INSTITUTE OF ENERGY
FOR SOUTH-EAST EUROPE

FRESH CHALLENGES FOR ENERGY SECURITY IN SE EUROPE

BY Costis Stambolis, John Roberts and
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1. Introduction

There are a host of ways of defining energy security. But one of the simplest is this: the availability of adequate and sustainable supplies of energy at reasonable costs. The problem is that all too often energy supplies may not be adequate or sustainable and, particularly at present, may be unaffordable for various households, communities or businesses.

Europe in general, and SE Europe in particular, is currently confronted by the twin challenges posed by the need both to diversify energy sources in the wake of Russia's 2022 cut off of gas supplies to much of Europe and the need to diversify away from fossil fuels in general in order to tackle climate change. At the same time, Europe and its neighbours have to prepare themselves for dealing with the onset of further emergencies, such as the latest and largely aerial war between Israel and Iran, might have serious consequences for global energy markets in general and development of East Mediterranean gas resources in particular. (*The issue of the Israel-Iran conflict and its implications for energy is specifically addressed in a separate box on pages 30-37).*

Specific challenges relating to the need to address the consequences of Russia's invasion of Ukraine whilst promoting the energy transition include the need to create or upgrade gas infrastructure, both in order to enable alternative suppliers to reach markets that were formerly dependent on Russian gas and to reduce carbon emissions by increasingly replacing lignite with gas as a fuel for power stations.

There are also opportunities to strengthen energy security through market integration, renewable expansion, energy storage solutions, and diversification of energy sources. Electricity integration in the form of cross-border power connectors and exchanges is being actively pursued. New technologies can help. The development of small modular reactors may enable nuclear power, commonly associated with extremely expensive projects that deliver power at highly inflated costs, to secure a renewed role in zero-carbon power provision. New forms of battery storage, coupled with improved designs that enable buildings not only to save energy but to store energy, can help. So, too, can demand-side management.

SE Europe faces particular problems. It has to transition to renewable energy but is currently reliant on fossil fuels, has a legacy of underdeveloped infrastructure, is buffeted by energy price volatility, and is surrounded by geopolitical uncertainty. This means its energy future hinges on the successful integration of renewable energy, regional cooperation, and EU financial support for building a more resilient, sustainable energy system.

Boosting regional energy security also requires boosting the energy security of individual countries, notably by reducing the over-reliance of some countries on fossil

fuel imports. This is particularly evident in the case of Türkiye, Greece, Cyprus and Bulgaria. This requires a consistent multi-faceted effort, embracing additional renewables capacity, integration of serious energy storage, combining both battery energy storage systems (BESS) and pumped storage schemes, expansion and upgrading of electricity grids with additional cross-border interconnections. It also requires both the inclusion of nuclear power and further hydrocarbon exploration to develop sustainable local gas production.

In short, the region needs to boost production from indigenous resources, both renewables and conventional. In particular, SE Europe should expand its own gas production base. Türkiye, Romania and Croatia already produce sizeable gas quantities, while new players may be added soon, notably Cyprus and Bulgaria, while Greece, Albania and Montenegro may also become producers subsequently. The Eastern Mediterranean shows particular promise for further major gas discoveries, but faces considerable problems concerning potential markets.

Strengthening local energy production will enhance energy security, reduce dependency on imports, support economic development, and contribute to environmental sustainability. To achieve this, strategic investments in infrastructure, technology, and workforce development are essential, along with supportive policy frameworks and regional cooperation.

One specific problem - impacting on the continent, the region, individual countries and businesses and households alike - is that such infrastructure has to be put in place at a time when government revenues are low, corporate finance is problematic and energy prices are relatively high, putting further pressure on utilities, distributors and consumers.

2. European Energy Security in the Light of the 2022-2023 Crisis

Overall, the EU has a relatively high dependence on energy imports (58.3% in 2023), which has been steadily increasing since 1990. In general, Europe's vulnerability to energy security issues manifests itself quite differently when it comes to oil and gas. Oil is a fungible commodity, which can be supplied from multiple sources to multiple destinations in multiple forms, by pipeline, maritime tanker, or by road and rail. If one group of suppliers, like the Arab oil producers in 1973, cuts off supplies to regular customers, they can be replaced by oil from other producers without too much physical strain – although the impact on prices may be severe.

But gas is different and, to a very large extent, the energy crisis of 2022-2023 concerned gas and the impact of Russia's decision to halt gas exports to much of Europe in the wake of its full-scale invasion of Ukraine in February 2022. Until recently, gas was very different from oil in that it largely relied on pipeline deliveries under long-term contracts between a single supplier and a specific customer. Such a system is vulnerable to supply cutoffs through actions taken by one of the parties, or by transit states, or from Acts of God. However, such vulnerability can be considerably ameliorated if another delivery system becomes available: the supply of liquefied natural gas (LNG) by tanker from producers as far afield as North America and the Gulf, together with the necessary docking, regasification and pipeline connections at the European end. The arrival of LNG from these sources, coupled with the actions taken over the last 20 years or so as a result of previous crises, enabled Europe to cope with the 2022-2023 energy crisis, even though it resulted in massive disruption and demand destruction.

Since the first Russia-Ukraine gas crisis in 2006, Europe has witnessed the construction of a host of new or improved interconnectors for both gas and electricity and regasification terminals for LNG, thus ensuring smoother deliveries of both gas and electricity throughout much of Europe, not just the EU. The EU has also developed vastly improved legislative frameworks to bolster cross-border deliveries. Both physical and legislative approaches have been applied not only within the EU's own 27 member states but within states associated with the EU in the European Energy Community, a grouping that embraces all the countries of SE Europe, thus helping to ensure the security of energy supplies throughout most of the continent.

In considering European energy security and the resources available to supply European demand there is, of course, a need to distinguish between the EU, which has limited energy resources, and Europe as a whole. For example, Russia is a European nation but has been a problematic supplier to much of the rest of Europe. In contrast, Norway is outside the EU, but is none the less a trusted partner which enjoys genuinely warm and friendly commercial relations with the EU and supplies vast volumes of oil and gas to the EU. Moreover, Europe is also surrounded by various nearby sources for

current or potential energy supplies, notably North Africa, Azerbaijan and, prospectively, the Eastern Mediterranean.

Nonetheless, even partial supply disruptions can have severe consequences, as the European Union has experienced on several occasions, ranging from the oil shocks of the 1970s to the gas crises of 2006 and 2009 and the energy price crisis following Russia's full-scale invasion of Ukraine in 2022.

3. The Energy Crisis of 2022-2023

Russia's full scale invasion of Ukraine on 24 February 2022 was followed rapidly by moves by Europe in general, and the EU in particular, to reduce European reliance on Russian energy, especially gas. The invasion not only caused extensive devastation in Ukraine but also triggered a commodity supply shock in international markets, particularly in Europe. In March, Russia sought to counter economic and financial sanctions first by ordering its customers to pay for their gas in roubles, and then, when they refused to do so, by cutting off gas flows to Poland and Bulgaria (April); by ending deliveries to Finland (May), by limiting flows through Nord Stream to Germany and beyond (June) and then terminating all flows through Nord Stream (July). Finally, on 22 September 2022, all prospects for deliveries through Nord Stream came to an end when a series of explosions – still unexplained – caused serious damage to both the older Nord Stream 1 and the newly-completed Nord Stream 2 pipelines.

Even countries that were relatively friendly to Russia, notably EU member state Hungary and non-EU state Serbia, were significantly impacted, because Ukraine's own response to the Russian invasion included a decision in May to halt flows of Russian gas through the main transit pipelines across Ukraine, affecting about a third of Russian deliveries through Ukraine.

Although Gazprom continued to supply pipeline gas to Europe for much of the first half of the year, Russian exports still fell considerably from 150.2 bcm in 2021 to just 78.8 bcm in 2022, while in 2023 they amounted to just 42.9 bcm, with pipeline exports down to just 25.1 bcm and LNG exports at 17.8 bcm. Increased supplies from Norway, Qatar and above all, the US were able to replace about half of the lost Russian supplies. But the other half was simply a fall in consumption, due to energy saving, energy switching, and, above all, demand destruction triggered by high prices for the gas that was still available.

The impact was striking: gas consumption in Europe as a whole fell by 75.8 bcm from 572.5 bcm in 2021 to 497.7 bcm in 2022, while in 2023 consumption fell again by 34.3 bcm to 463.4 bcm. In the EU, consumption fell 46.9 bcm from 397.0 bcm in 2021 to 343.9 bcm in 2022, and then in 2023 by a further 24.4 bcm to 319.5 bcm.

Table 1: European Gas Balances, 2010-2023 (in bcm)

	2010	2019	2020	2021	2022	2023
Net Imports	308.8	347.5	320.2	336.1	315.5	270.5
All Europe						
Europe Production	310.1	234.9	218.9	211.0	220.2	204.3
Europe Consumption	623.4	555.2	541.7	572.5	497.7	463.4
Europe Net Import Requirement	313.2	320.3	322.8	362.2	377.5	259.1
European Union						
EU Production	125.6	61.0	47.8	44.3	40.8	34.4
EU Consumption	432.2	392.6	380.0	397.0	343.9	319.5
EU Net Import Requirement	306.6	331.6	332.2	352.7	303.1	285.1

Note: 'Europe' definitions in these tables exclude Russia

Source: Energy Institute, Statistical Review of World Energy 2024 (1)

This collapse in gas consumption amounted to demand destruction - which means, in practice, industrial closures or household abandonment of gas as a fuel – on a large scale. Other producers stepped up their deliveries to Europe to help compensate for lost Russian supplies. The USA, which was at that time bringing new LNG production on line, managed to increase its supplies to Europe from 18.9 bcm in 2021 to 50.1 bcm in 2022. Norway, largely by diverting gas that was previously earmarked to boost oil production, contributed significantly by adding a further 7.9 bcm while Qatar added another 5.5 bcm. Industries, households and utilities turned to renewable energy, prompting overall consumption of renewables in the whole of Europe to rise by 0.96 exajoules in 2022, equivalent to no less than 25.5 bcm.

But such increases simply could not match the scale of lost Russian deliveries, hence the demand destruction. The EU summed up the ensuing chaos: “Unpredictability brought panic to the markets, and energy prices reached an all-time high in August 2022. Analysts started to worry whether there would be enough gas to keep the EU’s economy running and – even more importantly – to keep people’s homes warm in winter” (2). The crisis sent shockwaves through the global economy and disrupted energy markets on an unprecedented scale. In its wake, with governments and industrial organisations urging reduced dependence on Russian gas, the European Commission committed the EU to becoming independent of Russian fossil fuels by 2027, including oil and coal, as well as gas supply chains.

Russia’s invasion of Ukraine and its subsequent actions exposed Europe’s most painful energy security vulnerabilities. It exacerbated energy issues epitomized by decades of gas supply deficit and highlighted the excessive reliance of many EU member states on Russian fossil fuel imports, notably the two biggest consumers, Germany and Italy.

Table 2: European Gas Imports, 2021-2024 (in bcm)

	2021	2022	2023	2024
Others	41.6	75.1	62.0	45.7
North Africa	44.1	40.4	41.0	39.2
Norway	79.5	89.7	87.8	91.1
US	18.9	50.1	56.2	45.1
Russia	150.2	78.8	42.9	51.6
- Russia Pipeline			25.1	31.6
- Russia LNG			17.8	20.0
Total	334.3	**334.1**	**289.9**	**272.7**

Source: European Council (3)

The war disrupted energy supplies, increased prices, and forced countries to rethink their energy strategies. It also prompted a string of policies and directives by the European Community. However, it also important to note that as a result of previous energy crises, the EU's principal bodies, the European Commission, the European Parliament and the European Council, had already put in place considerable regulations and requirements intended to cope with further crises.

In 2009, the EU approved the Oil Stocks Directive, which requires Member States to hold a minimum reserve and to inform the European Commission about the stocks they hold. Similarly, the EU Gas Storage Directive was introduced in 2022 to strengthen energy security by requiring Member States to fill at least 90% of their underground gas storage by November 1 each year. In response to evolving market conditions and concerns over rigid deadlines, the EU proposed and provisionally agreed in 2025 to extend the regulation through 2027 with added flexibility—allowing the 90% target to be met anytime between October 1 and December 1, and making interim fill levels optional rather than mandatory. The updated rules also permit deviations of up to 10% under certain conditions, aiming to balance energy preparedness with market realities.

In 2017, a gas solidarity mechanism was approved, which aims to provide a backstop for so-called solidarity protected customers, notably households and social services connected to gas distribution networks. In practice, this mechanism seeks to ensure continuous gas flows by mandating that one country will free up gas being delivered to customers who are not solidarity protected and enable it to be used by solidarity protected customers in a neighbouring country. The need for continuous flow can be crucial, since gas-fuelled appliances may need to be properly checked before re-ignition if the supply of gas has been interrupted. In 2019, the European Parliament and the European Council approved a regulation on risk-preparedness in the electricity sector that mandates Member States to implement tools for preventing and managing potential electricity crises – and to work together once such crises occur.

Despite this comprehensive framework, the issue of energy security will likely remain a long-term challenge for the EU as it seeks to implement the twin goals of promoting the transition to renewables in order to counter global warming whilst also tackling the consequences of the 2022-23 crisis and, indeed, insuring against potential future crises of similar magnitude.

Current revisions of EU energy regulations, now under way, offer an opportunity for the EU to adapt its existing security framework to meet new challenges resulting from the decarbonisation of the energy market and new import patterns. However, initial reports of this process indicate that, in what appears to be a response to President Trump's promotion of both fossil fuel development and the imposition of tariffs on almost all imports from both Europe and the rest of the world, the Commission may be primarily focusing on reducing the impact of existing rules intended to curb energy consumption and to promote use of renewables. **(4)**

The crisis may also have performed a more positive function than expected. Tight energy markets in 2021 threatened to slow down the EU's drive for decarbonisation through promotion of renewable energy use. The crisis forced increasing reliance on renewables and this should, in the long run, enhance energy security throughout the continent. But that does require that coverage is made available for the inherent intermittency of key renewables, since the sun does not always shine and the wind does not always blow. Such coverage will no doubt eventually come from various forms of energy storage, but for some years to come there will be a need for baseload supply from gas-fired power stations that can cover for such intermittency.

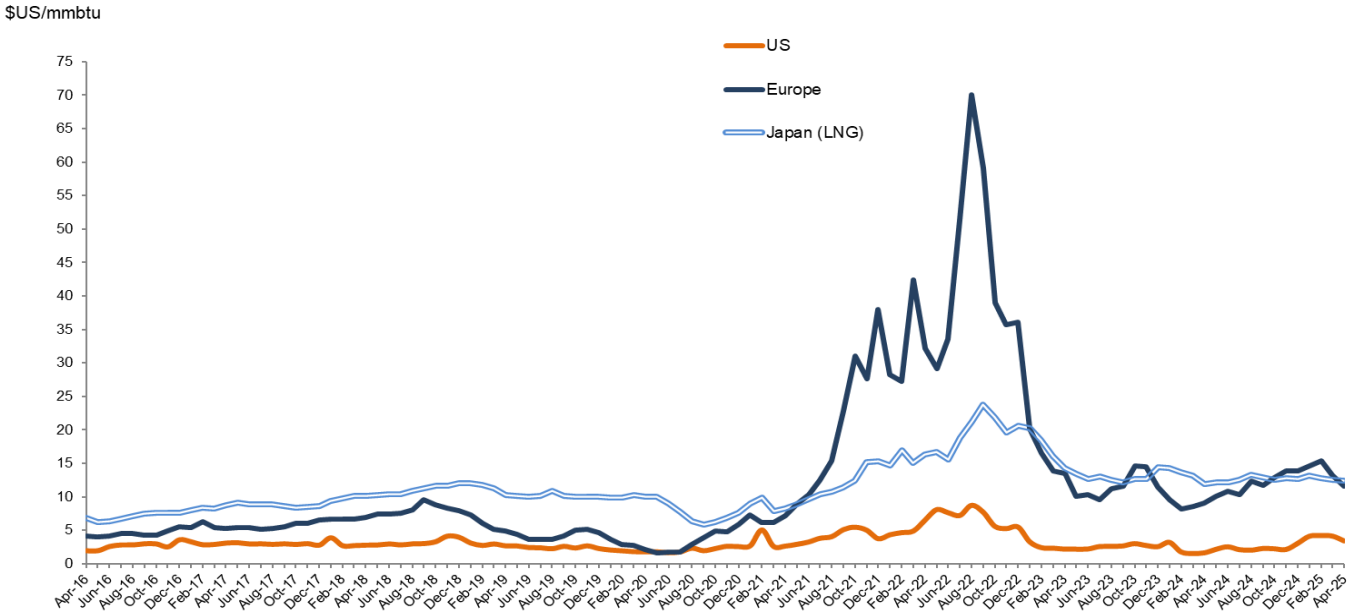
In curtailing its gas exports, Russia sought to promote chaos in much of Europe by driving gas prices to a level that would cause panic, perhaps even near total economic collapse, for key consuming countries. Prices soared, reaching a record high of €345 per MWh on 26 August 2022 on the Dutch TTF (Title Transfer Facility), Europe's principal gas price index.

By comparison, in in the month before the Russian invasion of Ukraine on 24 February 2022, they had fluctuated between €70 and €94 per megawatt hour. This particularly hurt countries in Central and `Eastern Europe that were both directly tied to Russian gas pipeline imports whilst lacking significant access to alternative import systems, notably LNG. Overall, however, the actions taken by European governments, regulators energy producers and consumers have since then helped to stabilise the position considerably. As of 11 June 2025, the Dutch TTF price was around €35.39 per MWh, scarcely changed from a year earlier.

Mainly, as a response to the Ukrainian crisis, but also as mitigation measures on climate concerns, various new policies were introduced in 2022 all around the world to accelerate the transition towards renewable energy sources (China's 14th Five-Year

Plan and market reforms, the REPowerEU plan, and the US Inflation Reduction Act[1] are cases in point). According to the IEA (5), renewable capacity expansion is projected to surpass previous expectations, with a significantly faster growth rate over the next five years.

Figure 1: Natural gas prices, April 2016-April 2025



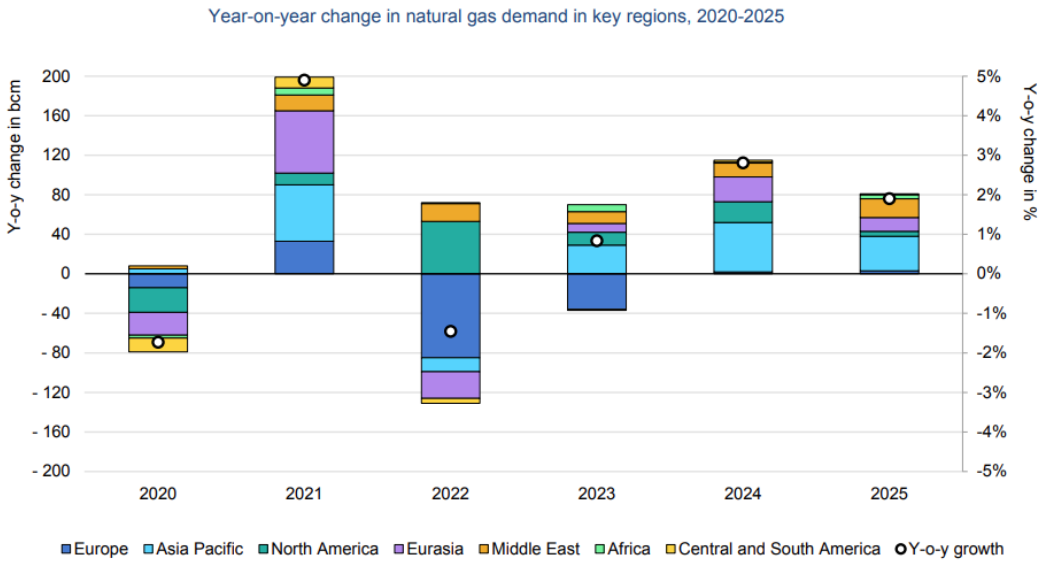
Source: World Bank

But above all, the invasion of Ukraine has proved a game-changer for energy security in Europe (6). The analyses of Mišik (7) and Osička and Černoch (8) have highlighted the importance of diversification strategies in Europe, which encompass reshaping external energy security, forming new supply partnerships, and increasing investments in decarbonization and renewable energy sources. Such modelling demonstrates that European countries can successfully diversify their gas trade partners with reliance on a single partner decreasing in all the large European economies.

One issue that European governments and utilities will have to address is whether the expansion of natural gas infrastructure may hinder a renewable energy future due to lock-ins and stranded assets. Nevertheless, it is envisaged that the gas infrastructure may be repurposed in the future to facilitate the import of green hydrogen.

[1] The Inflation Reduction Act of 2022 (IRA) is a United States federal law, which aims to reduce the federal government budget deficit, lower prescription drug prices, and invest in domestic energy production while promoting clean energy. It was passed by the 117th United States Congress and signed into law by President Joe Biden on August 16, 2022.

Figure 2: Natural gas demand growth is expected to slow down in 2025



Source: IEA

Following the Russian invasion of Ukraine, the Kremlin has tried to weaponise Russian gas exports and the EU's dependency on gas imports, in order to discourage EU support for Ukraine. However, the EU chose to resist and decided on a strategy of decreasing reliance on energy imports, especially from Russia. Through integrated macroeconomic-energy modelling, it is shown that while the EU initially might have suffered some direct economic impacts, in the medium-term it will be able to adapt to the new situation without suffering an economic slowdown. Adaptation happens through a combination of diversifying import sources and fuel- and technology-switching as well as demand reduction.

Adaptation has medium- and long-term consequences for the EU which go far beyond the immediate aftermath of the shock. Once technology change in power generation, in residential heat and in industrial fuel substitution happens, it is unlikely that such a change will be rolled-back when gas prices normalize. Therefore, as a silver lining to the shock, the gas price hike actually pushed the EU for a quicker decarbonization that at the same time results in a higher energy security situation for the bloc.

At the same time, Russia is having to diversify its supply routes to Europe. Russian gas exports via Soviet-era pipelines through Ukraine came to a halt at midnight on 31 December 2024, when Ukraine declined to renew an existing transit agreement. Gazprom had maintained some flows despite nearly three years of war in order to serve friendly customers such as Hungary and Serbia. In 2025, the only operational route for Russian pipeline gas deliveries to Europe is the TurkStream pipeline, running from Russia to Türkiye under the Black Sea. With a design capacity of 31.5 bcm per year, it supplies gas to Türkiye and South/Southeast European countries via Turkish territory. The twin-line pipeline can deliver up to 15.75 bcm per year per line.

Several energy analysts point out that the Russian energy weapon will not cause serious damage to the European economy, at least in the medium-term. Continued efforts over the past decade to accelerate the green transition and develop an extensive LNG network have put the EU in a good position to lessen dependence through a strategy of diversifying gas imports, mainly through LNG, further penetration of renewables in the electricity mix and, in some cases, increased reliance on coal. Nonetheless, although the EU has managed to reduce its reliance on Russian supply, Russian gas has not disappeared completely from EU's gas system. The European Commission is currently addressing the question of rising Russian LNG deliveries to Europe while Russian gas exports via the TurkStream pipeline are also increasing.

In tackling the energy crisis and its aftermath, the EU's integrated gas market has so far proven resilient, facilitating the reconfiguration of supply and demand and ensuring that gas flows where it is most needed. A combination of enhanced LNG supply, new gas infrastructure – including the installation of both LNG regasification facilities and interconnectors – and sharply reduced gas consumption has brought a new supply-demand balance equilibrium to EU gas markets, enabling a shift away from the widespread former dependence on Russian gas pipeline supply. But while there are very good prospects for major increases in global LNG availability as a result of current major projects around the world, if Europe is to gain from this it will also have to speed up its own development of regasification facilities and their associated infrastructure, This will be necessary both to avoid bottlenecks and to ensure that the arrival of enhanced supplies of LNG contribute to downward pressure on gas and power prices.

Market consolidation is not yet complete. There is still a need to safeguard competition and to enhance cross border cooperation, notably on transportation costs, to help ensure that increased reliance on LNG does not spark further price volatility in whatever gap there is before the next wave of LNG expansion is available to promote price stability. Other market issues that still require attention include the promotion of energy storage to cover seasonal variations in energy supply and demand and the way the market is evolving to incorporate larger volumes of decarbonized gases, such as biomethane and synthetic fuels.

4. Europe's Continuing Need for Gas and the Need to Boost Regional Gas Production

For Europe, one of the most important questions concerns the future of gas in its energy balance. The International Energy Agency anticipates that both gas demand and the requirement for imports will continue to fall in both Europe as a whole and the EU in particular. Such falls are anticipated in its estimates based on stated policies that are already in place and also in its alternative estimates – these are not forecasts – based on assumptions that various official pledges on energy will be put into effect (see Table 3).

At first sight, it would appear that both Europe and the EU are thus set fair for a future in which gas plays a steadily diminishing role. But there are various elements that might well change this trajectory substantially. There will quite likely be a modest reversal of the consumption cuts as national economies recover from the slumps induced not only by the Russian gas cutoffs but by the economic downturn associated with the COVID pandemic.

Table 3: European Gas Balances, 2010-2050 (IEA-WEO 2024) (in bcm)

	Actual				Stated Policies			Announced Pledges		
	2010	**2021**	**2022**	**2023**	**2030**	**2035**	**2050**	**2030**	**2035**	**2050**
Europe										
Production	341	239	253	236	164	170	176	150	139	102
Consumption	697	627	544	507	462	407	301	409	281	86
Import Requirement	-298	-362	-311	-294	-265	-228	-143	-247	-178	-27
EU										
Production	148	51	47	37	31	29	23	17	9	2
Consumption	446	413	358	331	296	257	166	264	187	29
Import Requirement	-298	-362	-311	-294	-265	-228	-143	-247	-178	-27

Note: 2021 figures from IEA WEO 2023. Tables A12 & A13.

Source: IEA World Energy Outlook 2024 Tables A12 & A13. (9)

There is also the requirement to provide cover for the intermittency of renewables-generated electricity. In practice in many countries, this means increased reliance on thermal power stations, including nuclear, themselves usually reliant on fossil fuels, notably gas, to provide what is termed baseload capacity. And with the need to tackle climate change, that favours reliance on the fossil fuel that produces the least carbon dioxide: natural gas. The problem is that while gas is required right now to fuel current and near-term future requirements for electricity, it is far from clear just how long this state of affairs will last. The expansion of diverse forms of renewable energy production, including wind, solar, biofuels and hydro – together with improvements in energy storage, grid flexibility and, potentially, the installation of new nuclear power

stations will all serve to reduce the requirement for baseload capacity and therefore for gas.

This is why the International Energy Agency anticipates that the decline in European gas consumption will likely start to accelerate around 2030. But the timeframe for all these elements to coalesce and thus eliminate the need for gas-fuelled baseload capacity is uncertain. In some parts of Europe, notably the Germany-Austria electricity market, grid flexibility is already deemed sufficient to eliminate the need for baseload capacity. In other regions, especially in SE Europe, this is far from being the case and there could well be a need for baseload capacity for the next decade or two, with gas-fuelled thermal power constituting the logical source of such baseload. The paradox is that while there is a definite short-term requirement for gas, financing the development of gas projects requires that there should be reasonable long-term prospects for actual sales. There is therefore considerable concern that the EU's pursuit of a green agenda neglects the baseload issue, thus damaging the energy security of the region in the long term. Moreover, the very fact that gas is a known quantity, means favours its retention rather than its wholesale substitution by alternative forms of energy production.

5. SE Europe and European Energy Security

The importance of SE Europe in European energy security has grown as European Union and its partners in the Energy Community accelerate their energy transition whilst also striving to ensure their energy security. Following the energy crisis triggered by Russia's invasion of Ukraine, European countries have prioritized diversification, resilience, and regional cooperation—goals that align with the infrastructural and geopolitical developments unfolding in SE Europe.

In recent years, the region has also emerged as a critical gateway for Europe's gas supply, especially in light of shifting geopolitical dynamics and the continent's efforts to reduce dependence on Russian energy. In particular, the region's strategic location at the crossroads of Europe, Asia, and the Middle East places it in a unique position to facilitate the transportation of natural gas from a variety of sources to Central and Western Europe.

Within the region itself, Russia's full-scale invasion of Ukraine in February 2022 naturally prompted increased concern about energy security, primarily because of the need to replace lost Russian gas supplies but also because it highlighted the need to develop more flexible methods of receiving and distributing energy within the region. In general, the European Union's prioritisation of diversification, resilience, and regional cooperation is shared by most governments in the region and is reflected in both their geopolitical goals and in the development and expansion of regional infrastructure.

If only because oil is more fungible and can be transported from country to country or region to region in a variety of ways, in terms of the supply element in regional energy security, the main issue is gas. However, in terms of the impact on both industrial and individual consumers, the question of high oil prices and the affordability of gasoline and diesel are also key energy security issues.

SE Europe also plays a significant role in broader European energy security both as a region through which external suppliers transit oil and gas to other European destinations and because current projects for new gas production in the Black Sea mean that it is on the cusp of becoming a useful contributor to European gas supplies. Of course, East Mediterranean gas is also a factor in terms of new regional gas production; this issue is addressed in a subsequent chapter. In addition, SE Europe is itself an increasingly interesting energy market and this has energy security implications.

Until the Russian invasion of Ukraine in 2022, energy security was an important, rather than a critical issue for the region. Russia did possess a near monopoly in gas supplies

but, despite tensions stemming from supply disruptions in 2006 and 2009 concerning the transit of Russian gas through Ukraine, and Moscow's 2014 de facto annexation of Crimea, Russian gas was continuing to flow steadily. Moreover, at the same time, the EU-backed development of interconnectors and LNG regasification facilities, together with the launch of commercial gas deliveries from Azerbaijan in 2020 via the newly created Southern Gas Corridor, were laying the foundations for more diversified supplies and thus for more competitive markets in the region.

The February 2022 invasion, and Russia's subsequent halting of the vast majority of its pipeline exports to most of Europe, changed all that. Gas supplies were curtailed, prices soared and reliance on coal, particularly lignite, grew, with all the implications for climate change stemming from increased utilisation of these high CO2 emission fuels. Some factors did help to offset the loss of Russian gas for the region, notably increased imports of LNG via new regasification facilities in Greece and increased supplies of pipeline gas from Azerbaijan.

There is therefore much greater interest in energy security throughout the region, with concern essentially focussed as much on supply as on voluntary actions to limit demand through energy efficiency measures (the issue of demand management is addressed in a subsequent chapter).

In strict energy security terms, there is a need for countries in SE Europe to reduce their gas imports from Russia. In practice, however, the fact that Russian gas remains considerably cheaper than LNG supplies has created a set of highly complex arrangements involving Russia, Turkey, Bulgaria and Greece.

For decades, Greece and Türkiye had imported Russian gas via the Trans Balkan system (which traverse Ukraine, Moldova, Romania and Bulgaria). After the Russian decision to cut the natural gas supply to Bulgaria on its long-term contract, there was a change in the direction of physical natural gas flows as Bulgaria sought to import alternative gas volumes in reverse mode from Greece. Nonetheless, although continuing reliance on Russian gas imports poses a serious security risk, a number of countries have chosen to disregard this and have continued trading with Russia.

What makes this possible is Russia's development of the TurkStream pipeline system which, at a time when its former principal export systems across Ukraine and Poland are out of action, enables Russia to continue to supply traditional customers in Central Europe, including Serbia, Hungary and Slovakia, via Türkiye. This was made feasible by the opening of the 31.5 bcm/y TurkStream pipeline under the Black Sea in 2020 and its 15.75 bcm/y northern extension, dubbed Balkan Stream, through Bulgaria and Serbia, which opened in 2021. A planned direct connection to Greece was never implemented but Russian gas still reaches Greece via Balkan Stream and the Greece-Bulgaria interconnector entry point at Sidikastro. And yet, at the same time, the Greece-Bulgaria interconnector and the Sidikastro border point are viewed as a logical

way for LNG entering at the Greek LNG terminals to reach destinations to the north, notably Ukraine. Efforts to secure such deliveries have so far had limited success with the complexity of developing deliveries along this route illustrated by the failure of the first auction for capacity on the pipelines connecting Greece with Ukraine in May 2025[2].

Moreover, Russia itself can still use energy as a weapon in the region. Bulgaria, for example, is a major transit country for Russian gas deliveries in the region, so a potential standoff with Gazprom over contractual breaches could set off a major gas security crisis, This would particularly impact those countries with both a dependence on gas in energy provision but which lack physical access to alternative supplies. In case of a transit halt, Serbia, North Macedonia and Bosnia and Herzegovina, all of which still import Russian gas, would be especially hard hit. Although a 1.5 bcm/y interconnector between Greece and North Macedonia is currently under construction, it is not expected to open until 2027.

Bulgaria is also potentially at risk for some months to come as a result of the EU-wide embargo on Russian oil imports, Russia's Lukoil owns the biggest refinery in SE Europe, Bulgaria's Neftochim refinery, on the Black Sea. Although there have been moves to sell the refinery to other parties, including Qatar's Oryx Global, Kazakhstan's KazMunaiGaz and Hungary's MOL, nothing has yet been finalised. Meanwhile, the refinery's sales practices are under investigation by the EU'S Competition Commission which has initiated proceedings to establish possible violations of national and European competition legislation by Lukoil Neftochim Burgas and Lukoil-Bulgaria.

Neftochim is indispensable for the oil and fuels supply of many countries in the region, though not for Greece and Romania., which have extensive refining operations on their soil. In technical terms, 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, unless the operation is sold to some other buyer, such a diversification strategy would require Bulgaria to make a difficult choice 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 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.

[2] https://www.argusmedia.com/en/news-and-insights/latest-market-news/2693444-new-trans-balkan-pipeline-gas-product-fails-to-sell

The role of SE Europe in energy transit: pipelines and LNG terminals

The push for diversification long preceded the Russian invasion of Ukraine in 2022. Many countries in the region relied for decades on Russian gas imports as a major source of energy, and at the turn of the century, such projects as the Revithoussa LNG terminal near Athens (opened 1999) and the Turkey-Greece pipeline from Karacabey to Komotini (opened 2007) were initiated.

With support from the EU, but driven primarily by the commercial consideration that Azerbaijan needed to sell its gas as well as its oil, final investment decisions for the pipelines comprising the Southern Gas Corridor were taken in 2013. Prompted by previous Russia-Ukraine disputes, the decade before the 2022 invasion also saw the development of new LNG import terminals and cross-border interconnections. This process, however, is not yet complete with further interconnectors being developed, notably in connection with a project to link Greece, Bulgaria, Romania, Hungary, Slovakia, Moldova and Ukraine known as the Vertical Gas Corridor.

The Southern Gas Corridor

The Southern Gas Corridor consists of three interlinked pipelines that collectively carry gas from Azerbaijan to Italy by way of Georgia, Türkiye and Greece. Together with increased LNG imports, it is a one of the two main pillars of European efforts to diversify gas deliveries and reduce or replace reliance on Russian gas. Connections to other pipelines, notably the Interconnector Greece-Bulgaria, enable Azerbaijan to supply gas to at least 12 customers in Europe.

The three pipelines are the South Caucasus Pipeline (Expansion) which runs from Baku to the Georgian border with Türkiye; the Trans Anatolian Pipeline (TANAP), which runs from the Turkish border with Georgia to Türkiye's border with Greece; and the Trans Adriatic Pipeline, which runs from the Greek border with Türkiye to Melendugno in southern Italy, where it connects with the Italian pipeline system (see map). The system has been fully functioning since 2020, with TAP currently delivering close to 13 bcma to markets in Southern and Central Europe. The first two pipelines ensure deliveries to Georgia and Turkey while TAP ensures deliveries to Bulgaria, Croatia, Georgia, Greece, Hungary, Italy, North Macedonia, Romania, Serbia, Slovakia and Slovenia. Deliveries to Albania are due to start in 2026.

Apart from Azerbaijani supply, the system also serves to enhance European energy security in two other ways. On the one hand, it has the flexibility for expansion that would enable it to carry gas from other Caspian producers, notably Turkmenistan, should a Trans Caspian Gas Pipeline ever be built. On the other it has connections both to the Interconnector Greece-Bulgaria (IGB), which was developed in sync with the SGC, and with the new Greek FSRU facility off Alexandroupolis.

Map 1: The SCP-TANAP-TAP System

Source: TAP-ag.com

Under a July 2022 Memorandum of Understanding between Azerbaijan and the European Union, the aim is to secure some 20 bcma of gas deliveries to Europe in or around 2027. Azerbaijan and the SGC operators have so far managed to increase throughput from an initial 10 bcma to around 13 bcma, but there are problems concerning further expansion of both the production required to increase deliveries and the infrastructure required – in effect, provision of further compression – to transit the gas. Leading European financial institutions are either reluctant to provide loans for fossil fuel activity or are simply barred from providing such loans. But Azerbaijan is committed to producing more gas; it has the resources that enable it to do so; the SGC system is designed so that it is capable of expansion; and its operators are committed to implementing such expansion as and when there is commercial throughput to be carried.

SOCAR, Azerbaijan's state-controlled oil and gas company, which will lead the effort to increase gas production from existing and new fields in the Caspian, says that long term supply contracts are necessary with European customers. A condition, which the EC is not at this stage willing to endorse.

In sum, there will be further expansion of the SCP, even though both the extent of the capacity increase and the timeframe for its implementation remain uncertain.

The Interconnector Greece-Bulgaria and the Alexandroupolis FSRU

The Interconnector Greece-Bulgaria (IGB), which started operations in October 2022, enhances energy security in Bulgaria and neighbouring countries by enabling access to both TAP and global LNG supplies through Greek terminals, notably the established Revithoussa LNG terminal and the new Alexandroupolis FSRU. It also constitutes one of the key foundations for the Vertical Gas Corridor.

The Alexandroupolis Floating Storage and Regasification Unit (FSRU) is particularly significant since It allows large volumes of LNG to be imported from the United States, Qatar, and other global suppliers, further boosting the region's role in reshaping gas flows into the continent and enabling landlocked countries such as Serbia and North Macedonia to tap into global energy markets. It entered service in October 2024 with a nominal capacity to handle 5.5 bcm/y. However, in January 2025, technical problems that damaged the high-pressure pipes forced the unit to cease functioning and, as of June 2025, it was only expected to return to full use in the autumn of 2025. Once it becomes fully operational, it will strengthen Greece's role as a crucial transit hub for gas supplies destined for Europe. Indeed, Greece stands to play a pivotal role in shaping further Europe's energy infrastructure and supply routes through the development of the Vertical Gas Corridor.

The Vertical Gas Corridor

The Vertical Natural Gas Corridor is an ambitious project that aims to enhance energy security in SE and Central Europe by creating an effective system for delivery of gas landed at Revithoussa or Alexandroupolis to be forwarded to destinations as far afield as Ukraine and Slovakia. But although the physical infrastructure connections have progressed far enough to allow for bids stage to be made to use the system to supply Ukraine, the costs for transiting gas through the system have so far proved too high to attract prospective shippers.

First conceived in 2014, following the signing of an MoU between Greece, Bulgaria and Romania and elaborated by IENE in a pioneering 2015 study **(10)**, the Vertical Natural Gas Corridor is envisaged as a system comprising both existing and planned pipelines. The Corridor starts in Greece, passes through Bulgaria and reaches Romania, where it splits, with one branch heading northwest to Hungary and Slovakia and other northeast to Moldova and Ukraine. The system would thus help a cluster of countries in Central, Eastern, and SE Europe to reduce and eventually phase out their dependence on Russian gas.

Map 2(a): Schematic Diagram of the Vertical Gas Corridor

Source: DESFA

Map 2(b): The Vertical Gas Corridor in SE Europe

Source: DESFA

In 2022, the national gas system operators of Greece (DESFA), Romania (Transgaz), Bulgaria (Bulgartransgaz) and Hungary (FGSZ), together with the operators of both the Interconnector Greece-Bulgaria (IGB) and the Alexandroupolis FSRU, signed a

Memorandum of Understanding concerning their participation in the Vertical Corridor and hence deepening cooperation in the energy field. Ukraine, Moldova and Slovakia joined the Vertical Gas Corridor in January 2024, in the sidelines of the Ministerial Meeting of Central and Southeastern Europe Energy Connectivity (CESEC) that took place in Athens. **(11)**

The Corridor, however, is proof that successful cooperation in physical development needs to be accompanied by managerial and regulatory cooperation. The first auction for capacity in the system was a failure as the tariffs demanded by the operators of the various Corridor elements were simply too high. However, in 2025 the core requirement of the system is for deliveries all the way through the Ukraine. In two or three years' time, as Neptun Deep comes on line, there will no longer be a need to move gas all the way along the system, since LNG landed at Alexandroupolis could, for example, simply be sent into Bulgaria and then onwards to further destinations in Central Europe while offshore production from Romania would be available for deliveries to Ukraine.

SE Europe as a Producer: Gas Prospects in the Black Sea

Romania and Türkiye are poised to become leading gas producers in SE Europe, reshaping the region's energy landscape. In addition, there is a distinct possibility that Bulgaria may also join this club. Romania already holds the distinction of being the largest natural gas producer in the region, with long established onshore reserves and production infrastructure. However, its future as a major supplier lies offshore, in the Black Sea. The Neptun Deep project, operated by OMV Petrom and Romgaz, is expected to start production around 2027, with initial production of around 4 bcma and eventually around 8 bcma. This would significantly boost Romania's current output and position it to become a potential exporter to neighbouring countries.

Türkiye, traditionally a major importer of gas from Russia, Azerbaijan, and Iran, has recently taken major steps toward domestic production. The discovery of the Sakarya gas field in the Turkish sector of the Black Sea marked a turning point. Production started in 2023 but is proceeding more slowly than the Turkish authorities anticipated due to severe technical difficulties. The goal of producing some 10 bcm per year by 2026-2027 looks unlikely to be met. Logically, Sakarya should enable Türkiye to reduce its dependence on foreign suppliers but this may take some time as Turkish consumption is still rising. In 2024, Turkey imported 56.39 bcm, of which 45% came from Russia. In 2024, imports totalled 52.2 bcm.

Table 4: Gas Supply and Demand in Türkiye, 2010-2024 (in bcm)

	2010	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Imports	38.0	48.4	46.4	55.2	50.3	45.2	48.1	58.7	54.7	50.5	52.2
Production	0.7	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.8	2.3
Exports (Greece plus)	0.6	0.6	0.7	0.6	0.7	0.8	0.6	0.4	0.6	0.9	1.8
Consumption	38.1	48.0	46.4	53.9	49.2	45.3	48.3	59.8	53.2	50.0	53.0
closing stock	1.9	2.1	1.7	2.9	3.2	3.1	2.9	1.9	5.3	5.4	5.0
stock change			-0.4	1.2	0.2	-0.1	-0.2	-0.9	3.4	0.1	-0.5

Sources: EPDK, Ankara

The field is operated by Turkish TPAO, and ongoing exploration could uncover additional reserves. However, while Turkish officials may talk of the idea of self-sufficiency in gas, it should be noted that Türkiye imported no less than 50.5 bcm in 2024, and the current import trend is still upwards.

Bulgaria's Han Asparuh prospect is becoming increasingly interesting. The operator is OMV Petrom (via its local subsidiary OMV Bulgaria) and optimism about its potential was enhanced with the disclosure in June 2025 that a first well, Vinekh-1, due to start in the 4Q 2025 and with results expected in 1Q 2026, would be immediately followed by drilling of a second well, Krum-I. The fact that a decision to drill a second well has been taken before drilling on the first well has begun, let alone produced any results for evaluation, is raising hopes that OMV and its Israeli partner, New Med Energy, may have another Neptun Deep on their hands. Development however would take some time. Romania's Neptun Deep is anticipating a four-year timeframe between the drilling of its first exploration well in 2023 and the start of actual production in 2027.

All three countries are not only seeking to develop domestic production but are also investing heavily in infrastructure. Bulgaria is building an extension to the IGB to improve its connection to the Trans Balkan system while Romania is integrated into the European gas grid via the BRUA pipeline, which connects Bulgaria, Romania, Hungary, and Austria. This positions Romania to become a reliable source of supply for Central and Eastern Europe. Similarly, Türkiye has become a critical transit hub, hosting pipelines such as TANAP and TurkStream, and is developing plans to act as a gas trading hub between Asia and Europe. This dual role — as a producer and transit country — enhances its strategic importance.

The role of Romania and Türkiye as gas producers is especially significant in the context of Europe's efforts to diversify energy sources away from Russia. Both countries offer geographically advantageous and politically stable alternatives, which could attract investment and strengthen regional energy security. Their growing role could also support the development of more competitive gas markets in SE Europe, where many countries still rely heavily on a single supplier.

In summary, Romania and Türkiye – and possibly Bulgaria - are set to play increasingly important roles in SE Europe's natural gas sector with their Black Sea discoveries and prospects constituting major additions to regional supply. Combined with their strategic location and the work of all three countries to expand their infrastructure, these developments could help reshape the future of energy in the region, enhancing the possibility of a real gas trading hub developing and supporting greater resilience and energy independence for SE Europe and beyond.

SE Europe as a market

Individually, the countries of SE Europe have relatively small energy markets. There is a lack of liquidity in market development and a corresponding dependence on reliance on external hubs for price setting. Collectively, a regional market would possess the critical mass necessary for long term supply contracts and real hub development enabling them to move from over-the-counter (OTC) trading to monthly and annual contracts, more akin to the trading products seen in such hubs as the Dutch TTF. In contrast, failure to develop energy markets within the region has the potential to cause instability, thus threatening transit systems.

SE Europe: bridge or bottleneck?

There is an overarching goal that governments in SE Europe should seek to achieve, which is to turn the region into an energy bridge rather than a bottleneck. With the European Union seeking to secure an end to all gas imports from Russia, turning the region into an energy bridge requires increased cooperation, speeding up the development of both LNG import facilities and interconnectors, and development of common regulatory practices. It also requires the strengthening of good governance throughout the region, not least in order to resolve the contradiction between Russian gas trying to head southwards via the TurkStream system and LNG and pipeline gas from Azerbaijan seeking to head northwards. This, in turn, requires consistency concerning the future use in reverse mode of the Soviet-era Trans Balkan Pipeline system linking Ukraine to Turkey and Greece and, in particular, clarity concerning how the Interconnector between Greece and Bulgaria should be used. Other projects that need to be progressed rapidly include the Serbia-Bulgaria interconnector, the North Macedonia-Greece pipeline, and the development of one or more regional gas hubs.

Moreover, a radical improvement in the quality of governance that focuses on countering corruption is imperative if the region is to develop and implement effective strategies to tackle the twin issues of energy security and climate change.

There is a 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 addresses the need to remove the most polluting fossil fuel of all, lignite, on which a number of countries (e.g. Bosnia and Herzegovina, Serbia, Kosovo and Bulgaria) still

rely for much of their basic energy provision. Such a strategy has to address such factors as the critical role of renewables, electrification, energy efficiency and innovation, if it is to ensure the long-term energy security of the EU without compromising the climate transition process. This requires governments in SE Europe to speed up their implementation of the REPowerEU Plan put forward by the European Commission in March 2022.

Greater cooperation is also needed for both import of LNG and allocation of imports. Gas imports at LNG regasification terminals in Greece, Croatia and Türkiye already play a crucial role in maintaining European security of supply; now there is a need for Bulgaria, Greece and Romania to consider whether they should conclude joint LNG import agreements with major suppliers such as Qatar, Algeria or the US that extend beyond emergency month-by-month deliveries. Likewise, they should sign solidarity agreements along the model of other EU member states in order to optimize the allocation of the limited volumes of alternative gas supplies that enter the region.

Hub development

Overall, SE Europe is becoming a pivotal geographical hub in Europe's energy landscape. Its gas infrastructure is being designed with future flexibility in mind, including the potential to transport renewable gases such as hydrogen and biogas. This forward-looking approach should ensure that today's investments will remain relevant as Europe moves toward climate neutrality by 2050. Through a combination of strategic location, new infrastructure, and diversified sources, the region is thus helping to secure Europe's gas supply while enabling the transition to a more sustainable and integrated energy system. However, it has yet to create the conditions in which its role as a geographical hub can be transformed into a true trading hub.

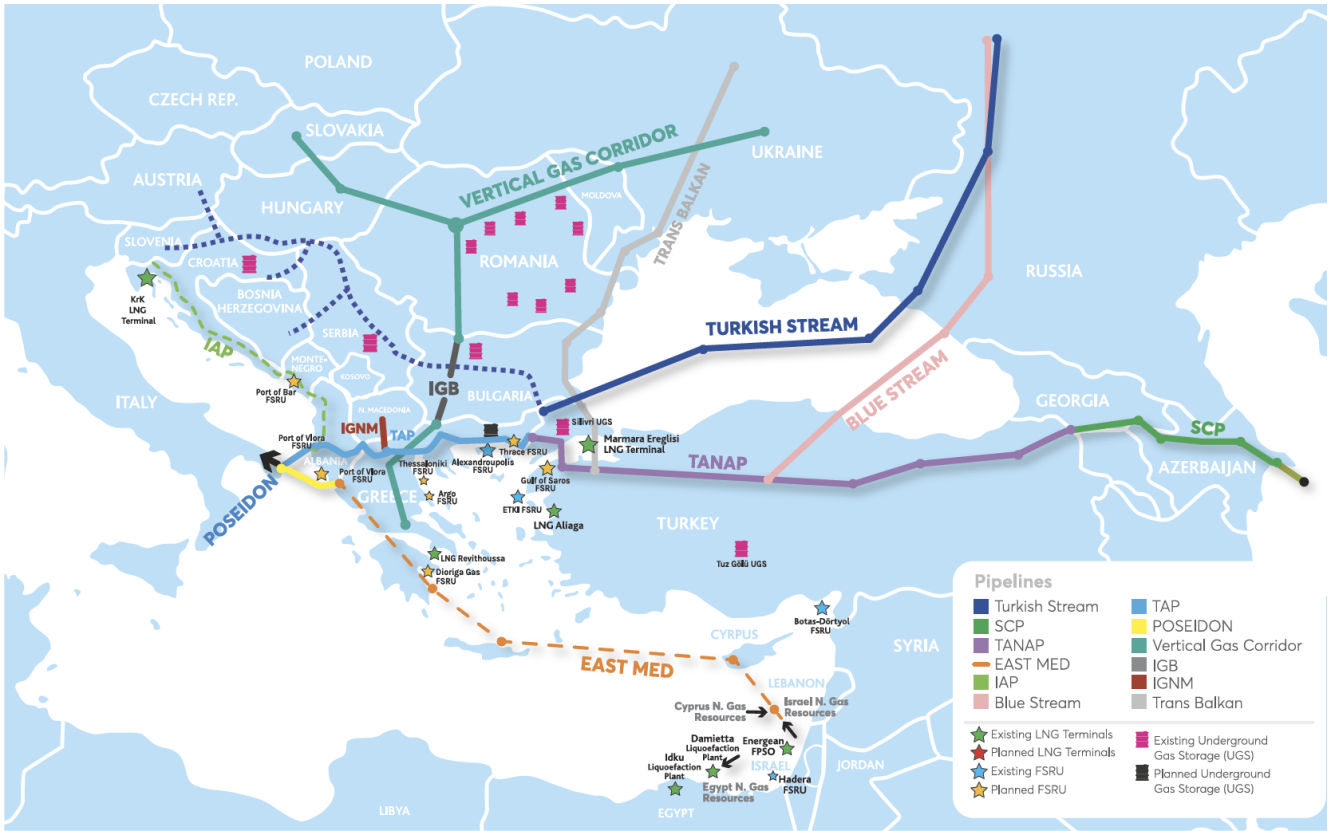
Moreover, the region's evolving role also comes with challenges. Political instability, regulatory fragmentation, and limited investment capacity can hinder progress. Nevertheless, EU financial support, national reforms, and multilateral cooperation are helping address these obstacles and strengthen the region's integration into the broader European energy system.

It is likely that there will be considerable further integration of both regional gas infrastructure and markets with the implementation of energy projects currently being developed and new projects envisaged in, and supported by, the EU's projects of common interest (PCIs). Such integration will likely include both new and existing gas supply sources, delivery systems, major gas trunk pipelines, LNG regasification terminals and underground gas storage facilities. This integration, however, needs to go hand-in-hand with the emergence of genuine gas hubs where gas from multiple sources can be freely traded and sold to multiple purchasers.

Such a system will take several years to evolve but it will serve to boost regional energy security by enhancing both resilience and sustainability in what is at still at present a cluster of small and often weak markets. The links between governments, system operators and regulators in the region that are currently under development as a result of cooperation on existing projects would be would be strengthened, encouraging harmonisation and consistency of regulations throughout the region (as opposed to the development of a totally integrated system subject to a single management system).

The timeframe for such integration remains uncertain, but the real progress being made in such projects as the Vertical Gas Corridor, the expansion of the Southern Gas Corridor, the LNG terminals in Greece and the production of offshore gas in the Black Sea and the East Mediterranean constitute solid grounds for optimism concerning SE Europe's ability to play a truly positive role in both regional and European energy security.

Map 3: The Expanded South Corridor



Source: IENE

6. The East Med as a Potential Gas Supplier to the EU

The Eastern Mediterranean region holds significant natural gas reserves (about 2.83 trillion cubic meters[3]), with Egypt and Israel leading in terms of volumes. These gas discoveries have the potential to transform the region into a major energy exporter, particularly to European markets seeking to diversify their energy sources.

However, a shadow hangs over the region in the shape of the hostilities between Israel and Iran and the repercussions on regional energy that may result from the outbreak of heavy bombing, missile and drone attacks between the two countries in the wake of Israel's strikes against Iranian nuclear facilities and military targets on 12 June 2025 (see box).

Box 1: What happens if Israeli pipe exports to Egypt falter?

The most critical energy relationship in the Eastern Mediterranean is that between Israel and Egypt. Egypt is the dominant gas market in the region while Israel and Egypt are the two largest producers. Yet even their combined production remains insufficient to meet persistently rising Egyptian demand.

The recent Israel-Iran war (June 13-24) has already had a profound impact on East Mediterranean energy. On 16 June, Israel halted production at its offshore Leviathan and Karish fields leaving only Tamar as a major source of production. At the same time, it suspended deliveries to Egypt. On 18 June, Israeli Energy Minister Eli Cohen acknowledged the fields were shut in on military advice and that Tamar was staying open in order to meet Israel's own gas requirements. Cohen was cautious about the resumption of exports, saying: "I hope I will be able to use another rig as soon as possible and use it for the supply of gas [exports]. For me, the most important thing is [supplying] Israel."[4]

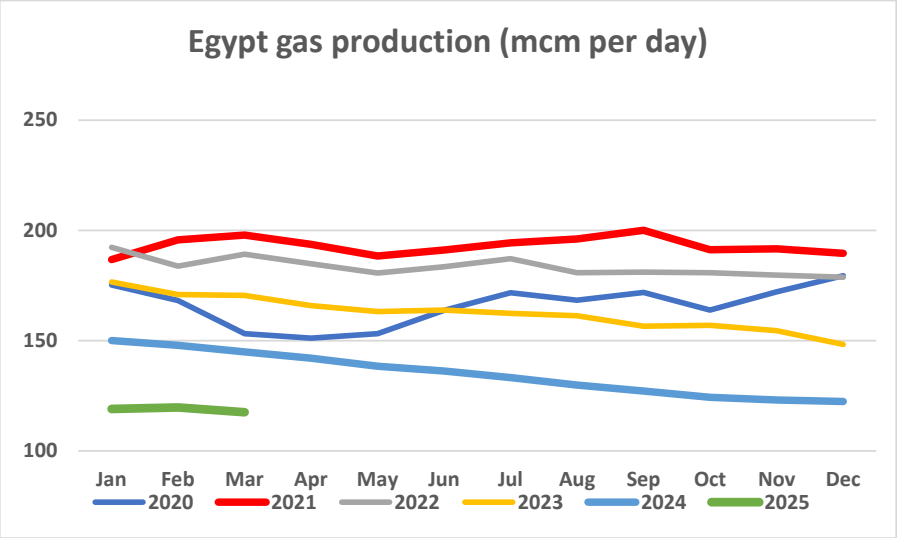
The consequences of a prolonged absence of Israeli supply for Egypt are serious. Israel routinely accounts for around 15% to 20% of Egyptian gas consumption. Egypt has entered its peak summer season and the need for gas for power generation, and power generation for air conditioning, will be immense. Already there have been indications that gas shortages are beginning to bite with all the country's urea plants halting production as soon as news came through of the halt to Israeli gas supplies. And these developments are also taking place against a background of prospective water shortages.

[3] Botrous, D. (2025), "Development of Natural Gas Resources in the Eastern Mediterranean Region during the First Quarter of the Twenty-first Century: A Study in Political Geography", *Journal of Sustainable Development in Social and Environmental Sciences*. 4. 190-212. 10.21608/jsdses.2024.316494.1037

[4] https://www.timesofisrael.com/israel-will-resume-natural-gas-exports-once-it-is-deemed-safe-says-minister/

In order to supplement gas supply, Egypt has already signed agreements to import no less than $8 bn worth of LNG this year and is now at close to maximum capacity for LNG imports. On the eve of the outbreak of open Israeli-Iranian hostilities, it had one new floating regasification and storage unit (FSRU) in place and three more on the way. If it needs to replace any or all Israeli supplies, it will probably also need to secure additional FSRUs, and these cannot be procured instantly.

Nor can Egypt simply step up production. Although output seems to have stabilised for the moment. Under current circumstances, provision of sustainable LNG deliveries from the liquefaction plants at Idku and Damietta looks highly unlikely until such time as major new regional supplies, such as from Cyprus, can come on line. And that may not be until 2030 or thereabouts.



Source: JODI

Additionally, a prolonged shut in of Leviathan and Karish not only threatens Egypt's already delicate gas balance but also Israeli supplies to Jordan, which relies heavily on Israeli gas. In this context the move from Jordan to Egypt of an FSRU previously used to bring gas into Aqaba may cause further problems for the energy-short Kingdom.

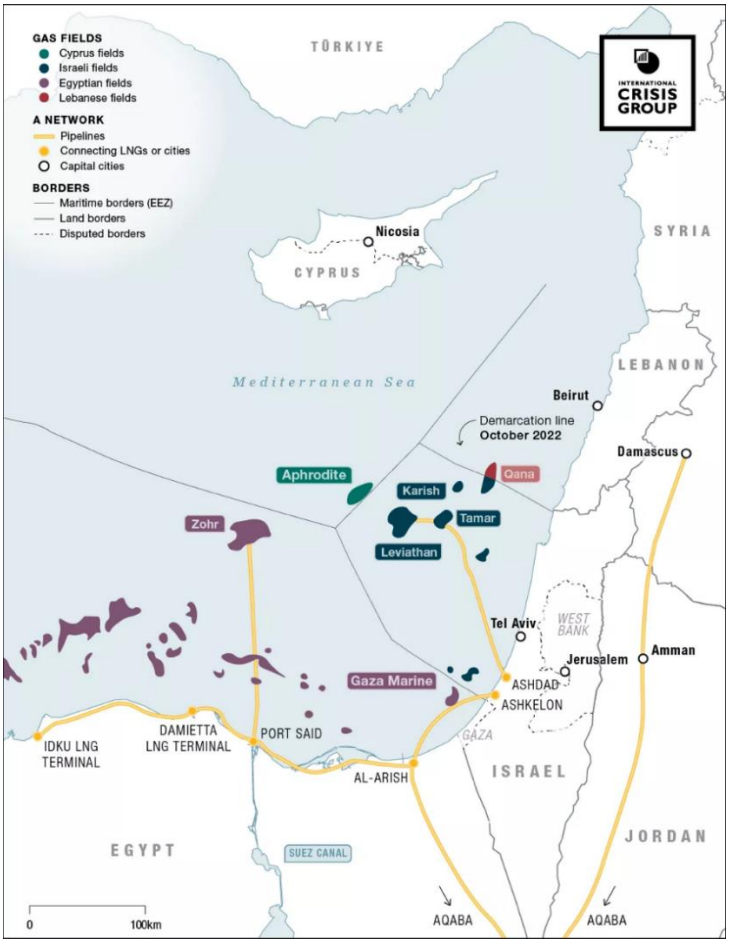
Other issues also need to be borne in mind. One is political: the danger that military hostilities between Israel and Iran may reignite and might force Arab governments, under pressure from their own populations, to place support for fellow Muslims above the traditional Sunni-Shia divide. Although Israel has resumed regular exports, the Egyptian authorities may at one point come under pressure to refuse to allow Israeli imports. A second issue is whether Iran, which during the 12-day war hit an Israeli oil refinery, might successfully strike Israeli gas facilities, either directly or indirectly via its Houthi allies in Yemen. Even the threat of such action might prove destabilising.

Although the largely aerial war, which took place between Israel and Iran (June 13-25), did not impact Israeli energy export operations, various elements need to be borne in

mind. One element is whether Iran, directly or indirectly via its Houthi allies in Yemen, might still successfully strike Israeli gas facilities, thus causing a halt or limitation of exports. Even the threat of such action might prove destabilising. If, for whatever reason, Israeli deliveries to Egypt were to be suspended, Egypt would then face a real supply problem.

In the present climate, the long-term future of natural gas supplies is not assured. The world is transiting to clean energy and many countries, including EU member states, have signed up to net-zero emission targets. In 10-15 years, the world may be facing declining gas demand and challenging markets – as Europe is now. If plans to export East Med gas outside the region do not mature soon, it risks missing the export-boat altogether.

Map 4: Natural gas reserves in the East Mediterranean



Source: International Crisis Group

There is a case that Europe will require additional gas supplies and that the East Med will be in a position to contribute. The problem is the timeframe. As noted previously, as European gas demand is in a permanent decline , there will be a need for gas imports for many years – possibly decades – to come. This means there is scope for both existing suppliers such as Azerbaijan to increase their deliveries and for new

suppliers, such as those in the Eastern Mediterranean, to enter the market. A recent falling off of US LNG exports to Europe, coupled with increased US interest in exports to markets in the Asia Pacific region, may offer possibilities for new entrants.

The future is regional

Outside Europe, there is a massive market in the East Med that can – at least in theory – absorb most local gas production. That is Egypt. However, this market is only available at a very high cost to both current and prospective suppliers. Years of declining production have turned Egypt from an exporter to a net importer of gas and LNG in particular to satisfy its ever-growing demand for gas both for power generation and as feedstock for its petrochemical and fertiliser industries. Although Egypt is expected to spend about $8 billion on LNG imports in 2025, long-term reliance on Egypt to purchase regionally produced gas is a questionable proposition. Energy prices within Egypt are heavily subsidised and this puts pressure on producers to sell their gas to Egypt for less than they can secure from sales to wholly commercial markets in Europe.

There are substantial issues that need to be addressed if East Med gas is to be channeled to Europe. One is whether guarantees will be required for producers in Israeli and Cypriot waters currently planning to use the existing Egyptian liquefaction facilities at Idku and Damietta to monetise gas that they have produced or are intending to produce into LNG, which can be exported to destinations in Europe and elsewhere, without risk of Egyptian authorities insisting that some or all of the gas be made available for their own domestic market.

Another issue is whether there are both sufficient resources and sufficient political and commercial will amongst the cluster of producers working in the Eastern Mediterranean to support development of either an onshore liquefaction plant in Cyprus or floating liquefaction facilities in either Cypriot or Israeli waters. A third option, a pipeline to Greece and then on to Italy (see East Med pipeline), appears to be technically feasible but is potentially highly expensive. On a more modest scale, a pipeline connection to Türkiye would almost certainly prove commercially viable but would also require substantial shifts in regional geopolitics.

Current developments

The East Med is both a proven resources base with major fields such as Israel's Leviathan and Egypt's Zohr contributing to regional gas supplies. Moreover, a cluster of international companies and consortia is already engaged in ongoing exploration or developing more recent discoveries.

The current situation is that new projects in Israel have been sanctioned to increase gas exports to Egypt from about 10bcm/yr at present to 21 bcm/year by 2028. Egypt

is also in discussions with Cyprus to import gas from the 2.5 tcf Cronos and 3.5 tcf Aphrodite gas fields. Inter-governmental agreements to facilitate these projects were signed on 17 February 2025 by the countries' presidents in Cairo. These should clear the way for the field operators, Eni and Chevron, to agree field development plans with Cyprus's Ministry of Energy.

Eni plans to follow-up on this later this year. Cronos will be developed subsea, with the gas transported to the Zohr facilities for processing. Most will be exported to the gas-hungry Egyptian market, but some of it is likely to be liquefied at Damietta to service Eni's existing LNG clients.

But there are still question-marks about Chevron. The immediate hold-up is resolution of the dispute with Israel's Ishai Group which claims that the Aphrodite gas-field extends into the Israeli EEZ. This is expected to be clarified during the next few months. The big challenge, though, that weighs heavily in the minds of the oil and gas companies, is Egypt's ability to maintain regular payments in the longer-term and willingness to pay market-prices for this gas. These are the main reasons why, so far, these companies have not been expediting new gas projects offshore from Cyprus.

Map 5: South Crete I and II Offshore Blocks

Source: International Crisis Group

In early 2025, Chevron expressed interest in exploring three offshore blocks in Greece: two located south of Crete—South Crete I and South Crete II—and one off the southwestern coast of the Peloponnese peninsula. These areas are adjacent to concessions held by other major energy companies, such as ExxonMobil and Helleniq Energy. The Greek Ministry of Environment and Energy has accepted Chevron's expressions of interest and has launched international tender for these blocks. Chevron has been in discussions with Helleniq Energy, regarding potential

collaboration in existing offshore concessions in the Ionian Sea and south of Crete. These talks may lead to Chevron acquiring stakes in these areas, further solidifying its role in Greece's and in the region's energy landscape.

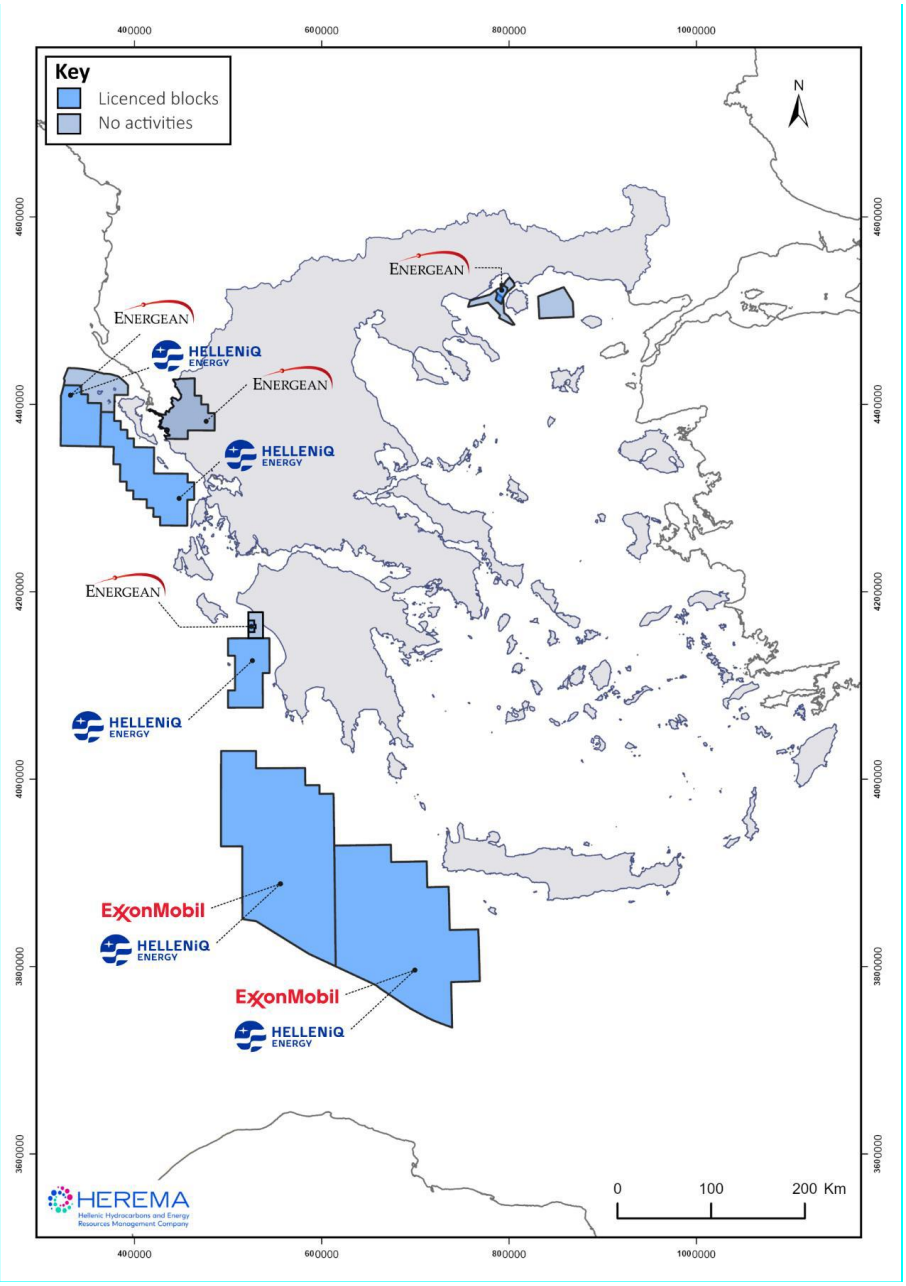
In addition, Greece is actively exploring its natural gas potential, particularly in offshore regions near Crete, with ExxonMobil playing a pivotal role in these efforts. In partnership with Helleniq Energy, ExxonMobil leads a consortium conducting seismic research in its offshore block to the southwest of Crete. The first phase, completed in October 2024, involved acquiring 7,789 kilometres of 2D seismic data—significantly exceeding the required 3,250 kilometres. This extensive data collection indicates a strong commitment to assessing the area's hydrocarbon potential. The consortium has now entered the second phase, focusing on collecting and analyzing 3D seismic data over a three-year period. The results will inform decisions on potential exploratory drilling. ExxonMobil's involvement underscores the significance of Greece's offshore gas reserves in the broader context of European energy diversification and security, as shown in Map 5.

The ExxonMobil factor

Following the successful exploratory drilling in Egypt's North Marakia block, ExxonMobil has just started drilling a promising target, Electra, in Cyprus block 5, to be followed by Pegasus in block 10. Should Electra turn-out to be as big as some reports claim, 30 tcf, it would require a number of appraisal wells over 2-3 years before development options can be firmed-up. Depending on the shape of the global LNG market in the next decade, discovery of even 10 tcf or more gas could be sufficient to support a world-class LNG export project, targeting Asia. The most-likely location of such a project would be Vasilikos in Cyprus, but another option would be to revive the now-under-utilized LNG plants at Idku and Damietta in Egypt, which have a combined capacity of 12.5 million tonnes of LNG per year.

Given ExxonMobil's processes for planning and sanctioning new major projects, such a project is unlikely to become operational before the early 2030s. So far, Cyprus has discovered close to 400 bcm (more than 14 tcf) of gas and ExxonMobil, which is anticipated new discoveries, could add to this. Clearly it is important to develop this resource and utilize as much of it as possible regionally to cover the region's growing energy needs during transition. Today, gas and LNG can contribute to decarbonisation by displacing oil and coal in the power sector. To that extent, regional cooperation to facilitate exploitation of East Med's gas resources can make a difference.

Map 5: Current acreage map in Greece



Source: HEREMA

All these developments are taking place a background of contentious maritime boundaries associated particularly with Turkish assertions to extensive offshore areas around both Cyprus and Crete. Although there have been occasional confrontations, Turkish actions have not stopped exploration activity, since these are in waters to the south of the island which not only fall within the prospective Exclusive Economic Zone of the island as a whole but are effectively beyond any EEZ that might reasonably accrue to the Turkish North, were it to be considered an entity with a right to its own EEZ.

The biggest outstanding issue is Türkiye's assertion that it has a common maritime boundary with Libya, following an agreement reached between Türkiye and Libya in

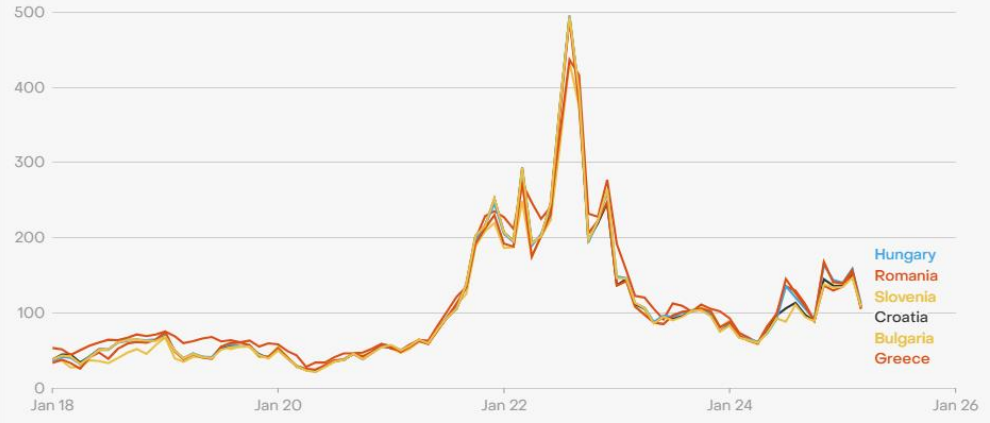
November 2019. An assertion that can only be made by ignoring the existence of Crete and which therefore has no substance in international maritime law (i.e. UNCLOS). Hence, the Greek government has declared the said agreement as null and void under international law. There have also been suggestions that Türkiye and Syria might enter into a maritime zone agreement similar to the disputed agreement between Türkiye and Libya. But there are no indications that the seas between Cyprus, Syria and Türkiye have any hydrocarbon potential while any such agreement would not affect the areas south of the island where all the current gas field discoveries are located.

7. Electricity Markets in SE Europe are a Cause for Concern

Electricity in SE Europe is cause for concern in view of extreme price volatility and problems of basic supply. The price volatility issue has profound implications for both national economies and European unity since its principal element is a divergence – at one point, an extreme divergence – in wholesale electricity prices, with those in SE Europe being much higher than those in western and northern Europe. Moreover, electricity supply poses energy security issues in its own right, in the form of interruptions and blackouts.

The need to revitalise SE Europe's electricity systems was highlighted in the summer of 2024 when the region experienced a major energy crisis as wholesale electricity prices in Central and Southeast Europe rose sharply. There had been an earlier crisis in 2022, when electricity prices soared in the wake of Russia's invasion of Ukraine and subsequent fuel shortages (see Figure 3), but the impact of that crisis had been felt throughout the continent, whereas the 2024 crisis impacted only on SE Europe and parts of Central Europe.

Figure 3: Wholesale electricity prices in selected SE European Countries (€/MWh)

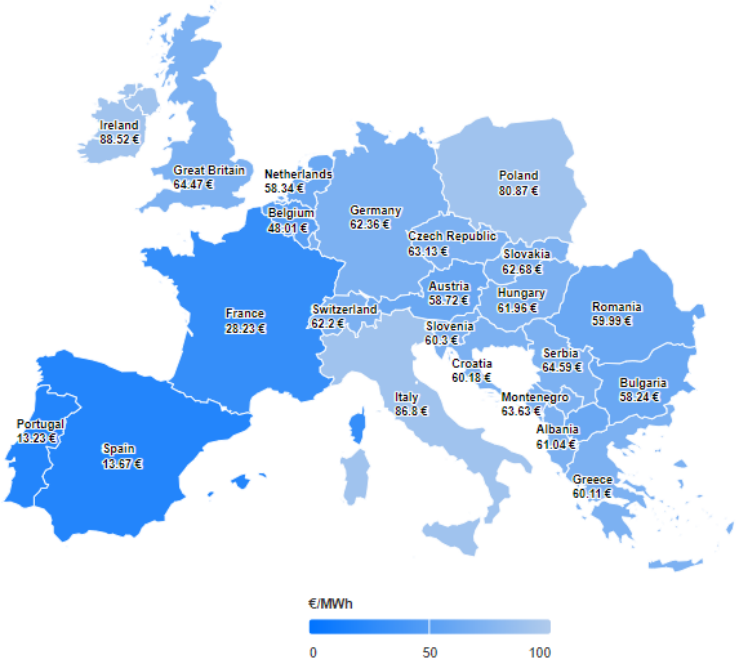


Source: Ember

There was a significant weakening in market coupling, as wholesale prices in these regions increased by two or three times across countries and even more during peak hours. Various factors such as heatwaves, geopolitical tensions, infrastructure limitations and market dynamics might all help to explain the price increase. But the uneven nature of the shock demonstrated that small dislocations in one part of the system can create massive and disproportionate impacts across a much wider region. Overall, wholesale electricity prices in Central and SE Europe rose sharply, resulting in a massive divergence between wholesale electricity prices in Hungary and SE Europe by comparison with Austria and countries in western and northern Europe. This gap is

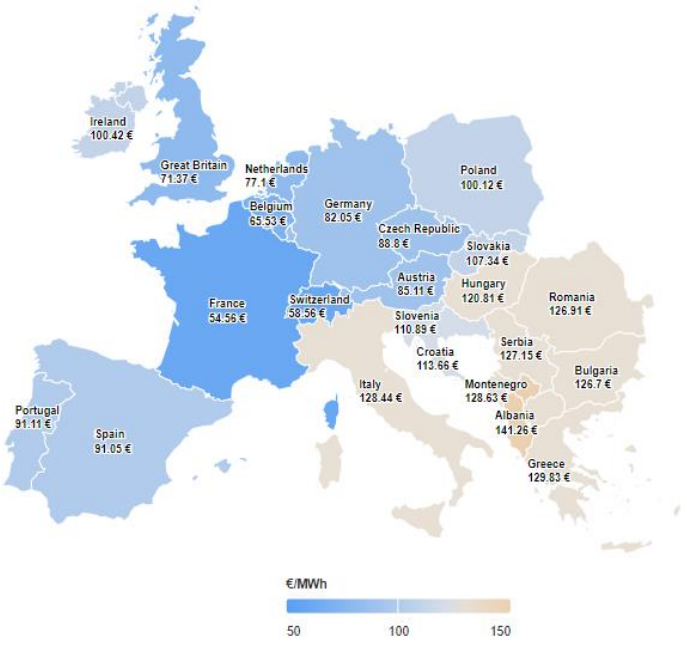
shown in Maps 6 and 7, which show day ahead prices in April 2024 and August 2024 respectively. Map 8, shows that by May 2024 the gap had eased, but was still present.

Map 6: Wholesale Day-ahead electricity prices in Europe, April 2024



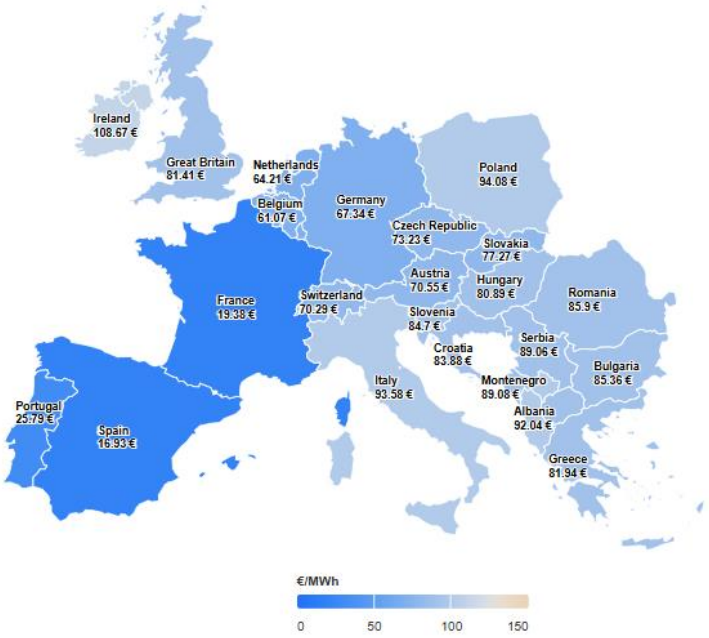
Source: Energylive

Map 7: Wholesale Day-ahead electricity prices in Europe, August 2024



Source: Energylive

Map 8: Wholesale Day-ahead electricity prices in Europe, May 2025



Source: Energylive

This happened despite the fact that electricity market operations in SE Europe use the EU's Target Model, which aims to stabilise markets across most of Europe by means of an enhanced network of interconnectors, thus leading to the effective development of a single market for electricity from the Baltic to the Mediterranean and from the North Sea to the Black Sea.

The concept of marginal pricing, which determines electricity prices based on the cost of the last unit needed to meet demand, is central to many liberalized electricity markets but has not been explicitly discussed in relation to the Target Model in SE Europe. This omission creates confusion about how the Target Model—designed to integrate EU electricity markets—actually influences price formation in the region.

To clarify the link, it is essential to outline how the Target Model implements marginal pricing through mechanisms, such as day-ahead markets, cross-border capacity allocation, and market coupling. In SE Europe, the application of these elements has been uneven, with varying degrees of integration and regulatory readiness. As a result, electricity prices often reflect local market inefficiencies or capacity constraints rather than the theoretical efficiencies promised by the Target Model.

In September 2024, such was the upward momentum on electricity prices in Greece, with the government having to reintroduce subsidies to households, that the Greek Prime Minister, Kyriakos Mitsotakis, felt compelled to send a strongly-worded letter to the European Commission. SE Europe was struggling to keep the lights on, he said **(12)** and the EU had to do something about it. The solution Mitsotakis proposed

focused on creating a centralised energy market regulator and greater integration of national grids. On the face of it, this is a solution that makes sense, although, because of technical inadequacies, it may end up doing more harm than good.

In his letter Prime Minister Mitsotakis highlighted that wholesale electricity prices in Greece had surged from €60/MWh in April 2024 to €130/MWh by August 2024. With other countries in a similar position, Mr. Mitsotakis described the situation as a "regional crisis." He noted that, compared to the previous summer, wind and solar power generation had increased by 25%, while lignite-based production had declined by 27%. Of course, there is no guarantee that higher RES share in the electricity mix will necessarily lead to lower electricity prices, since so many other factors come into play in determining market prices.

Mitsotakis emphasized the concerning gap between Greece's strong progress in the energy transition and the sudden, sharp rise in electricity prices. "This disconnect demands a political solution," he warned, adding that if left unresolved, it could harm citizens, weaken economic competitiveness, and jeopardize public support for the EU Green Deal. It is worth noting that wholesale electricity prices in Greece fluctuated at €132/MWh in Q1 2025, while the Greek PM suddenly became aware that the high RES penetration and low coal use do not necessarily lead to lower electricity prices.

According to market analysts, a key reason for the electricity crisis in SE Europe in September/October 2024 was the disappearance of Ukrainian electricity exports to neighbouring countries as Russia methodically sought to destroy the country's power grid, which now has 70% of its previous capacity. For the region, this means that reliance on Ukrainian electricity exports is over and new ways must be secured to augment electricity supply in Central and SE Europe. At the same time, there is also a need for Ukraine to import electricity from the rest of Europe to make up for lost local generation, which naturally reduces the volume of electricity available for internal markets in SE Europe. **(13)**

The Greek PM's suggestion for greater grid integration essentially comes down to facilitating more exports of electricity between neighbouring countries in the region. This, he argued, would help secure supply and bring prices down—a big problem for governments in the region, as it requires considerable investments in expanding electricity grid infrastructure. More interconnectors would indeed help regional exports. However, a problem that we may face here is that they could jeopardise local supply of electricity.

When countries commit to exporting certain amounts of electricity to their neighbours they are bound by contracts to do so. The bind stands regardless of how much electricity local generators produce, although stipulations about minimum guaranteed supply for the local market are always sensible. However, electricity output can vary, especially with weather-dependent generators such as hydro, wind, and solar. This

could result in shortages either for the local or the regional grid.

Following the Greek PM's letter to the European Commission's President, Greece, Romania and Bulgaria are developing a proposal for an intervention mechanism that would activate whenever wholesale electricity prices in SE Europe spike sharply due to the region being disconnected from the broader European energy market **(14)**.

Also, North Macedonia has separately called on Energy Community Secretariat Director Artur Lorkowski to launch an investigation into the causes behind the significant electricity price gap. The request, signed by Minister of Energy, Mining and Minerals Sanja Božinovska and Regulatory Commission President Marko Bislimoski, highlighted several contributing factors: reduced electricity flows due to extensive maintenance on key interconnections, coal plant overhauls and reconstruction efforts, extreme summer heat, low hydropower output, and Ukraine shifting from exporter to net importer of electricity. These issues have created a widening divide in prices between the Balkans and Hungary on one side and Central and Western Europe on the other. (15)

Another critical issue is intense electricity market volatility, which illustrates the structural differences on how electricity markets in the region operate. Balkan countries rely on the Net Transfer Capacity (NTC) model to allocate transmission capacity, while Central and Western Europe use the more complex Flow-Based Market Coupling (FBMC) approach. The FBMC algorithm can severely restrict or entirely block electricity flows from Germany and Austria into Hungary, which serves as the main power hub for the region and a key supplier to Ukraine. As a result, Ukraine increasingly sources electricity from the south, further driving up prices in SE Europe.

As electricity market volatility and high prices continued well into the fourth quarter of 2024, the Greek Prime Minister Kyriakos Mitsotakis felt necessary to send a second letter to Ursula Von der Leyen in January 2025 to request that the European Commission should consider new ways to bring down gas and electricity prices. "Prices are telling us we need to move faster but also differently – to think about new ways to tackle the problems that confront us," Mitsotakis said in the letter, according to Bloomberg News. Mitsotakis urged the EU to better integrate national grids and said it needs a new push in gas security. "Shifts in the geopolitical landscape make this task even more urgent," he said, underlining that even though Europe is preparing for a future where gas will play a smaller role, "we will depend on gas for at least two decades." He called on the EU to empower European companies to invest in gas projects and infrastructure and to sign contracts that guarantee access to global supplies. For electricity, the prime minister called for a task force to be set up to increase flows across borders where there are significant price disparities.

In January 2025, Mitsotakis reiterated his concerns and proposed a more comprehensive approach to energy market challenges. He pointed out the persistent

disparities in electricity prices, with some EU countries facing triple-digit prices, while others experienced minimal or even negative costs. Mitsotakis called for the creation of a special task force to enhance cross-border electricity flows, especially in regions with significant price differences.

He also advocated for a re-evaluation of the EU's approach to energy network planning, emphasizing the need for substantial investments in power grids to support increased renewable energy integration, a balanced strategy for natural gas imports to ensure competitive pricing and supply security and limiting excessive regulatory burdens related to pollutant emissions to maintain economic competitiveness. Mitsotakis emphasized that these proposals align with the EU's goals for competitiveness and the successful implementation of the Green Deal.

As Greece is set to advocate for the completion of the single energy market, Prime Minister Mitsotakis emphasized the need for stronger governance within the EU energy system—specifically, mechanisms that would grant the EU greater influence over national decisions with potential regional impacts, such as planned power outages. He also called for enhanced regulatory oversight, proposing the establishment of a pan-European electricity regulator capable of monitoring multiple markets simultaneously to ensure transparency and reassure the public that manipulation is not taking place. Regarding exports to Ukraine, Mitsotakis noted that the strain is unevenly distributed, disproportionately affecting countries lacking adequate internal EU electricity transfer capacity.

Furthermore, the Greek PM highlighted that Greece is already applying a windfall tax on energy companies, using the revenue to subsidize vulnerable consumers, and is exploring additional tools under the new EU electricity market framework to protect households during periods of extreme price volatility. Currently, EU rules only allow market interventions after sustained high prices, but Greece—along with Romania and Bulgaria—plans to propose a mechanism for immediate action in response to sudden price surges. Mitsotakis also stressed the urgent need for advancing cross-border interconnectors, arguing that extreme price differences between countries strengthen the case for investing in grid integration. **(16)**

Both letters by the Greek PM underscore Greece's proactive stance in seeking EU-wide solutions to energy market challenges, aiming to ensure fair pricing, market stability, and the successful transition to sustainable energy sources. However, the EC snubbed the Greek PM since its official response was neutral to negative, claiming that the Target Model is working well for most EU electricity systems.

According to press reports **(17)**, the three Balkan countries are advocating for a portion of electricity market revenues to be allocated to grid upgrades and the development of robust cross-border connections. Internally, Greece continues to grapple with market distortions. Meanwhile, Eurelectric **(18)** has pointed to reduced power exports

from France and higher natural gas prices as key conributors to regional price disparities.

However, maintenance-related outages are expected to rise, as illustrated by Bulgaria's Kozloduy nuclear plant taking one of its reactors offline until November 30, 2024, cutting 1 GW from the regional grid. Much will now depend on winter temperatures. Romanian Energy Minister Sebastian Burduja called on the EU to offer compensation for Eastern Europe's high price differentials, stressing that countries like Romania cannot continue to bear the burden alone while supporting neighbors like Moldova and Ukraine. "If we truly belong to a single European energy market," he said, "we cannot accept a situation where only some nations are left paying the bill with prices two to three times higher than in the rest of Europe", Burduja stressed, as quoted by Agerpres. **(19) (20)**

In short, electricity is emerging as a key energy security risk in SE Europe due to the volatility and unpredictability of prices, as well as to the growing importance of grid stability and availability of interconnections. Beyond gas and oil supply concerns, the region now faces potential economic disruption from prolonged blackouts, as recently demonstrated in the Iberian Peninsula (see Box 2).

Box 2: The Iberian power outage

Spain's government and its grid operator have issued separate findings into the causes that led to the massive blackout across Spain and Portugal on April 28, which caused gridlock in cities and left thousands stranded on trains and in elevators across the Iberian Peninsula.

What Caused the Blackout?

The Spanish government said in a recent report that Spain's grid operator Redeia miscalculated the correct mix of energy in the system. The government also blamed some conventional power plants, or thermal power plants using coal, gas and nuclear, for failing to help maintain an appropriate voltage level and as a result, the grid was unable to cope with a surge in voltage that triggered a cascade of power plant disconnections, ultimately leading to the outage.

Redeia recently said that a surge in voltage was the immediate cause of the outage but blamed it on conventional power plants failing to control the voltage level. It pointed instead to anomalies in the disconnection of power plants on April 28 and an unexpected spike in electricity demand from the transport network.

What Should Have Happened?

Grid operators typically use a raft of tools to ensure power systems have the right frequency, voltage and supply to keep them stable. The government report said the

number of generators the grid had available to provide voltage control on April 28 was lower than it had in previous weeks and that not all units that should have responded did so as expected. The companies operating the plants that failed to ensure the proper voltage controls have not been named and Redeia's report also did not identify them.

Spain's Energy Minister Sara Aagesen told a news briefing in Madrid that the grid operator did not have enough capacity to regulate voltage. However, Redeia's operations chief Concha Sanchez recently said that based on the grid's calculations the grid had planned adequate voltage support, but some plants did not respond as expected.

Were Renewables to Blame?

Not exactly. Both the government and Redeia said renewable energy sources were not responsible for the blackout. Spain is one of Europe’s biggest producers of renewable energy and has a high share of solar power, which accounted for 59% of the country’s electricity mix at the time of the blackout. According to Redeia, the blame lies with conventional power plants and their lack of proper voltage control. However, according to grid management experts of a major European company, control of the energy mix becomes increasingly complex as intermittent RES take hold of the grid which becomes progressively difficult to manage.

Did the French Power Link Play a Role?

At the time of the outage, Spain was also exporting power to France and Portugal. Energy Minister Aagesen explained that at 12:03 p.m., an "atypical" oscillation was detected in the power system. In response, the grid operator implemented standard control procedures, including reducing electricity exports to France. While these actions successfully mitigated the oscillation, they also caused a secondary effect: an increase in voltage, according to the report.

What Happens Next?

The government recently said it will propose measures to strengthen the grid and improve voltage control. It also plans to better integrate the peninsula with the European grid, it said. The government report will go to the European Network of Transmission System Operators which is doing its own inquiry. Any parties found responsible for the blackout may be liable for losses incurred during the outage, subject to any legal action.

The main conclusion concerning the issue of electricity and energy security in SE Europe is that the region's electricity systems are currently becoming more unreliable as the role of renewables – which are intermittent – increases while the role of traditional baseload fuels, notably coal, diminishes. Hence, there is a constant need for consistent and competitively priced baseload.

In addition, there are the geopolitical risks associated with electricity transmission projects, where neighbouring countries dispute each other's Exclusive Economic Zone (EEZ), as it is the case between Greece and Türkiye in connection with laying out a major electricity link between Crete and Cyprus (see Box 3).

These issues illustrate the increased risk in energy supply, which will increase with the further development of electrification in the region. As policymakers aspire to transform and make energy systems entirely electric, we are facing increasing challenges and security risks. This is clearly demonstrated in the core of SE Europe, where the development of electricity grids has not matched the growth of installed generating capacity. The difference between electricity systems and other types of fuel (e.g. oil and gas), concerning risk characteristics, is that they are more vulnerable as their operation relies on a host of subsystems and extended infrastructure, such as electricity grids, interconnections, substations, inverters, power electronics, etc.

Lastly, there is the fact that these problems are also profoundly significant for gas, since gas is responsible for a large part of power generation. Moreover, as the region looks to secure stable baseload provision in ways that help mitigate climate change, the indications are that gas will play an ever greater role in electricity generation throughout much of the region, despite all the problems stemming from the loss of Russian gas supplies in the wake of Russia's February 2022 invasion of Ukraine.

Box 3: The Great Sea Interconnector (GSI)

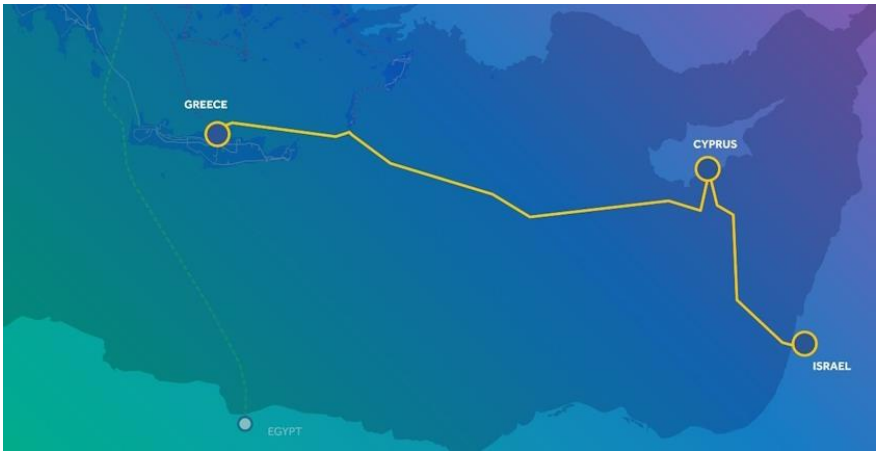
The electricity interconnection linking Greece, Cyprus and Israel, known as the Great Sea Interconnector (GSI), is one of the world's largest submarine power transmission projects, with a total cost of about €2.0 billion. Initially connecting Greece and Cyprus, with Israel to follow at a later phase, the project will establish a reliable and bidirectional subsea power link, which will help Cyprus end its energy isolation by contributing to the balancing of its electricity system. The GSI is also designed to enhance the further use of RES across the three countries. In effect, the GSI will make possible the linking of the European electricity grid to those in Cyprus and Israel. It is designed to enhance the efficient use of RES across the three countries, significantly cutting CO_2 emissions, while also providing Europe with an alternative energy supply route. The segment currently under construction, spanning 898 km between Cyprus and Crete (Greece), has secured €657 million in funding from the EU's Connecting Europe Facility. The submarine cable works have been awarded to French company

Nexans, and Siemens of Germany has been named the preferred contractor for the converter stations.

The cost-benefit study for the Cyprus-Israel section of the GSI, which constitutes the second part of the Greece-Cyprus-Israel electricity interconnection, has been recently presented to the competent regulatory authorities of Cyprus (CERA) and Israel (PUA) by Greece's Independent Power Transmission Operator (IPTO) as the project promoter, in the presence of representatives of the energy ministries of the two countries, as well as a representative of the Directorate-General for Energy of the European Commission.

The study confirms the significant benefits of the project for the two countries that the project interconnects, Cyprus and Israel. The two regulators are now expected to issue a joint decision on the Cross-Border Cost Allocation, which concerns the sharing of costs between the countries and the securing of the project's revenue.

As the IPTO stated, these procedures constitute the first critical step for the maturation of the project, in accordance with the European TEN-E Regulation, in order to establish the necessary regulatory framework that will ensure its revenue and enable its construction.



Source: IPTO

However, there is clear lack of progress when it comes to the laying out of the cable, as a number of geopolitical issues have emerged over the last 12 months. The most important of which is related to the difficulties experienced by IPTO in carrying out research on the seabed for the exact route for the laying out of the cable. In July and December 2024, research vessels, hired by IPTO, were prevented from carrying work following interference by Turkish navy ships off the island of Kasos and North East Crete respectively. Türkiye does not accept Greece's Economic Exclusion Zone in the Aegean and surrounding seas **(21).** The issue is still pending as the Greek government has instructed IPTO to refrain from carrying out any further work for fear of provoking Turkish reaction.

8. Demand-side Management and the Impact on Energy Security

Governments often prioritize energy supply-focused policies to strengthen energy security, frequently overlooking demand-side strategies. Most existing indicators and indexes used to assess energy security are also heavily weighted toward supply factors. However, this supply-centric perspective fails to fully reflect the actual vulnerabilities faced by states, businesses, and individuals during energy crises. In fact, a 2024 study by an international team of researchers found that demand-side measures offer significantly greater potential for reducing vulnerability to energy disruptions than supply-side approaches. (22)

But demand-side management policies are not being pursued at a large scale and in a formal policy. Demand-side management plays a critical role in improving energy security by ensuring reliable power supply, reducing costs, and enhancing grid stability. It helps balance supply and demand, minimizes reliance on expensive backup power generation, encourages energy efficiency, and supports the integration of renewable energy sources. By optimizing energy use across different sectors, demand-side management contributes to a more resilient and sustainable energy system, which is crucial for maintaining energy security in the face of growing demand and geopolitical uncertainties. (23)

Demand-side management refers to strategies and policies aimed at influencing consumer demand for energy, typically to improve efficiency, reduce peak loads, and support overall energy system stability. Rather than expanding energy supply through more infrastructure or imports, demand-side management focuses on optimizing consumption patterns, encouraging users—both households and industries—to shift usage to off-peak times, adopt energy-saving technologies, or reduce consumption altogether. This approach is increasingly vital in energy systems undergoing decarbonization and digitalization. (24)

From an energy security perspective, demand-side management plays a critical role in reducing dependence on volatile or insecure energy sources. By curbing demand, especially during times of supply stress (such as geopolitical disruptions, extreme weather, or high market prices), demand-side management can mitigate the risk of shortages and blackouts. For example, during the 2022-2023 European gas crisis, several countries introduced incentives and regulations for reduced energy use, which helped avoid more severe supply constraints. In this way, demand-side management becomes a flexible tool for both long-term planning and emergency response.

Technological innovation has significantly enhanced the effectiveness of demand-side management. Smart meters, demand-response platforms, and real-time pricing systems allow energy providers and users to dynamically adjust usage in line with grid

conditions. These digital tools also help integrate renewable energy by aligning demand with variable supply—such as shifting usage to when solar or wind power is abundant. In doing so, demand-side management supports both energy security and sustainability goals, helping countries reduce fossil fuel reliance without sacrificing grid reliability.

Behavioural change is equally essential to demand-side management success. Public awareness campaigns, financial incentives, and regulatory frameworks all play a part in guiding consumer behaviour. For instance, time-of-use tariffs encourage customers to use electricity during off-peak hours, reducing stress on the grid and lowering costs. However, these efforts require public trust, clear communication, and equitable design to ensure all social groups can participate and benefit—particularly vulnerable or low-income populations.

In conclusion, demand-side management is not just a tool for saving energy but a strategic pillar for energy security in the 21st century. It allows energy systems to become more flexible, resilient, and sustainable—especially in regions heavily dependent on energy imports or exposed to geopolitical risks. By combining technology, policy, and behavioural change, demand-side management enables countries to meet growing energy needs, while maintaining system stability and reducing exposure to external shocks.

9. Energy Storage and Electricity Grids

While the transition towards cleaner and more sustainable energy is desirable, it presents significant challenges for grid stability and management. A case in point is the real danger of grid destabilization as the latest experience of the Iberia peninsula blackout showed (See Box 2)[5]. The intermittent nature of renewable energy generation, coupled with unpredictable fluctuations in energy demand, has underscored the need for innovative solutions to ensure the reliable and efficient operation of the electrical grid.

At the core of modern energy solutions is the concept of energy storage. Technologies such as lithium-ion batteries, pumped hydro storage, and other advanced systems play a vital role in managing the inherent variability of renewable energy sources and enhancing grid stability. Energy storage acts as a critical link between energy production and consumption, providing the flexibility, resilience, and efficiency needed to navigate the complexities of today's power systems.

These technologies are essential for addressing the intermittent nature of renewables. Unlike traditional fossil fuel plants, renewable energy output depends on variables like weather and daylight. Energy storage systems capture excess energy produced during periods of high renewable generation and release it when output is low, effectively balancing supply and demand. This helps ensure a steady and reliable flow of electricity to consumers. Energy storage technologies can play a crucial role in reducing renewable energy curtailments (RES curtailments), particularly in countries like Greece, Romania, Bulgaria, and Hungary, which have recently faced significant challenges in integrating renewable energy into their grids.

It is clear that energy storage is more than just a technological advancement—it is a fundamental pillar of the shift toward a more sustainable and resilient energy system. By storing surplus energy during times of low demand and releasing it when demand peaks, energy storage improves grid reliability and supports the large-scale integration of renewable energy. Additionally, it reduces dependence on conventional fossil fuel-based backup power, alleviates grid congestion, and plays a critical role in ensuring smooth grid operation. In doing so, energy storage paves the way for the continued electrification of the broader energy system. **(25)**

Grid stability is fundamental to ensuring a reliable and efficient supply of electricity to consumers. At its core, it involves maintaining a continuous balance between electricity generation and consumption, while also managing a range of factors that could disrupt this equilibrium. As electricity demand grows and the share of renewable energy in the mix increases, ensuring this balance becomes more complex.

[5] https://www.ft.com/content/3b807eff-fdaf-49f6-9611-00c4ff992a43

Lately, energy storage has emerged as a critical tool in grid management, offering a wide range of services that enhance the stability, reliability, and efficiency of power systems. One of its most vital contributions is the real-time balancing of electricity supply and demand. Because renewable energy sources like wind and solar are inherently variable and weather-dependent, they can lead to sudden mismatches in supply and demand. Energy storage systems help by storing surplus energy during times of low demand or high generation and releasing it when demand rises or supply drops, helping prevent outages and ensuring smooth grid operation.

Another essential function of energy storage is the provision of ancillary services, including frequency regulation and voltage control. These services are crucial for maintaining the operational integrity of the grid. Storage systems can respond quickly to shifts in grid conditions, injecting or absorbing power as needed to maintain stable voltage and frequency levels. This capability helps reduce disruptions and supports a more resilient grid.

Energy storage also plays a key role in integrating distributed energy resources (DERs), such as rooftop solar panels and home battery systems, into the wider grid. By offering localized storage capacity and grid flexibility, energy storage supports smoother DER integration, reduces pressure on distribution networks, and boosts overall system resilience.

In addition, energy storage helps manage voltage fluctuations, which can otherwise damage equipment or cause power quality issues. By providing reactive power, storage systems help regulate voltage levels and ensure that electricity is delivered within safe and consistent parameters.

The integration of DERs, particularly renewables like solar and wind, is further supported by energy storage's ability to buffer their intermittency. These sources can be unpredictable, and energy storage smooths out their output by capturing excess electricity during peak generation and releasing it during lulls, helping maintain grid balance and reliability.

Furthermore, energy storage reduces the need for traditional fossil fuel-based backup power plants, which tend to be expensive, polluting, and less flexible. By taking over functions such as frequency and reserve support, storage systems can help decarbonize electricity grids and accelerate the transition toward a cleaner, more sustainable energy system.

Despite the immense potential, energy storage faces several challenges, including high costs, technological limitations, regulatory hurdles, and environmental impacts, particularly regarding raw material sourcing and supply chain vulnerabilities for systems like Battery Energy Storage Systems (BESS). Nonetheless, advancements in technology, supportive policy frameworks, and market incentives are rapidly driving

progress and making storage solutions more accessible and cost-effective.

Looking ahead, energy storage is set to become a cornerstone of modern grid management and a vital enabler of the global clean energy transition. Its flexibility makes it indispensable for integrating diverse energy sources and managing the evolving challenges of energy systems under decarbonization pressures.

To fully realize these benefits, collaboration is essential. Policymakers, industry leaders, researchers, and communities must work together to foster innovation, develop supportive regulations, and prioritize sustainability. With the right support and direction, energy storage can help build a cleaner, more resilient, and more prosperous energy future for generations to come.

The Case of SE Europe

Energy storage in SE Europe is becoming increasingly important as the region transitions toward cleaner and more sustainable energy systems. Countries, such as Greece, Bulgaria, Romania and the Western Balkans, are expanding renewable energy sources like wind and solar, which require flexible storage solutions to stabilize the grid. Energy storage helps balance supply and demand, ensures reliability, and supports decarbonization targets set by the European Union and other regional agreements.

Currently, pumped hydro storage remains the dominant energy storage technology in SE Europe. Large-scale facilities in countries like Romania and Serbia have been in operation for decades, offering significant capacity for grid balancing. These systems store energy by pumping water uphill when electricity is plentiful and releasing it to generate power during peak demand. In SE Europe, the total installed pumped hydro storage capacity in Greece, Bulgaria, Romania, and Slovenia approaches 2 GW operational, including over 699 MW in Greece (Sfikia and Thisavros) and 864 MW at Bulgaria's Chaira plant[6]. In Croatia, HEP is planning a 412 MW Senj 2 pumped storage project by 2028. Private and state players are evaluating 1.4 GW of pumped-hydro energy storage (PHES) in Croatia, while Slovenia has commissioned a 180 MW PHES plant. Regionally, up to 100 GW of pumped hydro potential has been theorized to support a fully renewable grid by 2050[7]. However, despite their effectiveness, pumped hydro projects require suitable geography and involve high initial investment and environmental assessments.

In recent years, the region has seen a growing interest in BESS. These systems are being deployed to complement intermittent renewable energy production and to

[6] https://www.greentechmedia.com/articles/read/could-europe-be-looking-to-its-southeast-for-energy-storage?utm_source=chatgpt.com
[7] https://www.greentechmedia.com/articles/read/could-europe-be-looking-to-its-southeast-for-energy-storage?utm_source=chatgpt.com

provide fast-responding services to the grid. Countries like Greece and Croatia have launched national funding schemes and pilot projects aimed at integrating BESS into their energy infrastructure. Investors and developers are also beginning to explore hybrid renewable-storage installations, combining solar or wind farms with batteries. Greece's Public Power Corporation has announced a massive 860 MW storage plan in Western Macedonia—split into 560 MW pumped hydro (2 existing mine-based sites totalling about 5.44 GWh) and 300 MW battery storage schemes. Earlier, PPC secured permits for six pumped hydro facilities accumulating more than 1.6 GW of generation capacity[8].

Policy frameworks and regulatory environments across SE Europe are still evolving to support energy storage development. Some countries have introduced dedicated legislation or incentives, while others remain in early planning stages. Harmonizing grid codes, creating energy storage markets, and allowing storage systems to participate in capacity and balancing markets are essential steps. Regional cooperation and EU funding are expected to accelerate these efforts, especially in the Western Balkans where access to financing and technology can be limited.

Looking ahead, the role of energy storage in SE Europe is likely to expand rapidly. With increasing renewable penetration and the need for modern, resilient energy systems, storage technologies—both existing and emerging—will be critical. Continued investment, improved regulatory clarity, and cross-border collaboration will help the region unlock the full potential of energy storage, enabling a cleaner and more stable energy future.

[8] https://balkangreenenergynews.com/greeces-ppc-boosts-pumped-storage-hydropower-project-pipeline-to-1-6-gw/?utm_source=chatgpt.com

10. Enhancing Nuclear Power in SE Europe

Nuclear power already plays a crucial role in providing stable, low-carbon baseload electricity, but only a few countries in SE Europe currently rely on it significantly. In SE Europe, there are five countries (Bulgaria, Hungary, Romania, Slovenia and Croatia) that currently operate nuclear power plants (NPPs), while Türkiye, which is expected to build no fewer than 3 NPPs over the next decade, is due to commission its first NPP at Akkuyu this year.

Bulgaria has two operable nuclear reactors at Kozloduy, with a combined net capacity of 2.0 GWe. In 2021, nuclear energy covered 34.6% of Bulgaria's electricity needs. Hungary has four operable nuclear reactors at Paks, with a combined net capacity of 1.9 GWe, with nuclear energy covering 46.8% of the country's electricity needs in 2021.

Map 7: Operational and Planned Nuclear Power Plants in SE Europe

Source: IENE study "SE Europe Energy Outlook 2021/2022", Athens, 2022 (26)

Similarly, Romania has two operable nuclear reactors at Cernavodă and Slovenia one at Krško, with a combined net capacity of 1.3 GWe and 0.7 GWe respectively, with nuclear energy covering 18.5% and 36.9% of the electricity needs of each country respectively. Nuclear power remains a viable option for growth because it offers

important base load capacity and supports the EU's decarbonization policies, as analysed in IENE's "SEE Energy Outlook 2021/2022" study (26).

Over the last 15 years, IENE has closely monitored developments in the region's nuclear power sector. In this context, the Institute has successfully organised two regional conferences. Under the general title "The Nuclear Option for SE Europe: A Critical Appraisal" (27), the first such conference was convened in Sofia on May 19, 2009 and the second one in Bucharest on May 6, 2015. (28)

Table 5: 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.

Source: World Nuclear Association

The zero emissions from operating NPPs contribute most effectively to the region's efforts to curtail GHG emissions. This should mean that nuclear energy will have an important role to play in the SE European energy and electricity mix for several decades to come.

Table 6: Nuclear Power Plants (Under Construction, Planned and Proposed) in Türkiye

Country	Name	Type of reactor	Capacity (MWe)	Start construction	Planned operation
Türkiye	Akkuyu 1	VVER	1200	April 2018	2025
	Akkuyu 2	VVER	1200	April 2020	2026
	Akkuyu 3	VVER	1200	March 2021	2027
	Akkuyu 4	VVER	1200	July 2022	2028
	Sinop 1-4	APR-1400?, VVER-1200?	5200	uncertain	-
	Igneada 1-4	HPR1000 x 4	4x1100	unknown	-

Source: World Nuclear Association (29)

The contrast is between the immediate outlook for nuclear power in the region and longer-term prospects. Since Russia's full-scale invasion of Ukraine in 2022, there has been increasing pressure throughout the region, as in Europe as a whole, to maximise the use of nuclear energy and thus reduce reliance on Russian gas imports. There is

therefore likely to be pressure on operators to extend the lifetimes of ageing reactors in the short term.

Previous concerns that nuclear power might have to be curtailed in the wake of the tragic accident at Japan's Fukushima NPP in March 2011 have been allayed as a result of security reviews conducted by the SEE countries that host NPPs. None of the five countries operating NPPs in the region are likely to shut down their plants with their governments very well aware that any reduction in nuclear's contribution to electricity generation cannot be easily replaced by renewables or natural gas.

For now, the bottom line is that nuclear energy for electricity generation purposes will remain a significant component of the energy mix in both SE Europe and the world as a whole. The longer-term questions are whether nuclear power will actually play an increased role in regional energy balances and whether plans to construct new NPPs will appear as long-term solutions to decreasing dependence on Russian imports.

There is already evidence that the role of nuclear will increase, but it is not yet possible to assess the scale of this increase. That is because much of the focus is on the introduction and installation of Small Modular Reactors (SMRs), and this, in turn, depends on such uncertain factors as the speed at which they enter service, the rate of system proliferation and the efficiency of individual units. However, this advanced nuclear technology does offer a potentially flexible, scalable, and lower-cost alternative to traditional large-scale reactors, making it particularly attractive in the region's evolving energy landscape.

As a result, SMRs are gaining traction in SE Europe as countries seek to enhance energy security, reduce carbon emissions, and transition away from fossil fuels. In particular, Romania and Bulgaria have active plans for the introduction and installation of SMRs.

Both Romania and Bulgaria are currently looking at conventional and SMR nuclear facilities. The Romanian Government's 2021 Integrated National Plan for Energy and Climate Change provided for both the refurbishment of the country's existing reactors and for construction of two new Candu units. But while the next three years saw agreements signed and contracts concluded for nuclear plant refurbishment that should enable the existing reactors to operate for a further 30 years, so far there have been no firm contracts for the construction of new reactors. **(30)**

In September 2024, the US Export-Import Bank (Eximbank) approved a final commitment for a $98m loan for pre-project services required for the development of Romania's first SMR cluster on the site of the former coal plant at Doicesti, northwest of Bucharest. This would comprise a cluster of six 77 MWe modules using technology developed by the US NuScale Power company, ensuring a total capacity of 462 MWe. **(31)**

Bulgaria has likewise been considering both the construction of new mainstream plants and of SMRs. The country's official energy strategy, set out by Energy Minister Rosen Hristov in January 2023, included plans for two new reactors at Kozloduy and two at Belene, a site previously considered for a new plant to be built in conjunction with Russia's Rosatom (32). No firm contracts for actual construction have yet been signed. Bulgaria is also studying NuScale SMRs, with a view to installing them at Kozloduy. In December 2024, the US Trade and Development Agency signed a grant agreement with the state-owned Bulgaria Energy Holding for technical assistance "to accelerate the deployment of small modular reactor (SMR) nuclear power plant technology and advance the country's energy security and clean energy goals." (33)

Turkiye's development of nuclear energy is proceeding – but at an uncertain pace. The first unit of the country's first nuclear power plant, at Akkuyu on the country's southern coast, was in May 2025 reported to be "on track for preliminary testing by the end of 2025 or early 2026." However, the same report also said that the overall project "is reportedly facing a critical delay in the arrival of approximately $7 billion in expected funding, significantly slowing progress on the construction of its second, third, and fourth reactor units." (34)

The project is being developed by Russia's Rosatom on a build-own-operate basis model initially agreed in 2010. It provides for installation of four VVER-1200 type pressurized water reactors with a total installed capacity of 4,800 megawatts. The funding delay appears to relate both to international sanctions which limit Russia's ability to transfer funds abroad and to Turkish rejection of Russian efforts to secure financial concessions, including exemptions from withholding tax. On 24 July 2025, following reports that Russian workers at the plant had not received their wages for two months, there were further reports of workers going on strike.

Overall, SE Europe looks set to increase its reliance on nuclear energy for electricity generation over the next few decades, but by how much, and at what pace, remains uncertain.

11. Conclusion

Europe has made considerable progress towards improving its energy security but more can done, particularly in SE Europe where several countries need to enhance their own domestic production of energy, notably renewables but also fossil fuels. There is a particular need to focus on both the supply of gas to the region and the production of gas within the region, notably in the Black Sea and the Eastern Mediterranean.

In addition to gas supply, the provision of electricity in SE Europe presents a notable energy security risk on two counts. The first is related to market volatility and high wholesale prices (which ultimately affect the economy and consumers) as this has been amply demonstrated over the last four years, and the second has to do with likely disruptions.

As intermittent renewables are continuously gaining share in the electricity mix of the various countries and the region as a whole, controlling the stability of electricity grid becomes an issue. With inadequate cross-border electricity connections and fading base load, transmission operators are often required to shed off excess electricity produced from renewables and exercise tough controls on electricity flows in order to maintain grid operation and avoid major blackouts. This approach inadvertently leads occasionally to local blackouts and minor disruptions to electricity supply. Thus, the provision of smooth electricity flows is a matter of concern and if left unchecked could become a serious energy security risk.

In view of the above, i.e. high price volatility and electricity grid operability, the need for electricity market integration and greater interconnectivity is paramount. Hence, further development and integration of both gas and electricity networks is required while serious consideration needs to be given to such issues as nuclear power, demand-side management and energy storage. And, somehow, all this has to be done without increasing the costs to ordinary consumers, who are both living in an increasingly uncertain world and suffering from the consequences of prolonged high energy prices.

In short, enhancing energy security in SE Europe is a demanding and complex issue as this does not rely on just one or two parameters and it involves a whole range of factors often contradictory between them. On the one hand, we have the physical constraints of obtaining adequate, continuous and competitively priced oil and gas volumes - which still constitute the bulk of the region's energy supply - and on the other hand, we have the challenges posed by the complexity of energy market operations epitomised by such concepts as marginal pricing and the EU's Target Model.

As a result, any effort to improve energy security in the countries themselves and the

SE Europe region as a whole needs to take into consideration a host of factors and try to balance them on a going basis. In this context, enhancing energy security in SE Europe requires a synthetic approach based on the provision of high quality data and readiness for intervention at political level.

Above all, it requires improved cooperation at government and institutional level between all countries in the region. In a nutshell, such cooperation becomes the number one priority and an essential precondition for enhancing energy security in the region.

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