due to the many barriers is considered a difficult market to serve as it is

fragmented, with small-scale investments, and riskier than the other building categories.

With the support of donor engagement in energy efficiency projects, many Western Balkan countries have established, or are in the process of establishing, centralised energy efficiency financing mechanisms. These are complemented by multi-country initiatives supported by International Financial Institutions (IFIs), as shown in Map 5.

One category is represented by multi beneficiary programmes, mostly funded by loans from IFIs with incentives and technical support provided by the European Union. However, despite the large number of regional energy efficiency credit lines (supported by IFIs and the EU) available to help improve energy efficiency in residential buildings in the Western Balkans, their uptake has remained modest and focused on high income segments and those living in detached houses.

Map 5: Overview of Centralised Energy Efficiency Financing Mechanisms in the Western Balkans



Sources: Energy Community Secretariat

The building sector accounts for over 40% of total energy consumption in the Western Balkans. Renovating public and private buildings to meet minimal energy performance standards can make a very significant contribution to the reduction of GHG emissions, improve living standards and health. A building Renovation Wave implemented with the help of the Energy Community will assist the Western Balkans and SE Europe in general in decarbonizing public and private building stock, with a strong emphasis on digitalisation and taking into account energy poverty. The EU, together with international financing institutions, will support the efforts of the Western Balkans partners to triple the current renovation rate and energy savings in existing buildings and achieving nearly-zero energy and emission standard in new buildings.

6. The Energy Security Dimension

The energy sector and pursued policies and strategies may be analysed through different angles - economic, environmental and geopolitical. The geopolitical approach to energy emphasises energy security, which in most cases appears to dominate energy policy. This stands in contrast to the economic or environmental approaches, which prioritise sustainability and competitiveness.

Energy security priorities are perceived both in terms of supply routes and origin of resources. The geopolitical approach primarily considers the geographical position of a particular country or region from the perspective of the location of the energy resources and how this affects the other parameters. These normally include access, the actors that control resources, their price, existing and alternative transport routes, relations with the regional and global markets, market mechanisms and the regulatory framework that may influence suppliers and marketeers, the availability and management of these energy resources, as well as political decisions and the manner and framework within which they are made.

Although most countries aspire to the lowest possible energy dependence and the maximum use of their indigenous energy resources, whether mineral or renewables, this is not always possible, either due to lack of mineral resources (oil, gas, solid fuels) or of finances. This is often the case where a long-term import deal (e.g. for oil and gas) is preferable in economic terms to the development of local mineral resources. However, in certain cases where a country's sovereignty is at stake and the inland or seaborne transport of energy supplies is vulnerable to enemy action, then, despite the high cost, it is preferable to aim for indigenous energy source exploitation (such was the case in Nazi Germany with the local production of synthetic oil from coal using the hydrogeneration process **(14)**). Putting for a moment aside the energy security dimension, we observe that countries, which have managed to take advantage of their indigenous mineral energy resources, produce oil and gas, much more cheaply and have an advantage when it comes to the domestic market, where they can achieve competitive prices, or aim towards exports to secure valuable income.

In Europe, and this applies largely to SE Europe, because of the long peace period the region has enjoyed since WWII, many countries placed energy security as a secondary priority. Their primary concern was market development and delivering affordable energy, whether electricity or oil, to as many people as possible. It was only after the war in Yugoslavia in the 1990's and the assertiveness of energy rich Russia following the collapse of the Soviet Union that energy security started to become a major priority of strategic planning.

With several countries in the region until very recently relying entirely on Russian gas imports, there was a major drive soon after the turn of the century to seek alternatives. Under much pressure from the EU, the South Corridor was developed along with a number of new LNG import terminals and cross-border interconnections. However, the region still remains vulnerable due to the limited number of suppliers and to even fewer supply routes.

The Russian invasion of Ukraine has exposed Europe's most painful energy security vulnerabilities. It exacerbated the energy crisis that had been driven by gas supply deficits since 2021. The war showcased the excessive reliance of many EU member states on Russian fossil fuel imports, spotlighting in particular the biggest consumers Germany and Italy. The "earthquake" on the energy markets threatens to slow down the low-carbon transition in Europe although the decarbonisation and the massive uptake of RES could be the strongest policy instrument to achieve sustainable energy independence. Countries in SE Europe are particularly vulnerable to such a scenario.

In the pursual of current EU policies, SEE countries need to immediately cut their dependence on Russian fossil fuel imports as a matter of national security. This is the way to stop funding

Russia's war and to counter its malign economic and political influence across the EU. In the context of deteriorating ties with Gazprom, governments in the region have to take immediate measures to ensure the security of supply and the protection of vulnerable consumers. After the Russian decision to cut the natural gas supply to Bulgaria on its long-term contract, there will be a change in the direction of physical natural gas flows as Bulgaria seeks to import alternative gas volumes in reverse mode from Greece.

In SE Europe, gas imports through the LNG regasification terminals in Greece, Croatia and Turkey could play a crucial role in maintaining the security of supply. However, it is imperative that Bulgaria, Greece and Romania sign solidarity agreements along the model of other EU member states to optimize the allocation of limited volumes of alternative gas supplies entering the region. The three countries should also seek to conclude a joint LNG import agreement with major suppliers such as Qatar, Algeria or the US that extends beyond emergency deliveries month by month.

As Bulgaria is a major transit country for Russian gas deliveries in the SEE region, a potential standoff with Gazprom over contractual breaches could set off a major gas security crisis, especially in countries with high gas dependence of the energy demand and no physical access to alternative deliveries. In case of a transit halt, Serbia, North Macedonia and Bosnia and Herzegovina, will be especially hard hit.

The Bulgarian refinery Neftochim on the Black Sea coast, which is the biggest in SE Europe and also owned by the Russian private company Lukoil, is indispensable for the oil and fuels supply security for most countries of the region barring Greece and Romania. The diversification of the crude oil deliveries for the processing facility is possible as the refinery could operate with similar petroleum grades from Saudi Arabia and the United Arab Emirates. However, this diversification strategy could require Bulgaria to adopt difficult to enforce legal measures against the Russian company on the wholesale market including the possible need to put the refinery complex under state supervision. Retaliatory measures cannot be ruled out, which means that the SE European countries need to boost coordination efforts on jointly managing the oil and fuels stocks in the region as to prevent unsustainable price spikes and deficits on the wholesale and retail markets.

Efforts to fortify energy security in SE Europe are gaining momentum with the launch of a collaborative project aimed at establishing a novel gas transit route. Dubbed the "Vertical Corridor", a name that was initially given to this project through the completion of an IENE Study **(15)**, this initiative seeks to mitigate the impact of disruptions in gas supply by providing alternative pathways for gas transportation.

The proposed corridor offers Azerbaijan an opportunity to expand its gas export network, aligning with its commitment to double gas exports to Europe by 2027. Leveraging existing pipelines across Greece, Bulgaria, Romania, Moldova and Ukraine, the Vertical Corridor aims to facilitate the flow of Azerbaijani gas to eastern and central European markets.

Under the auspices of the European Union's Central and South Eastern Europe Energy Connectivity initiative (CESEC), stakeholders are collaborating to enhance regional energy infrastructure and diversify gas supply sources. A recent Memorandum of Understanding

(MoU) signed among key players marks a significant milestone in advancing this initiative. The project involves upgrading and expanding existing gas transit infrastructure to accommodate higher capacity and optimize gas flow directions where necessary. By leveraging LNG imports and gas shipments from Azerbaijan via Turkey, the Vertical Corridor seeks to meet rising demand in Moldova and Ukraine while bolstering energy security across the region.

Crucially, the development of the Vertical Corridor holds potential implications for existing gas transit routes, including the Southern Gas Corridor and the Trans Adriatic Pipeline (TAP). While the full impact remains to be seen, the emergence of alternative transit options could reshape gas transportation dynamics in the region.

Meanwhile, efforts to enhance Azerbaijan's gas production underscore the nation's commitment to fulfilling export obligations. Anticipated production from new gas fields, coupled with ongoing negotiations for additional supply sources, position Azerbaijan as a key player in Europe's energy landscape.

As stakeholders navigate challenges and opportunities associated with the Vertical Corridor project, the quest for energy security and diversification remains paramount. Collaboration among nations and sustained investment in infrastructure will be crucial to unlocking the potential of this transformative initiative.SEE governments should also work out a set of longer-term measures along the "REPowerEU" Plan put forward by the European Commission. They need to design a new energy and climate security strategy that not only tackles the region's excessive reliance on Russian fossil fuel imports, but also the critical role of RES, electrification, energy efficiency, and innovation for ensuring the long-term energy security of the EU without comprising the climate transition process.

The most important prerequisite for the success of energy security reforms in SE Europe is the strengthening of good governance. A radical improvement of the quality of governance that focuses on countering corruption and state capture risks in the energy sector is imperative for the design and implementation of an effective energy and climate security strategy.

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