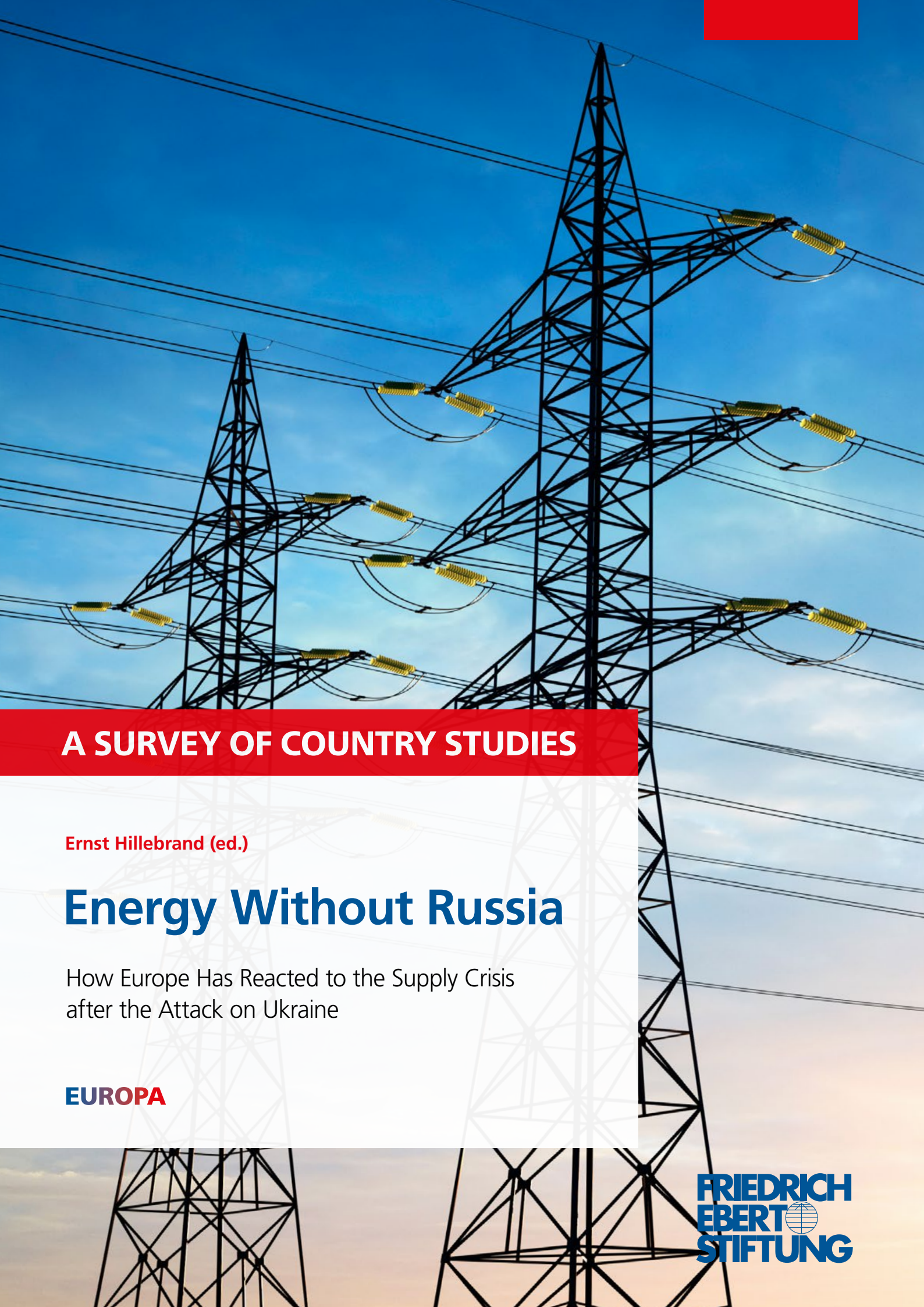

A SURVEY OF COUNTRY STUDIES

Ernst Hillebrand (ed.)

# Energy Without Russia

How Europe Has Reacted to the Supply Crisis after the Attack on Ukraine

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## About the editor

**Dr. Ernst Hillebrand** is head of a regional project of Friedrich-Ebert-Stiftung on economic issues in Central Eastern Europe and former head of the Eastern Europe Department of the FES.

Ernst Hillebrand (ed.)

# Energy Without Russia: A Survey of Country Studies

How Europe Has Reacted to the Supply Crisis after the Attack on Ukraine

# INTRODUCTION

**by Ernst Hillebrand**

# ENERGY WITHOUT RUSSIA: HOW HAVE EUROPEAN COUNTRIES REACTED?

Russia's invasion of Ukraine had a massive impact on the European Union's energy supply. In recent decades Russia had become by far the EU's most important energy supplier. In the period between 2010–2020, around 40 per cent of European gas imports came from Russia, as well as around 30 per cent of oil imports and over a third of coal imports. In 2020, 24.4 per cent of gross available energy in the EU came from Russian sources.

Given this dependence, a massive impact of the war on supply security and energy prices in Europe was inevitable. Not only in Germany did people fear a collapse of entire branches of industry or a politically destabilising "winter of discontent", fuelled by rising energy and heating costs.

Against this backdrop, the Friedrich-Ebert-Stiftung commissioned a series of short studies that describe how the European states reacted to the supply crisis following the Russian invasion of Ukraine and how these reactions affected the supply situation in the different countries. These papers deal with the short-term aspects – aiming at price stabilisation and security of supply – as well as the medium- and long-term adjustments that have been undertaken or are planned in the countries under study.

All in all, the picture that emerges is one of efficient action by the EU member states. To a high degree, they have been able to break away from dependence on Russia for fossil fuel supplies in a relatively short period of time. Overall, they managed to provide affordable energy for the population and industry, to limit price increases for consumers and reduce dependence on Russian energy sources. According to European Commission figures, between Q1 2022 and Q1 2023, Russia's share of EU energy imports fell from 26% to 3.2% for oil, from 38.8% to 17.4% for gas, from 18.1% to 13.2% for LNG and from 42.1% to zero for coal. Not only did the "winter of discontent" fail to materialise, but also the economic and social consequences of the decoupling from Russian energy supplies have so far remained within manageable limits.

The medium-term effects, on the other hand, remain much less clear. In all countries examined in the papers, the consequences of the Ukraine war have led to debates about a redesign of the energy infrastructure and about the future energy policy. Where pipeline gas will continue to be important, this is a question of better connection to alternative pipelines and a new focus on imports from countries such as Norway, Azerbaijan and Algeria. Many countries are expanding their LNG infrastructure. But more fundamental decisions also have to be taken: The decoupling from Russian fossil fuel supplies will lead to a more fundamental debate on the future energy mix. According to the authors, interest in and acceptance of renewable energy sources has increased everywhere. But this also holds true for nuclear energy, which has again become the focus of interest in a number of countries. In some countries, not least Germany, there is still the hitherto unresolved question of how energy can be made available for industry at competitive prices without the use of Russian fossil fuels.

The papers brought together in this reader were initially published as individual publications during the summer of 2023. They focus on the immediate measures taken in response to the Russian invasion of Ukraine and its consequences. What was asked for was a description of the policies and measures pursued and their effects. Many of the authors would have preferred a more analytical and often also more critical approach to the topic of energy policy in their respective countries. However, the editors' aim was first of all to give an overview of how Europe has managed to ensure that the consequences of the Ukraine war and the EU sanctions against Russia have not led to an economic, social and political destabilisation of the EU itself. Given the initial situation, the fact that this has actually been achieved is impressive enough.

*Budapest, October 2023*

# BULGARIA

by Remina Aleksieva
and Kalina Tcolova

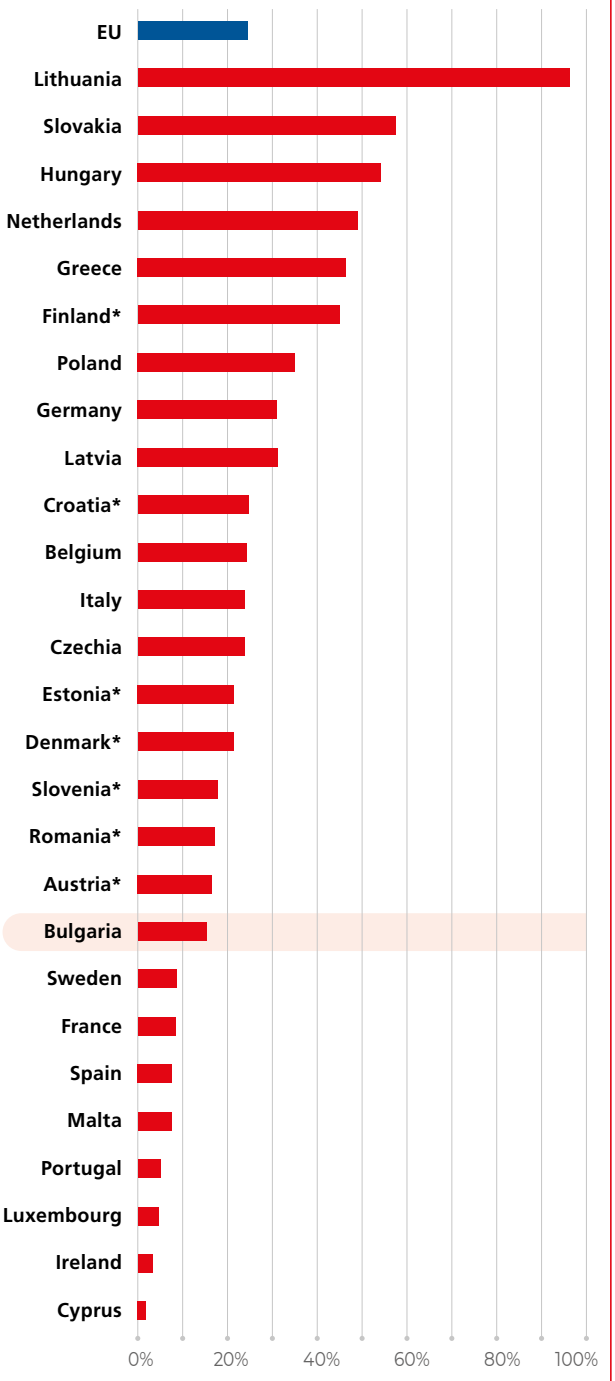
# INTRODUCTION

The Russian invasion of Ukraine has exposed Europe's energy and climate security vulnerabilities. With a high dependence on Russian oil and gas imports, Bulgaria met a staggering increase in gas, power and fuels prices, intensifying both the social and political instability.[1] Bulgaria has been especially exposed to the energy crisis as the country's energy mix relies heavily on fossil fuels, particularly coal for electricity generation, and crude oil products for transportation.

A year after the invasion, Gazprom remains a crucial gas supplier in Southeast Europe. Bulgaria continues to import Russian pipeline gas from TurkStream and indirectly from Greek gas companies with long-term supply agreements with the Russian firm.

Resolving energy and climate security requires systematic and clear short-term and long-term measures that would put Bulgaria on a consistent pathway to strategic decoupling from Russia and carbon neutrality.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

1 Center for the Study of Democracy, *Breaking Free: Natural Gas Security and Decarbonization in Southeast Europe.* Policy Brief No. 130, March 2023.

# 1

# BULGARIA'S ENERGY SECTOR: STATE OF THE ART

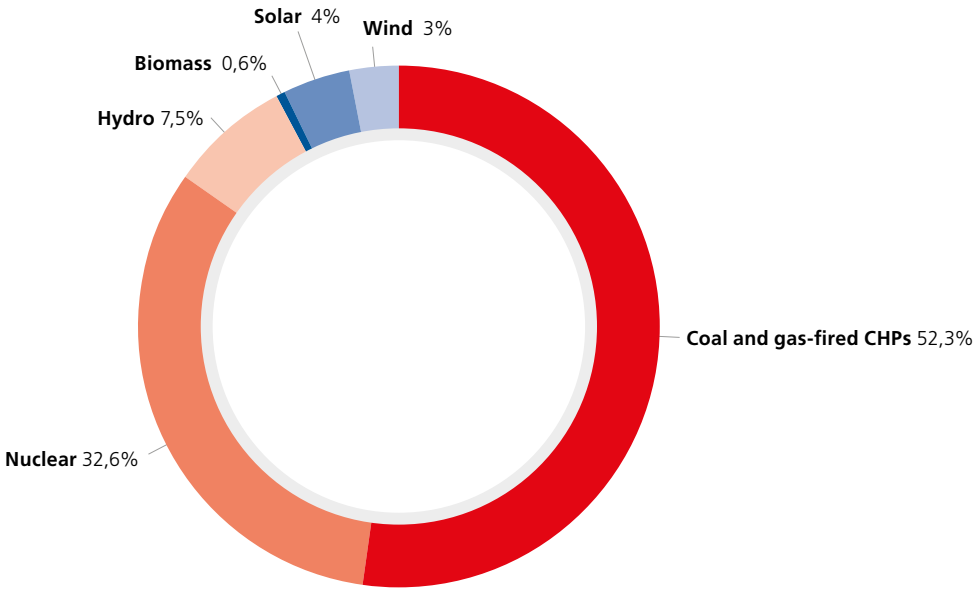
The Bulgarian energy sector has been long heavily dominated by fossil fuels, with lignite coal as the central local energy source and crude oil products serving as the main fuel for transportation. Despite the growing adoption of wind and solar energy technologies over the past ten years, primary solid biomass (firewood) continues to dominate the national renewable energy sector by covering the domestic heating needs of around half of Bulgaria's households. Although natural gas plays only a marginal role in the energy mix, 94% of the gas supply for 2021 came from Russian imports. After the state-owned, dominant wholesale market supplier Bulgargaz refused to accept a ruble-based payment scheme proposed by Gazprom, the Russian company unilaterally suspended gas deliveries on 27 April 2022. Even after the Gazprom supply cut, roughly half of the natural gas imports still come from the indirect purchases of Russian gas from Greece, Romania, and Turkey via TurkStream.[2]

Lignite coal remains the primary source of electricity generation (44%), while nuclear energy covers another 1/3 of the production. The share of RES such as hydro, solar, and wind has been steadily growing and now accounts for around one fifth of the power mix. The hydropower generation capacity in the country is functioning only at one third of its installed capacity due to regular malfunctioning, inefficient operation and a lack of market-driven utilisation.

Despite its having been Gazprom's decision to single-handedly cut the gas supply to Bulgaria, the Bulgarian caretaker government has sought to renew negotiations with Gazprom, taking over the responsibility for the termination of the contract. In addition, successive governments lobbied the EU institutions to grant Bulgaria an exemption to the sanctions against Russian oil imports, thus upholding the dominant position of Lukoil in the country's refining and wholesale market. The Bulgarian government has even threatened to veto potential sanctions on Russia's state-owned nuclear sector.

2 Center for the Study of Democracy, *The Future of Natural Gas in Southeast Europe.* Sofia: 2023.

Figure 2
**Bulgarian Gross Electricity Generation for 2022 by Source**




Source: Bulgarian Electricity System Operator

Since the Gazprom supply cut, Bulgaria has been purchasing natural gas monthly from companies in the SEE region, who have active long-term contracts with Gazprom, thus indirectly continuing to buy Russian gas usually at higher prices than the one in its long-term contract (which expired on 31 December 2022). Further delays on the construction of the key interconnector pipeline with Greece meant that for most of 2021 and 2022, Bulgaria was paying a higher price for the Azeri gas for 2/3 of the contracted volumes although the Azeri supply, based on a 25-year 100% oil-indexed agreement, is currently much cheaper than the average European gas price on the spot market. The commissioning of the gas interconnector Greece-Bulgaria (IGB) on October 1, 2022, allowed Bulgaria to receive the full Azeri gas volumes at the long-term contractual price. Shortly, IGB will be also shipping liquefied natural gas (LNG) arriving at the Alexandroupolis floating storage and regasification unit (FSRU), which is due to come online in January 2024.

# 2

# THE RESPONSE TO THE ENERGY CRISIS

Soaring prices for energy commodities, including natural gas and coal, led to a sharp surge in power generation costs and contributed to an acceleration of inflation. Bulgaria attempted to offset the high energy prices by introducing a stimulus package, covering 80% of the price of electricity paid by businesses that reach over €100 per megawatt hour. This measure led to excessive profit for the largest energy consumers in the country, instead of supporting small to medium-sized enterprises in improving their energy efficiency and decarbonising their mix. The surge in fuel prices prompted the Bulgarian government to introduce a 'fuel subsidy', offering a 12.5 eurocent reduction for every litre of gasoline and diesel. The government allocated €3.9 billion in total to households and businesses, or 5.9% of GDP in 2022, contributing to the country's ballooning budget deficit.[3]

On 5 February 2023, the EU's sanctions package, which includes a ban on imports of Russian crude oil and refined products, came into full effect. The embargo does not apply to Bulgaria as the government was able to secure a derogation from the sanctions for Lukoil's Neftochim Burgas Refinery and petrochemicals complex, allowing it to continue processing Russian oil and selling refined products to Bulgarian and Ukrainian consumers.[4]

Bulgaria has claimed that the refinery's operation and the country's supply of refined products would not be guaranteed without the derogation. Bulgaria defended the derogation of the EU's ban on imports of Russian crude oil and refined products by claiming that it would prevent market disruption, increase tax revenues, and lower fuel prices. The Bulgarian government, which has a 'golden' share in Lukoil's Neftochim Refinery, giving policymakers the ability to influence the company's strategic policy, has been unsuccessful in negotiating better prices with the refinery or making it diversify the supply of crude oil to non-Russian sources.

In terms of natural gas, only a small fraction of Bulgarian households, comprising a mere 2%, are connected to the gas grid. These consumers were suddenly faced with dramatic increases in gas prices in 2022 and limited financial support from the government. The impact of these skyrocketing prices has been concentrated among middle and upper middle class households, which constitute the majority of gas users. Households connected to central district heating have also been affected, given that gas is a key input for heat generation. Hence, district heating prices increased by approximately 40% during the crisis. Despite these challenges, district heating prices remain heavily subsidised and competitive compared to other alternatives. The industry sector, the largest consumer of gas in the country, has been significantly affected by the rise in gas prices. However, this has not led to massive bankruptcies, as the subsidies for electricity prices and fuel switching to the much cheaper propane have preserved the country's industrial competitiveness.

The Bulgarian gas transmission system operator bought a 25% stake in the Alexandroupolis terminal guaranteeing that Bulgaria would have strategic access to the facility. The fact that the Alexandroupolis FSRU will be connected to TAP and the IGB means that the terminal could become a hub for LNG supplies to all of the SEE regions. If Bulgaria can secure a 10-year LNG supply contract from 1 January 2023, together with the Azeri gas shipped via IGB, the country would have almost completely diversified away from Russian gas and could play a key role in improving the natural gas security position of all countries in the region via the Bulgaria-Serbia interconnector currently under construction. In addition, Greece, Bulgaria, and Romania have accelerated the joint work on reversing the physical flow on the Transbalkan Pipeline in the South-North direction, hence supplying alternative natural gas volumes to Moldova and, ultimately, to Ukraine.

## LONG-TERM SUPPLY DIVERSIFICATION

Bulgaria will find it difficult to eliminate its dependence on Russian gas without taking additional steps to secure at least another 0.7 bcm per year of alternative supply through 2030.[5] Securing the natural gas supply would be challenging in the event of a complete Russian gas cut-off in the SEE

3 Sgaravatti, G., S. Tagliapietra, C. Trasi and G. Zachmann, *National policies to shield consumers from rising energy prices*, Bruegel Datasets, 2023.

4 Center for the Study of Democracy, *Decoupling from Russian Oil*. Sofia: 2023.

5 Center for the Study of Democracy, *The Future of Natural Gas in Southeast Europe*. Sofia: 2023, p. 27.

region. Azeri gas can cover only about one-third of national demand, which will be sufficient for the needs of households and district heating companies. Industrial consumers, however, are at risk. Bulgargaz purchases the necessary volumes month by month without a long-term contract and at prices above the Title Transfer Facility benchmark. If there is an abrupt supply shortage, other gas buyers from Greece and Turkey would most probably compete for all available capacity at the existing LNG terminals, as currently there is no solidarity mechanism among neighbouring SEE countries to distribute available gas volumes equally.

Even in the most ambitious decarbonisation and gas phase-out scenario that includes comprehensive gas demand reduction measures, the share of Russian gas will not fall below 33% even by 2030. Thus, there is a need for additional steps towards diversification to ensure Bulgaria's security of supply.[6] Bulgaria must collaborate with Greece and Turkey to agree on a common plan for using LNG regasification facilities in the event of a security or supply crisis. In late 2022, Bulgargaz and the Turkish state-owned monopoly, BOTAS, signed a deal that would enable the Bulgarian company to import up to 1.5 bcm/yr based on guaranteed access to the Turkish gas transmission system for an equivalent capacity volume. While this agreement is a step towards improving the security of supply, it falls short of the long-term objective of signing an interconnection agreement between Bulgaria and Turkey that would allow foreign gas traders access to the Turkish gas market, making Turkey one of the most important natural gas hubs in Europe

A sustainable solution to the gas security conundrum would be the conclusion of a long-term LNG supply agreement with a major supplier such as the US, Qatar, Algeria, etc. Despite the abundance of LNG deliveries to Europe, so far Bulgaria has secured only individual cargoes, usually at above-market prices using trading intermediaries. The lack of access to an LNG regasification facility is one of the biggest obstacles to striking a long-term LNG supply deal for Bulgargaz. This may change with the commissioning of the Alexandroupolis FSRU on the Greek Aegean coast, where Bulgargaz has booked 1 billion cubic meters of firm long-term capacity over the next ten years. Bulgaria can also strengthen its security of supply position by unlocking the country's large energy efficiency potential linked to fuel switching from gas to electricity, demand side measures in industry, and the uptake of cutting-edge low-carbon technologies with hydrogen and synthetic fuels.[7]

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6 Ibid.

7 Center for the Study of Democracy, *The Future of Natural Gas in Southeast Europe.* Sofia: 2023, p. 39.

# 3

# LONG-TERM ENERGY AND CLIMATE POLICY

Implementing ambitious decarbonisation policies that reduce natural gas demand can greatly diminish the country's vulnerability to Russia and contribute to stronger energy and climate security. Instead of focusing on developing a strategy to gradually phase out fossil fuels and accelerate investments in renewables, in 2021, Bulgaria increased its electricity production from coal by 30.8% without an agreed outlook to reduce its role in the energy mix.

The Bulgarian Parliament passed a decision requiring the government to renegotiate the National Recovery and Resilience Plan and remove the 40% $CO_2$ emissions reduction target by 2026 while keeping coal-fired power plants operating until at least 2038. However, the Parliament passed a decision requiring the Bulgarian government to renegotiate this commitment leading to a delay in the Plan's implementation, meaning that Bulgaria could lose up to EUR 7.5 billion in structural funds by 2027.

Bulgaria's energy strategy for the next 30 years prioritises large-scale infrastructure projects.

The vision of maintaining subsidies for the coal sector in Bulgaria after 2025 is economically unsound and runs against EU rules on state aid for polluting plants. The concerns about electricity supply security justifying the preservation of coal are overstated, as Bulgaria is currently a major exporter of electricity in Europe. Moreover, modelling assessments conducted by the Bulgarian Electricity System Operator in October 2022, assessing the power supply and demand trajectories of the whole SEE region, reveal that the coal phase-out in combination with massive investments in renewables will not jeopardise the security of supply and is feasible with the necessary investment in the transmission grid capacity.[8]

The current energy and climate strategy would make Bulgaria reliant on importing green energy from neighbouring countries. Additionally, the potential impact of energy efficiency measures in reducing electricity consumption is not being fully considered, which could eliminate the need for large base load capacities after 2030, beyond the capacity of the Kozloduy Nuclear Power Plant.

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8 Chavdarov, N., and Sulakov, S., *Bulgarian Resource Adequacy Assessment*, Sofia: ESO, 2022.

# 4

# WHAT'S NEXT?

More than a year after the conflict in Ukraine began, Bulgaria has been hesitant to increase its 2030 energy and climate targets as local oligarchic networks have aimed to preserve the country's dependence on the use of coal for power generation.[9] The delayed debate about the impact of the European Green Deal on a national, regional, and local level has led to limited progress on building a consensus around Bulgaria's common decarbonisation strategies. There is an urgent need for a long-term national data-based energy transition policy with consistent targets, concrete milestones, and policy actions, as Bulgaria currently lacks a coherent and up-to-date energy strategy.[10]

To achieve climate neutrality by 2050, Bulgaria must accelerate the fossil fuel phase-out before 2030 and transform its economy on the back of accelerated electrification and industrial decarbonisation. This process goes through deep energy efficiency improvements, large-scale renewable energy investments including those in cutting-edge technologies such as offshore wind energy and power storage, as well as through the uptake of alternative fuels such as hydrogen and synthetic fuels in industrial processes where the use of electricity is not feasible.

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9 Center for the Study of Democracy, *Tackling the Energy and Climate Security Conundrum in Southeast Europe*, Policy Brief No. 110, May 2022.

10 Center for the Study of Democracy, *At a Decarbonisation Crossroads.* Policy Brief No. 127, March 2023.

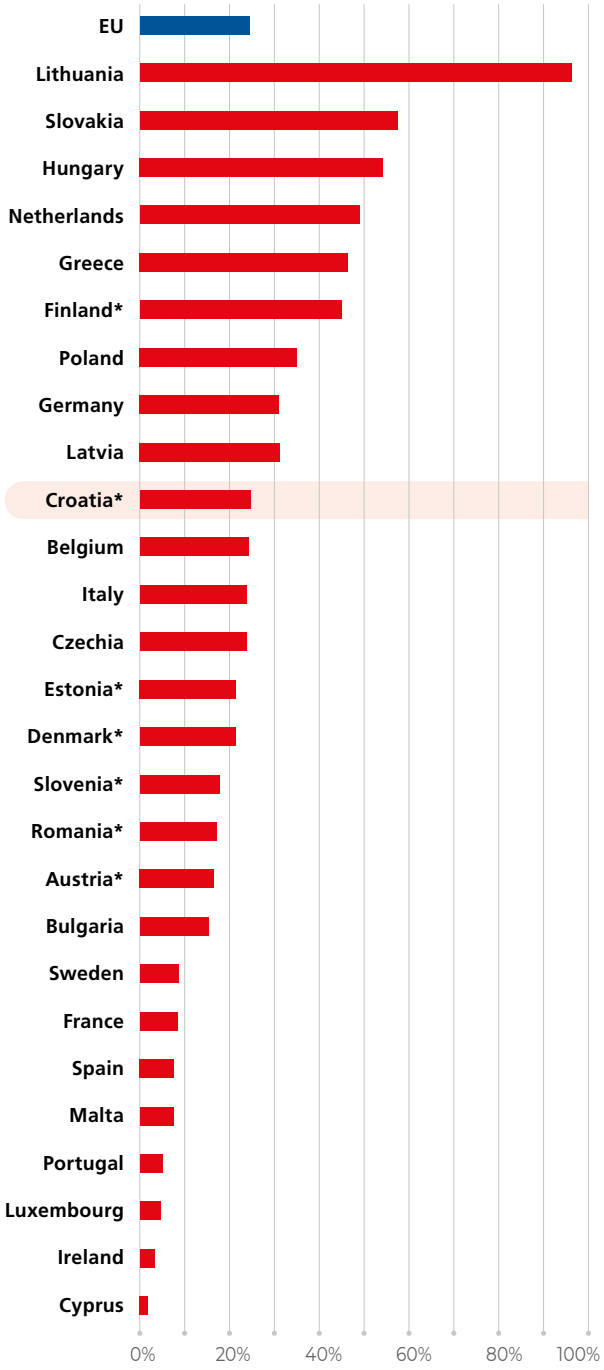
# CROATIA

by Julije Domac, Velimir Šegon
and Simona Tršinar

# INTRODUCTION

Croatia has quickly decreased its dependency on imported Russian gas by increasing its own production, stepping up the use of an existing LNG terminal, and significantly reducing gas consumption thanks to the favourable conditions of the mild winter. The main consequence of the Ukraine war and EU sanctions is the heavily regulated energy prices of electricity and natural gas, resulting in the national electricity supply company Hrvatska elektroprivreda (HEP Group) accruing heavy financial losses. The future will bring many challenges, mainly because there needs to be a systematic energy policy based on domestic and renewable energy resources, coupled with the fact that the energy market (electricity, gas, and heat) needs to be developed.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO ANTE (AS OF FEBRUARY 2022)

In 2020, oil and petroleum products accounted for 33.7% of Croatia's energy mix, followed by natural gas (30.3%), renewables and solid biomass (26.4%), electricity (4.8%), solid fossil fuels (4.3%), and non-renewable waste (0.5%).[1] Liquid fuels and natural gas accounted for the highest share in Croatia's total primary energy supply, 29.1% and 24.7%, respectively[2] (see Figure 2). Data for 2021 indicate that Croatia produced 15,210.4 GWh of electricity: 7,228.7 GWh by hydropower plants, followed by 5,771.0 GWh from thermal power plants, 2,061.8 GWh from wind power plants, and only 148.9 GWh from solar power plants.[3] The nuclear power plant Krško, jointly owned by Croatia and Slovenia (each owning 50%), produced 2,709 GWh of electricity for Croatian needs. The total electricity consumption in 2021 was 19,171.4 GWh. Thus, the net import amounted to 3,961 GWh or approximately 21% of total consumption. The ratio of total production to consumption was approximately 79%. Dominant consumption by sectors is that of business (10,230,276 MWh), followed by households (6,596,361 MWh) and public lighting (340,395 MWh)[4] (see Figure 3).

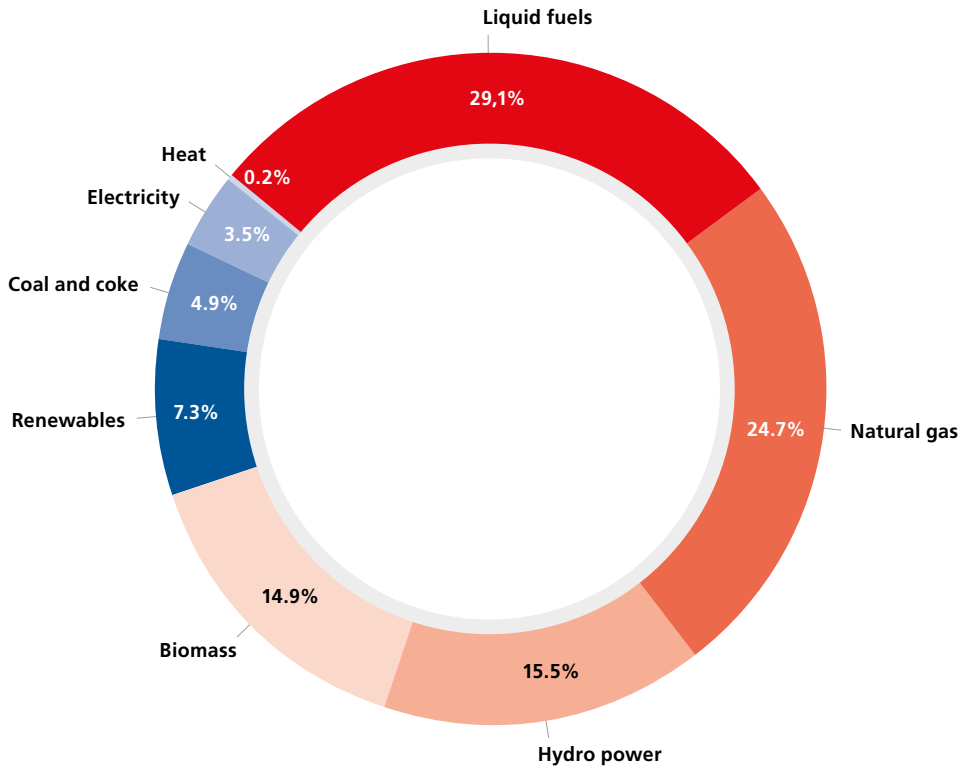
1 Statistical overview of the EU (2020).

2 EIHP, Energy in Croatia, (2021), available at https://eihp.hr/wp-content/uploads/2023/01/Energija%20u%20HR%202021_WEB_LR.pdf

3 EIHP, Energy in Croatia, (2021), available at https://eihp.hr/wp-content/uploads/2023/01/Energija%20u%20HR%202021_WEB_LR.pdf

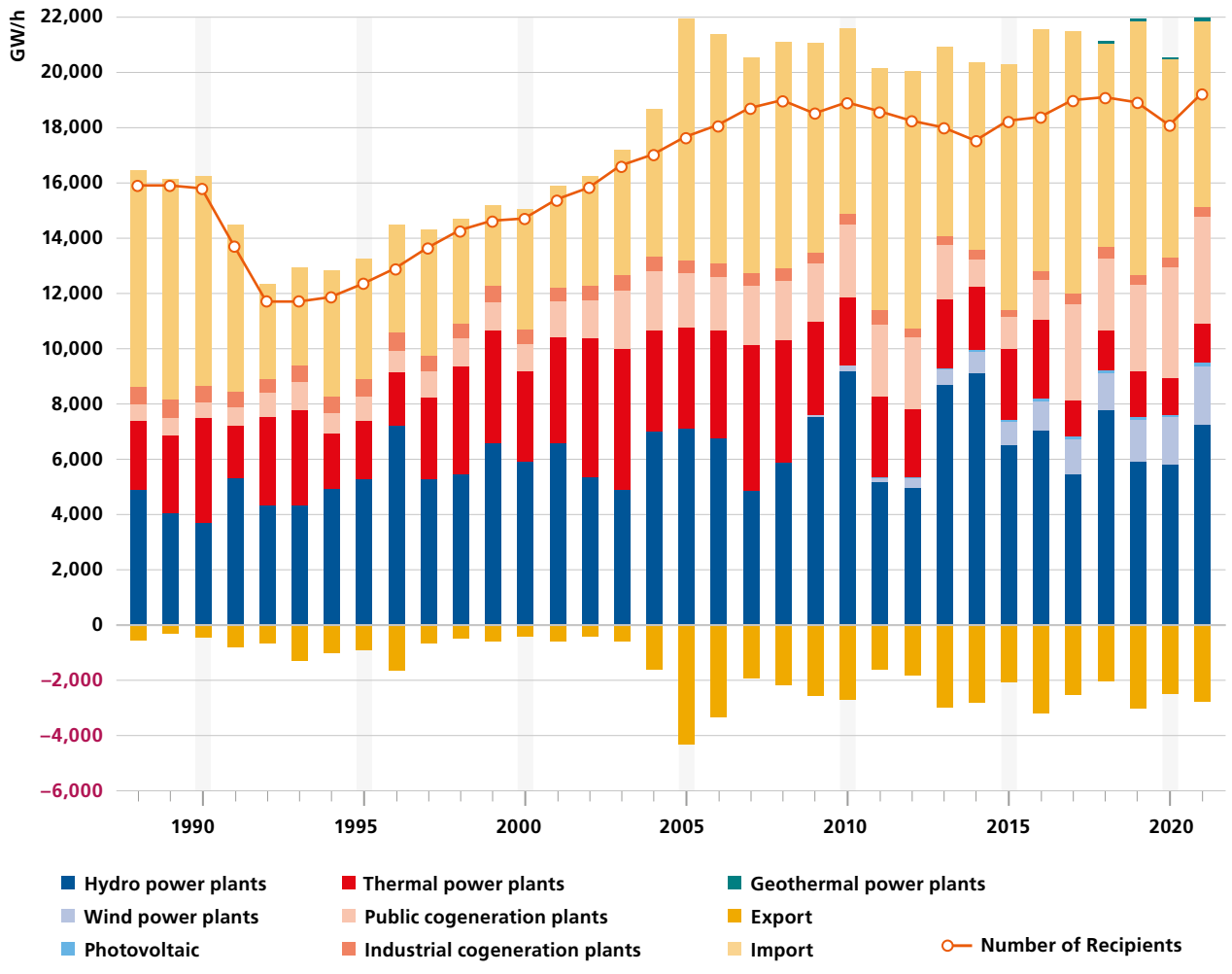
4 EIHP, Energy in Croatia, (2021), available at https://eihp.hr/wp-content/uploads/2023/01/Energija%20u%20HR%202021_WEB_LR.pdf

Figure 2
**Shares in the total primary energy supply**




Source: EIHP, Energy in Croatia (2021), S. 54, available at https://eihp.hr/wp-content/uploads/2023/01/Energija%20u%20HR%202021_WEB_LR.pdf

Figure 3
**Electricity supply in the Republic of Croatia in 2021**




Source: EIHP, Energy in Croatia, (2021), available at https://eihp.hr/wp-content/uploads/2023/01/Energija%20u%20HR%202021_WEB_LR.pdf

2021 Croatia's total primary energy supply amounted to approximately 413 GPJ, of which liquid fuels (fossil) covered 120 PJ, natural gas 102 GPJ, and hydropower 64 PJ. Total energy import is 321 GPJ, while total energy export is 123 PJ. Thus, the net energy import amounted to 198 GPJ, approximately 47.9% of the primary energy supply.

In 2020 Croatia's energy dependency rate was 53.6% (whereas in 2021, it was 52.1%), below the EU27 average of 57.5%. It is assumed that 80% of Croatian energy net imports are from Russia, with a dependency of 24.7% on energy imports. In 2020, Croatia had a 74.7% dependency on Russia for coal, 55% on natural gas, and 14.2% on oil.[5]

The national oil and gas company INA is co-owned by the Hungarian oil company MOL (with a 49.08% share), the Croatian government (with a 44.84% share), and institutional and private investors (6.08% share), with MOL having the majority on the Management Board and in effect managing the company. This leaves Croatia in a very dependent and vulnerable situation regarding the production and supply of oil and oil derivatives (dominantly gasoline and diesel), and despite having its own active oil and gas fields and refinery, INA has been constantly decreasing its production. This is especially the case regarding natural gas production and supply, where INA has practically left the dominant position to the company Prvo plinarsko društvo (PPD), which is essentially a local partner of Gazprom and is supplying customers through a ten-year contract with the Russian company.

– The national electricity and heat supply company HEP Group is 100% owned by the Croatian government. The Croatian electricity market has been formally liberalised since 2001; however in practice, the following indicates that the liberalisation has been achieved to only a very limited extent:

– Over 90% of electricity supply to customers (both households and commercial/industrial consumers) is delivered by the state-owned company HEP Group (based on data for 2021 from HERA – the Croatian Energy Regulatory Agency);

5 Statistical overview of the EU (2020).

- HEP Group is largely dominant in installed capacity, electricity production, and sales on the wholesale market, with almost two-thirds of the total;

- The transmission system operator, TSO (HOPS), is nominally an independent company; however, it is owned 100% by HEP Group, and in practice, its operation is considerably influenced by HEP Group senior management; and

- The distribution system operator, DSO (HEP-ODS), is part of the HEP group.

The TSO and DSO both play a critical role in the electricity market by managing the transmission and distribution network and ensuring the safe, secure, and reliable delivery of electricity to consumers.

In practice, neither TSO nor DSO are in a position to ensure transparent, fair, and timely access to the grid to all potential investors/producers.

# 2

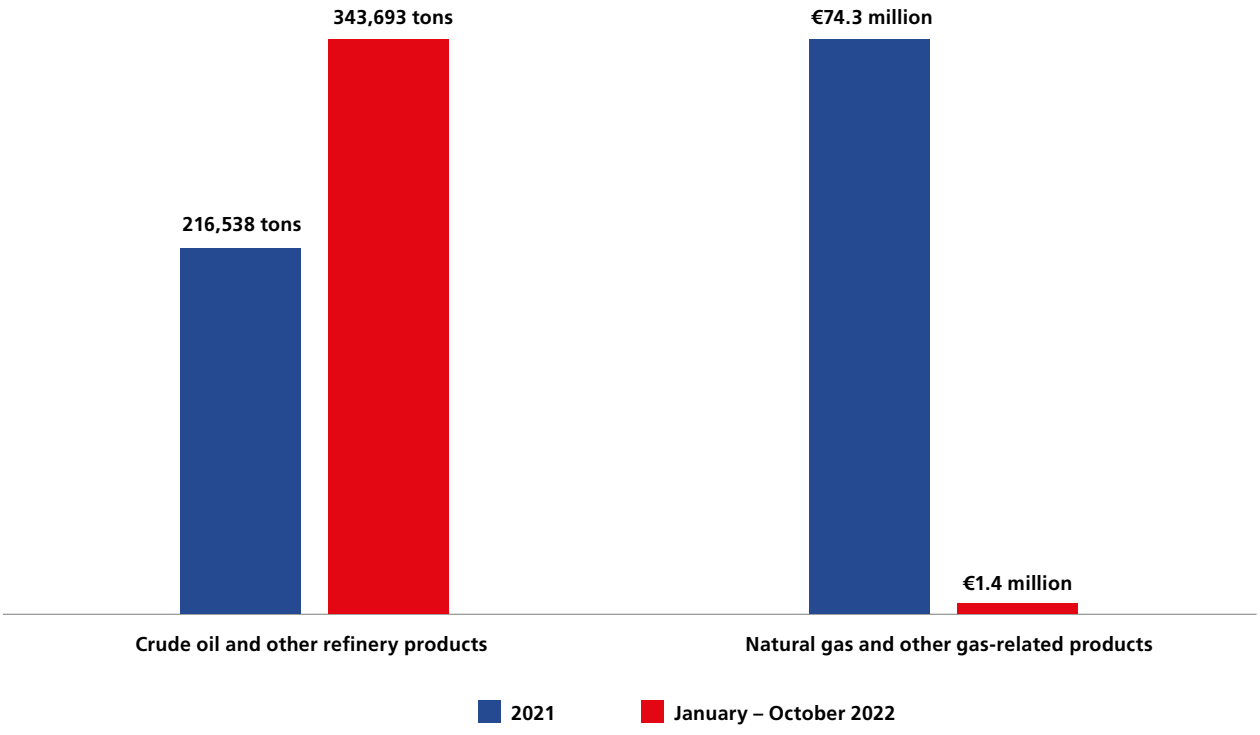
# AD HOC RESPONSES AFTER FEBRUARY 2022

In 2022, energy security became a priority in the EU, with ambitious targets set by the RePowerEU plan to make Europe's energy independent from Russia. In response to the energy crisis, the Croatian government introduced four packages of measures in February 2022. The measures were focused mainly on mitigating energy prices, reducing the VAT rate for heating energy to 5%, reducing excise duties on petroleum products, and leaving unchanged the unit price of thermal energy for all heating systems.[6] Overall, the presented measures ensured that in Croatia, the average gas price for households increased only by 13% (compared to 92% in the rest of Europe) and that citizens have the lowest price for electricity in all EU Member States except Hungary.

6 E-Građani (2023), available at https://vlada.gov.hr/vijesti/vladin-odgovor-na-globalnu-energetsku-krizu-1-7-milijardi-eura-za-zastitu-kucanstava-i-gospodarstva-od-rasta-cijena/37964

In 2022, the capacity of the Krk LNG terminal was expanded with a technical upgrade from 2.6 to 2.9 billion cubic meters of gas/year. The main financial burden of the regulated prices of natural gas fell on the HEP Group, which by governmental decision, had to purchase approximately 300 million m3 of natural gas and fill the domestic gas storage tanks before the 2022/2023 heating season. With government approval and backing, HEP Group had to take a one-billion euro loan. The decision was justified as the ad hoc response to the crisis, and the only option to fill the natural gas storage tanks was to force HEP Group to do it, as no other gas suppliers were willing to do so. Consequently, HEP Group is taking financial losses, since the price at which it bought the gas when the storage tanks had to be filled is lower than the current price (prescribed for households and the public sector by governmental decision).

Figure 4
**Croatian energy imports from Russia**




Source: Euractiv.hr, (2023), available at https://euractiv.hr/energetika/a239/Hrvatska-je-u-2022.-godini-povecala-uvoz-ruske-nafte-no-smanjila-je-uvoz-plina-iz-Rusije.html

Croatia fulfilled its gas storage obligations, reaching 97.03% by 1 November 2022, and ended the heating season with a filling level of gas storage at 73.04% by 2 May 2023.

In addition, the ad hoc response includes regulating electricity prices (for households, the public sector, and the commercial sector and industry) prescribed again by government decision in September 2022 and valid until September 2023.

At the same time, there were no clear signals and messages to consumers indicating the date until which the decision on regulated energy prices would be in effect. Consequently, there needed to be coherent saving strategies for energy consumption reduction or an official message about the necessity to save energy, either national or regional/city level, as in many other EU countries.

The impact of the energy crisis is still being evaluated, but early data show that Croatia's oil imports from Russia in the first ten months of 2022 (343,693 tons) exceeded those in 2021 (216,538 tons).[7] The EU sanctions on Russian oil were activated only in December 2022. However, the import of Russian natural gas amounted to only €1.4 mil in the first ten months of 2022, while in 2021, the import of natural gas amounted to around €74.3 million (see Figure 4). This is attributed to Croatian in-house production and the increased use of the Krk LNG terminal. Also, a decrease in electricity imports and an increase in RES production could be seen in 2022 and the first three months of 2023 in Croatia.[8] Therefore, even though the data is still being processed for 2022 and 2023, early monitoring indicates a positive trend toward reducing energy dependency on Russia.

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7 Euractiv.hr (2023), available at https://euractiv.hr/energetika/a239/Hrvatska-je-u-2022.-godini-povecala-uvoz-ruske-nafte-no-smanjila-je--uvoz-plina-iz-Rusije.html

8 Lovrić, Marko, Report on electricity conditions in HR for the month of March 2023 (2023).

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

The main impact of the Ukraine war and the EU sanctions on Croatia's energy sector so far have been related to the drastic increase/fluctuation of energy prices (natural gas, electricity) which negatively affected the overall economy. In September 2022, the Croatian government adopted a decision through which regulated energy prices were prescribed for October 2022 to March 2023, and this decision was renewed in April and is valid until September 2023. The main burden of the regulated energy prices has fallen on the national energy company HEP Group, which estimated its resulting losses for the period October 2022 to March 2023 at approximately €800 million, while a similar estimation of losses has been announced due to the renewal of the regulated prices. In April 2023 the government announced that due to this situation, it would subsidise HEP Group in the amount of €900 million.

At the time of this writing (mid 2023), this situation has not resulted in any considerable practical impacts on Croatia's electricity production (the majority of which comes from HEP Group). Even before the Ukraine crisis, HEP Group announced its plans to expand its portfolio of PV plants. However, the targets and dynamics have not increased considerably in the last year. Due to the relatively mild 2022/2023 winter, natural gas consumption has generally decreased. There were no major problems with supply, while due to the very good hydrology in the same period (that is, since HEP Group produces most of its electricity from hydropower plants, the favourable hydrology has considerably increased electricity production), the overall impacts of the Ukraine crisis on Croatia have been relatively mild.

# 4

# MEDIUM- AND LONG-TERM ANSWERS

The Croatian government has announced its decision to increase the capacity of the LNG terminal on Krk from 2.9 to 6.1 billion cubic meters of gas, which is twice Croatia's current demand. Possible options include an onshore terminal with a capacity of 15 billion cubic meters of gas, with an estimated price of €1.75 to 2 billion, or a floating terminal at €1.2 billion, with a capacity of 9.6 cubic meters per year. The expansion will also include the construction of the Plinacro gas pipeline between Zlobin and Bosiljevo, whereby a total investment of €180 million is foreseen, of which 25 million must be invested in the LNG terminal itself and 155 million for the new Zlobin-Bosiljevo gas pipeline. The construction of the gas pipeline will enable the increase of gas transport from the LNG terminal to its current technical capacity of about 3.5 billion cubic meters per year. This will significantly increase the security of gas supply to consumers in Croatia, and also create a basic prerequisite for the further development of the gas pipeline system and the increase of gas transport to Slovenia and Hungary, thereby reducing their dependence on Russian gas.

The Adriatic-Ionian gas pipeline project from the Albanian city of Fieri to the Croatian city of Split, with a total length of 511 km, is again under consideration. It was initially envisioned in 2012 when the Croatian natural gas transport company Plinacro and the Ministry of Economy began to participate in meetings of interested countries. The implementation was not started as planned because gas from Russia was cheaper, and the amount of gas from Azerbaijan was limited. However, recently, it was announced that the project could be reactivated, with a completion date estimated at 2025, but this development is still very early.

The Croatian government has on several occasions announced that it is seriously considering building the second block of the Krško nuclear power plant, which would be done as a joint investment between Croatia and Slovenia. However, currently, there is no further information regarding the implementation.

Croatia has considerable geothermal potential, but current production and utilisation are insignificant. The greatest potential lies within the Pannonian basin, and the potential utilisation includes electricity production (to a lesser extent, as temperatures are not sufficient), heating, agriculture, and balneology. There have been positive movements lately, especially connected to the energy crisis, as the Croatian government, through the Hydrocarbon Agency, has announced plans to increase geothermal energy utilisation in the country. There is dedicated funding for some projects in the National Recovery and Resilience programme. Apart from national vision and targets, increased interest is visible at regional and local levels, where a dominant application would be in the district heating sector, balneology, and agriculture. Several projects are under development in various phases, with some also including innovation in relation to the extraction of hydrocarbons from the geothermal stream and $CO_2$ capturing and storage in the process.

The government adopted the National Energy and Climate Action Plan (NECP) for Croatia in December 2019. The document is currently undergoing a revision; however, there needs to be more information publicly available, and there have been no activities involving a wide group of stakeholders in the process.

Croatia has considerable potential for PV installations. Unfortunately, this potential is still mostly unutilized. According to the EurObserv'ER publication Photovoltaic Barometer, which compares data for PV installations for EU countries, at the end of 2021 Croatia had 26.9 W/capita of installed PV systems, which ranked it second worst in the EU (only Latvia was below that), with the Netherlands (815.4 W/capita) and Germany (706.2 W/capita) being the EU leaders. Unofficial data for 2022 indicate that Croatia has approximately doubled its capacity, which is still very small in terms of W/capita compared to other EU countries.

The main limitation to the widespread installation of PVs in Croatia is the capability of the distribution system operator and the transmission system operator to integrate PV plants. As mentioned, the investments in the electricity network at DSO and TSO levels need to be improved. However, if the same amount of installed PV plants in terms of W/capita were achieved in Croatia as in advanced countries such as the Netherlands and Germany, the total PV capacity would have to be between 3 and 4 GW.

The dominant policies related to reducing demand/consumption are those focused on increasing energy efficiency in buildings, as stated in the Long-Term Strategy for National Building Stock Renovation by 2050, adopted by the government in December 2020. The Strategy provides clear

goals and targets for the energy retrofit of buildings for all sectors (public, private, commercial) and outlines specific measures and activities to achieve the targets.

In practice, the energy retrofit of buildings has been carried out mostly through public calls for subsidies managed by the Ministry of Physical Planning, Construction and State Assets. However, the implementation is rather slow because allocations for calls (i.e., total subsidies) are relatively low. For example, the current public call (ending on 23 May 2023) for public buildings has a total allocation of €40 million for the entire public sector in Croatia, while according to the Program of Energy Retrofit of Public Buildings (adopted by the government in March 2022) the total needs to achieve targets for public buildings by 2030 amount to approximately €1.2 billion. In addition, there needs to be a clear indication of future calls and their allocations, which would contribute to the predictability and stability of the overall retrofit scheme. The current lack of predictability harms the construction industry, and it is questionable whether the industry will be able to implement all construction work needed to achieve the set targets within a reasonable timeframe and budget.

# 5

# FORESEEABLE CONSEQUENCES CONCERNING EU CLIMATE GOALS/TARGETS?

The awareness of the need to reduce energy consumption and the benefits of using renewable energy sources is increasing among Croatia's general population and entrepreneurs. Both sectors are expressing their wishes and demands for opportunities to invest in green energy projects and exert pressure to remove administrative and legal barriers, including simplifying procedures for obtaining permits for electricity grid connections. Croatia has the potential to become a net exporter of green energy, especially with a focus on solar PV

Croatia's local and regional authorities and their energy agencies are very active in starting and implementing sustainable energy projects, especially the deep energy retrofit of public buildings and the use of local renewable energy.

In 2022, the Croatian Parliament adopted a National Hydrogen Strategy until 2050, in which hydrogen was recognised as a significant energy source with a high potential to contribute to the decarbonisation objectives. The potential of hydrogen in Croatia derives primarily from an increasingly RES-based electricity production, which can support the production of green hydrogen. Due to Croatia's high solar energy potential, the uptake of the integration of PV systems with hydrogen technology is expected. Integrating RES with hydrogen systems could ensure the storage of surplus electric energy, addressing one of the greatest challenges of RES-based energy production.

The uncertainty in the future energy supply from Russia offers an opportunity to accelerate the energy transition in Croatia. Croatia is highly exposed to climate change and natural disasters, a fact which could be used to stress the importance of switching to renewable energy as, despite the recent expansion of renewables, fossil fuels continue to dominate Croatia's energy consumption mix. Energy efficiency improvements should also remain a priority. Future Croatian climate and economic strategies should align with the energy strategy to ensure energy independence and stability.

# CZECH REPUBLIC

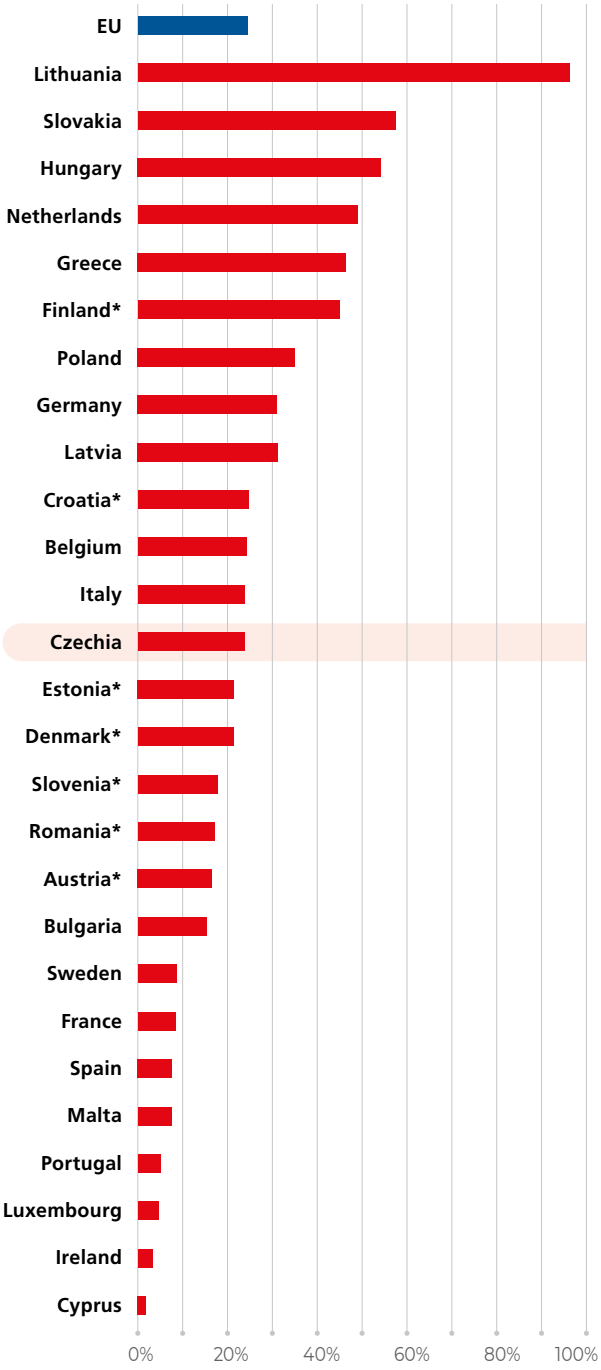
by Jaroslav Knápek

# INTRODUCTION

The beginning of the war in Ukraine caught the Czech energy sector in a situation of ongoing changes – in the field of legislation, the development of the use of RES, and the fuel base for electricity and heat production. In general, after February 2022, there has been both an acceleration of some trends triggered by factors such as decarbonisation targets (investment in energy saving measures, development of small PV systems, etc.) and a change in certain priorities and targets.

The Czech Republic has so far been heavily dependent on imports of energy commodities from Russia, especially in the case of oil, petroleum products, and natural gas. This posed a high risk of supply shortages or shutdowns with potentially fatal consequences for the Czech economy. This was also true in principle for nuclear fuel, although the situation was not as critical in this case thanks to the nuclear fuel stocks at both nuclear power plants.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# THE CZECH REPUBLIC'S ENERGY SECTOR BEFORE 2022

The Czech Republic's (CZ) energy sector has historically been based on the use of domestic lignite and hard coal.

Since the early 1990s, there has been a gradual decline in coal extraction and use. Still, solid fuels (predominantly lignite and hard coal) accounted for about 31% of total primary energy resources (PES) in 2021, compared to 65% in 1990 (Fig. 2).

Due to the high share of industry in GDP, PES consumption remains relatively high. The share of industry in the creation of gross value added (GVA) in the Czech Republic has long been around 30% (in 2019 it was 29.2%), while the average of EU countries is around 20%.[1]

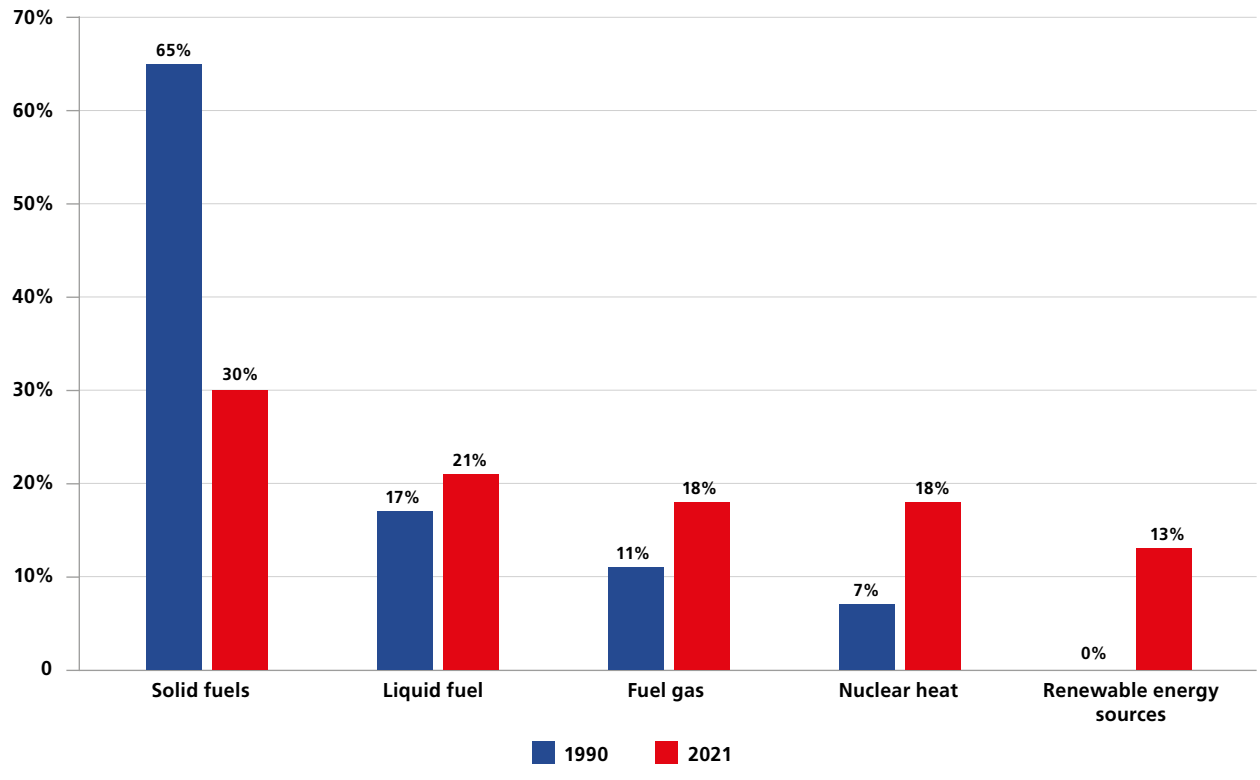
1 Zábojníková K. Odvětvová skladba České ekonomiky. STATISTIKA&MY. 11–12 | 2020 – ROČNÍK 10, ISSN 1804-7149.

The share of RES in final energy consumption has been gradually increasing, reaching 17.7% in 2021.

## 1.1 ELECTRICITY PRODUCTION

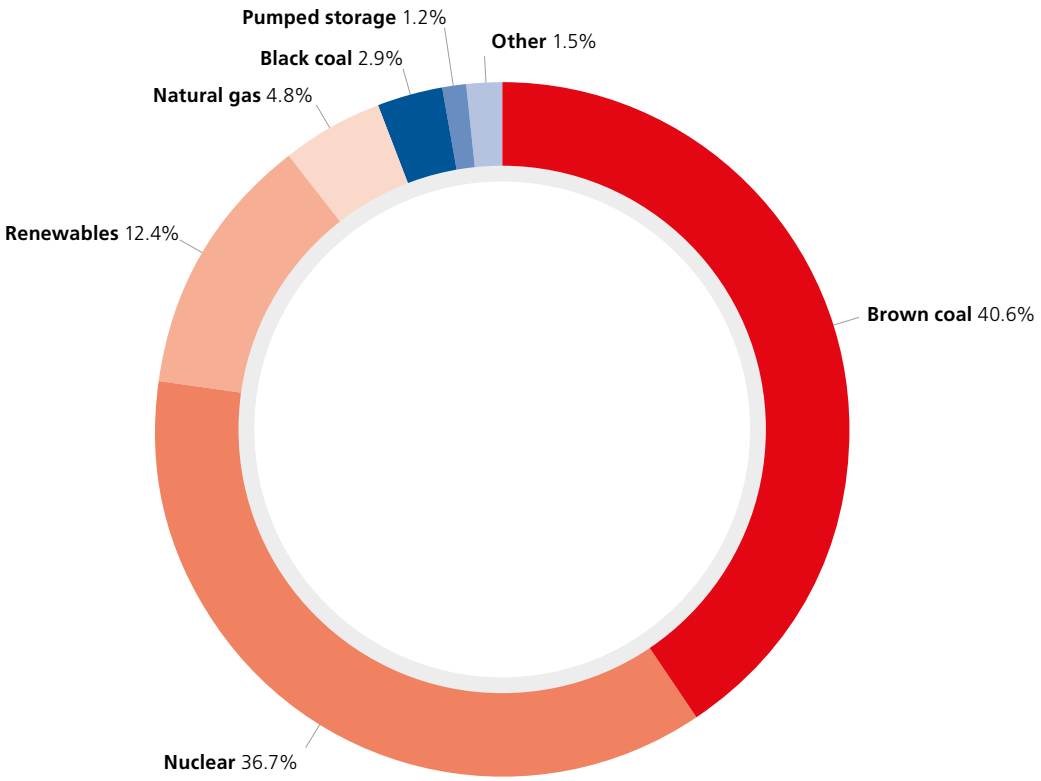
At the beginning of the 1990s, the dominant share of total electricity production was from coal-fired power plants and the Dukovany nuclear power plant. In 2002, after the commissioning of the Temelín nuclear power plant, the share of electricity from nuclear power plants began to increase significantly, while at the same time, although relatively slowly, the production of electricity from RES and natural gas is also growing. The peak of electricity production from natural gas was reached in 2021 (about 8.3% of gross electricity production).

Figure 2
**Structure of PEZ in the Czech Republic, 1990 and 2021**




Sources: Souhrnná energetická bilance státu v metodice Eurostatu za léta 2010–2021, https://www.mpo.cz/cz/energetika/statistika/energeticke-bilance/souhrnna-energeticka-bilance-statu-v-metodice-eurostatu-za-eta-2010_2021--271601/; Vývoj primárních a obnovitelných energetických zdrojů v letech 1990–2015, https://www.mpo.cz/assets/dokumenty/54201/64299/658425/priloha001.pdf

Figure 3
**Structure of gross electricity production in the Czech Republic by fuel types in 2022**




Source: ERÚ. Roční zprávy o provozu elektrizační soustavy ČR.

Despite the gradual increase in electricity generation from RES and nuclear power plants, the share of electricity generation from coal remained high in 2022, at over 40% – see Fig. 3.

## 1.2 IMPORT DEPENDENCE OF THE CZECH REPUBLIC

Thanks to the use of domestic coal reserves, the Czech Republic has a relatively lower import dependence compared to the EU average. The gradual decline in domestic coal production and use has led to a gradual increase in import dependence on energy commodities, from less than 29% in 2011 to more than 40% in 2021.[2]

Until the outbreak of the war in Ukraine, the Czech Republic was characterised by a relatively high level of import dependence on Russia. In 2021, this dependence reached 25.4% (i. e. over half of the total import dependence). Imports of energy commodities from Russia were dominated by oil, liquid fuels, and natural gas.

The Czech Republic is almost 100% dependent on oil and natural gas imports. Domestic production of oil and natural gas amounts to only a few per cent of domestic consumption. The total import dependence of the Czech Republic in the natural gas commodity in 2021 was 92.1%, after taking into account the pumping of gas from underground storage (total imports of 8.7 bcm of gas, exclusively from Russia). Similarly, crude oil production in the Czech Republic covered only about 1.3 per cent of total oil consumption in 2021. Oil imports from Russia amounted to about 50% in 2021.

2 MPO. Energetická statistika - Energetická dovozní závislost České republiky v letech 2011–2021. https://www.mpo.cz/assets/cz/energetika/statistika/energeticke-bilance/2023/3/Dovozni_zavislost_2011-2021.pdf

# 2

# ENERGY – REACTION TO THE START OF THE WAR IN UKRAINE

## 2.1 IMMEDIATE RESPONSE TO LIMIT THE RISK OF PES SUPPLY DISRUPTION

After the start of the war in Ukraine, the immediate priority for the Czech government was to secure alternative supplies of oil and gas to replace supplies from Russia. As it turns out, the bigger and more complex problem for the Czech Republic is to replace Russian oil supplies from other sources. The Czech Republic is connected via the IKL pipeline to the TAL pipeline system, which enables the transport of crude oil from Trieste via Vohburg in Germany to the Central Oil Tank Farm in Nelahozeves. The capacity of the TAL pipeline is fully utilised and it is not possible to immediately increase its capacity to meet the needs of supplies to the Czech Republic. In 2023, an agreement was reached with the other TAL pipeline shareholders to implement the TAL-Plus project, which will make it possible to increase the capacity of the TAL pipeline by about 4 million tonnes per year from 2025.[3] This will allow for the transport of a total of 8 million tonnes of crude oil per year to fully cover the needs of the Czech Republic. Oil transport via the Druzhba pipeline is exempt from EU sanctions imposed on Russia (ban on oil purchases) until the end of 2024. At the same time, a complete switch from Russian oil will require technological changes at the Litvinov refinery or finding oil suppliers with similar characteristics to Russian oil.

As with oil, the Czech government has been searching urgently for alternative gas suppliers since the beginning of the war in Ukraine. Through ČEZ, a. s., the Czech Republic managed to secure a stake in the new LNG terminal in Eemshaven in summer 2022, which would provide the Czech Republic with a capacity of up to 3 bcm of gas per year.[4] At the same time, the Czech Republic is negotiating participation in the expansion of the upcoming floating LNG terminal near Gdańsk (Poland). The Czech Republic is also a member of the Trident Initiative, which includes 12 countries located between the Baltic, Black, and Adriatic Seas. The initiative is aimed at linking the member countries and making efficient use of LNG terminals.

Another immediate response of the Czech government was to include natural gas as a new item in the strategic reserves. Gas purchases of 2.4 TWh were made in 2022.

One operative measure taken was an amendment to the Energy Act (in June 2022), which allows gas traders to withdraw contracted but unused capacity in underground gas storage facilities. This is a 'take it or lose it' rule, the purpose of which is that traders lose their unused reserved capacity without compensation. At the same time, there is an increased emphasis on monitoring the filling of the gas storage facilities for the following winter 2023/2024. Currently (as of 11 August 2023), the filling of the storage facilities is 92.1%.[5]

In the case of nuclear fuel, immediately after the start of the war in Ukraine, the decision was made to find a supplier other than the Russian company TVEL for security reasons. This company has been supplying nuclear fuel to the Dukovany power plant throughout its operation and currently also to the Temelín power plant. In 2022 (thanks to an exemption from the ban on flights from Russia to the EU), a total of three deliveries of new fuel assemblies for both plants took place. They thus have a fuel supply for 2 (Temelín) and 3 years (Dukovany) respectively. The new fuel supplier for both plants is Westinghouse, which will begin supplying fuel starting in 2024. The issue of supplying nuclear fuel for VVER-440 and VVER-1000 units operated by 5 EU Member States and Ukraine (18 VVER-440 units and 17 VVER-1000 units in total) is being addressed at the EU level through an agreement on the APIS project.[6] [7]

## 2.2 MEASURES TO REDUCE ENERGY CONSUMPTION

Another immediate step taken by the government, governmental institutions, and the business sector was the introduction of energy saving measures, for example, limiting the temperature of heated areas. This, together with the pres-

3 MERO ČR. Tisková zpráva. https://mero.cz/mero-cr-dosahlo-dohody--na-rozsireni-kapacity-ropovodu-tal-cesko-diky-tomu-posili-svoji-energetickou-bezpecnost-a-od-roku-2025-ziska-ropnou-nezavislost/

4 Vláda ČR. Tisková zpráva. https://www.vlada.cz/cz/media-centrum/aktualne/premier-petr-fiala-se-zucastnil-otevreni-lng-terminalu-v-nizozemskem-eemshavenu--198913/

5 Webový portál zásoby plynu. https://www.zasobyplynu.cz/

6 APIS - Accelerated Program for Implementation of secure VVER fuel Supply. https://apis-project.eu/

7 Westinghouse. Tisková zpráva. https://info.westinghousenuclear.com/news/westinghouse-led-project-will-secure-vver-fuel-supply-in-europe-and-ukraine

sure for savings brought about by the surge in energy prices, led to a significant decrease in energy consumption. In the case of electricity, total electricity consumption fell by 3.9% in 2022 compared to 2021, and in the case of households, electricity consumption fell by as much as 9%.[8] Natural gas consumption also decreased significantly, with 20% less gas consumed in 2022 than in 2021. When converted to the long-term temperature normal, the decrease in consumption was 16.5%.[9]

## 2.3 MEASURES TO REDUCE THE IMPACT OF RISING ENERGY PRICES ON CONSUMERS

The government and parliament have responded to soaring energy prices, particularly for electricity and gas. In October 2022, the so-called 'savings tariff' was introduced, which abolishes the RES charge of 495 CZK/MWh (+ VAT) and introduces an across-the-board support for households in the form of a direct one-off financial support of 2,000–3,500 CZK (depending on the category of consumption). The same was the case for natural gas. From the beginning of 2023, the energy-saving tariff was replaced by a cap on energy prices of CZK 2.5/kWh (excluding VAT) for natural gas and CZK 5/kWh (excluding VAT) for electricity. The capping (adopted until the end of 2023) applies not only to households but also to small and medium-sized enterprises (up to 250 employees). Larger entities have been given the possibility to benefit from direct support under the so-called Temporary Crisis Framework, which has been extended to all sectors of the economy. Energy-intensive enterprises were given the possibility to apply for direct support of up to EUR 45–200 million.[10]

In the case of electricity, especially for low-voltage end-users, a significant part of electricity payments is made up of transmission and distribution charges, including the cost of providing system services. Thus, another step was the capping of the price for transmission and distribution system services at the 2022 level (see ERO Price Decisions 13/2022 and 14/2022), coupled with compensation for losses to transmission and distribution system operators. CEPS, a. s. received a subsidy of CZK 7.2 billion for 2023 to cover electricity losses and a subsidy of CZK 15.5 billion to provide system services. These subsidies are intended to cover the increase in service prices compared to the period 2019–2021. Similarly, the state is paying compensation to distribution companies in 2023 in the total amount of CZK 13.3 billion. At the same time, CZK 2.1 billion has been provided for similar compensation for part of the costs of losses in gas systems.[11]

## 2.4 FINANCING MEASURES TO REDUCE THE IMPACT OF HIGH ENERGY PRICES ON CONSUMERS

The financing of measures to reduce the impact of extremely high energy prices on consumers has required raising extra revenue for the state budget. One important additional source of funds is the extraordinary windfall profits tax imposed in the Czech Republic on companies in the energy production and trade, banking, petroleum, and fossil fuel extraction and processing sectors that meet the criteria for the imposition of the tax. The temporary extraordinary tax is proposed for the period 2023–2025 and operates as a 60% tax surcharge on excess profits, defined as the difference between the tax base in those years and the average profits for the period 2018–2021 plus 20%. Another measure to raise funds is the levy on capped electricity producer prices. Electricity producers levy 90% of the difference between the selling price and the officially set capped price. For example, for nuclear power plants the officially set cap price is EUR 70/MWh, for coal-fired power plants EUR 140–170/MWh (depending on installed capacity), for biogas plants EUR 240/MWh, etc. Generating plants with a capacity of less than 1 MW and pumped storage plants are exempted from the levy. Initially, the estimated amount of the extra revenue received was CZK 85 billion from the excess profits tax and CZK 15 billion from the electricity price caps. The dividend from ČEZ, a. s. is also an important source for the state budget. The Ministry of Finance (representing the state at the General Meeting) proposed, and the General Meeting thus decided, to distribute 100% of the profit for 2022. This means a revenue of approximately CZK 54 billion for the state. Although it currently seems unlikely to collect extraordinary taxes and levies in the originally planned amount, the significant drop in electricity and gas prices on the markets is playing a positive role. This in turn reduces the pressure on financing measures to stabilise energy prices. For example, the weighted average price on the spot market organised by OTE in June 2023 was about 99 EUR/MWh.[12][11] Even better price signals can be obtained from forward trades, e. g. on the PXE. The current price (as of 10 August 2023) of an annual electricity supply contract (www.pxe.cz) here is 138 EUR/MWh. This means that current prices of electricity as a commodity (similar to natural gas) are below the currently capped price.

## 2.5 CLIMATE TARGETS FOR THE CZECH REPUBLIC

The climate objectives and the instruments to achieve them are contained in three interrelated documents, namely the Climate Protection Policy[13], the National Energy and Climate

8 ERÚ. Tisková zpráva. https://www.eru.cz/domacnosti-v-roce-2022-rekordne-setrily-elektrinou

9 ERÚ. Tisková zpráva. http://www.eru.cz/sites/default/files/obsah/prilohy/20232402tzspotrebaazasobaplynu2022.pdf

10 MPO. Tiskové sdělení. https://www.mpo.cz/cz/rozcestnik/pro-media/tiskove-zpravy/vladni-pomoc-firmam-podle-docasneho-krizoveho-ramce-se-rozsiri-na-dalsi-sektory--270511/

11 MPO. Tisková zpráva. https://www.mpo.cz/cz/rozcestnik/pro-media/tiskove-zpravy/ceps-ziska-dotaci-na-ztraty-energie-v-prenosove-soustave-a-na-zajisteni-systemovych-sluzeb--272691/

12 OTE, Roční zpráva o trhu s elektřinou 2023. https://www.ote-cr.cz/cs/statistika/rocni-zprava?date=2023-01-01

13 MŽP. Politika ochrany klimatu v České republice. 2017. https://www.mzp.cz/cz/politika_ochrany_klimatu_2017

Plan (NKEP)[14], and the State Energy Concept.[15] The original targets of the NKEP were set at a 30% reduction in GHG emissions in 2030 (relative to 2005) and for RES to account for 32% of gross final energy consumption in 2030.

These documents do not reflect the dynamic changes taking place between 2019 and now (Green Deal, Fit for 55, RE-PowerEU, geopolitical developments). The Government of the Czech Republic adopted the key theses and starting points for the update of the documents in April 2023[16] with a deadline of the end of 2023. The strategic objectives for the energy transformation are: 1) security of energy supply (including diversification of imports of PES); 2) competitiveness and social acceptability (energy affordability, predictability of the regulatory environment, reduction of the risk of energy poverty, etc.); and 3) sustainability of energy management (inter alia, reduction of GHG emissions in line with EU targets). One of the key energy targets is to reduce the share of fossil fuels in the consumption of PES to 50% by 2030 and to phase out the use of coal for electricity and heat generation by 2033.

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**14** MPO. Vnitrostátní plán České republiky v oblasti energetiky a klimatu. 2019. https://www.mpo.cz/cz/energetika/strategicke-a-koncepcni-dokumenty/vnitrostatni-plan-ceske-republiky-v-oblasti-energetiky-a-klimatu--252016/

**15** MPO. Státní energetická koncepce. 2015. https://www.mpo.cz/dokument158059.html

**16** MPO. Východiska aktualizace Státní energetické koncepce ČR a souvisejících strategických dokumentů. https://www.mpo.cz/cz/energetika/strategicke-a-koncepcni-dokumenty/vychodiska-aktualizace-statni-energeticke-koncepce-cr-a-souvisejicich-strategickych-dokumentu--273672/

# 3

# CONCLUSION

The war in Ukraine has caught the Czech energy sector in a crucial initial phase of transformation, consisting mainly in the search for alternatives to domestic lignite and hard coal. It is not only the transformation of the electricity generation sector, but also the transformation of the heating sector, which currently appears to be one of the most important priorities of the Czech energy sector. But moving away from coal also means finding a long-term sustainable and workable solution for the approximately 300,000 households still using domestic coal for local heating. The transformation of the Czech energy sector away from coal has so far been built on two basic pillars, namely the combination of further development of nuclear energy and renewable energy sources, with natural gas playing a key role in the transformation of the heating sector, and in the provision of flexibility services in electricity generation.

Following the outbreak of war in Ukraine, the Czech government and the entire energy sector have been forced to respond rapidly to the situation. In addition to the need to address the extreme increase in electricity and gas prices, other critical aspects include finding ways to get rid of dependence on imports of energy commodities from Russia, especially in the case of crude oil, natural gas and nuclear fuel. In 2022 and 2023, it is possible to negotiate the replacement of natural gas from Russia by LNG supplies, including securing a participation in the LNG terminal at Eemshaven. Similarly, the replacement of oil supplies originally provided by the Druzhba pipeline through the intensification of the TAL pipeline with a connection to the IKL pipeline is being negotiated. The resolution of oil supplies is linked to technological measures on the TAL pipeline and the earliest possible date for the replacement of Druzhba pipeline supplies is towards the beginning of 2025. Similarly, the replacement of Russian natural gas is linked to the contracting of LNG imports to Europe (in addition to the strengthening of supplies from Norway). Here too, the rational horizon for getting rid of dependence on Russia seems to be around 2026. The key factors are the speed at which new LNG terminals can be built, and savings or reductions in gas consumption. In the area of nuclear fuel substitution, a solution has already been found and from 2024–2045 fuel supplies from the Russian company TVEL are to be replaced by supplies from Westinghouse.

The very rapid development of photovoltaic power plants continues, with the limit for unlicensed plants being raised from 10 kWp to 50 kWp in 2023. However, along with the rapid development of these installations, issues regarding storage, the rational use of energy at the point of generation, etc. must also be addressed. Here, the reality is still somewhat behind the rapid development of PV applications.

At the same time, energy legislation is being amended to allow the introduction of new entities such as energy communities, storage and aggregation service providers. Alongside this, a new tariff structure reflecting the changes in the structure of energy production and consumption (including the rapid growth of PV installations in particular) is being designed and should be gradually phased into use between 2024 and 2026.

In conclusion, the Czech energy sector has managed the crisis period following the start of the war in Ukraine, despite the combination of several other factors, such as its having coincided with the transformation of the energy sector away from coal and the implementation of the Green Deal objectives. Nevertheless, for at least the next few years, the Czech energy sector will remain dependent (albeit to a much more limited extent) on supplies from Russia, especially for crude oil (at least until 2025).

# DENMARK

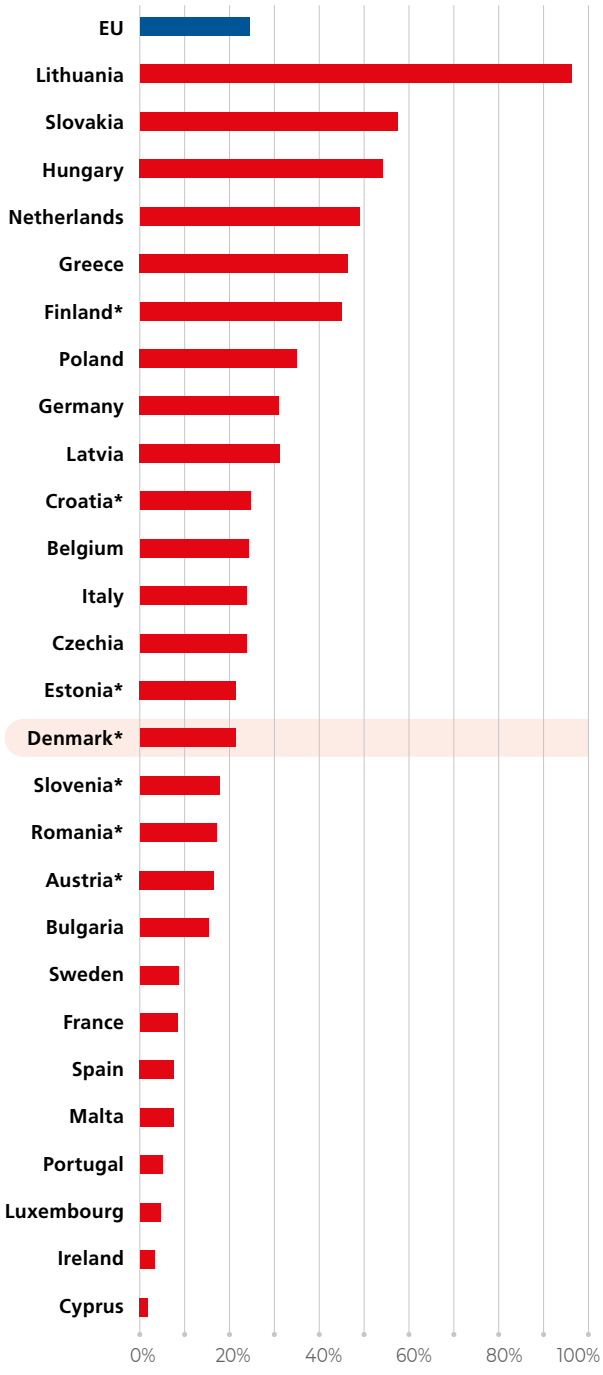
by Izabela Surwillo
and Veronika Slakaityte

# INTRODUCTION

Prior to the Russian aggression on Ukraine in February 2022 and the subsequent energy crisis, Denmark's total dependency on Russian energy imports stood at 21.1%, which was below the EU average of 24.4% (European Commission 2022). Notably, Denmark also had one of the EU's lowest gas import dependencies with only 4% of its total energy consumption covered by Russian gas (McWilliams and Zachmann 2022). Furthermore, Denmark's strong wind power sector, along with domestic reserves of fossil fuels (including oil and gas industries), resulted in a high level of self-sufficiency, reaching 60% in 2022 (Danish Energy Agency 2022a). Consequently, in comparison to many other EU Member States, Denmark faced fewer challenges in diversifying its energy imports away from Russia. As a result, the impact of the EU's energy sanction packages against Russia on the Danish energy sector was relatively low, with more immediate effects observed in the substitution of Russian coal and wood pellets.

This paper assesses the impact of the energy crisis on Denmark. It delves into the specifics of the Danish case by analysing the energy situation of the domestic energy market prior to the war in Ukraine in 2022, the short- and long-term policy responses following its outbreak, the impact of the conflict and the energy sanctions on Denmark's domestic energy sector, and its alignment with the EU climate goals.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

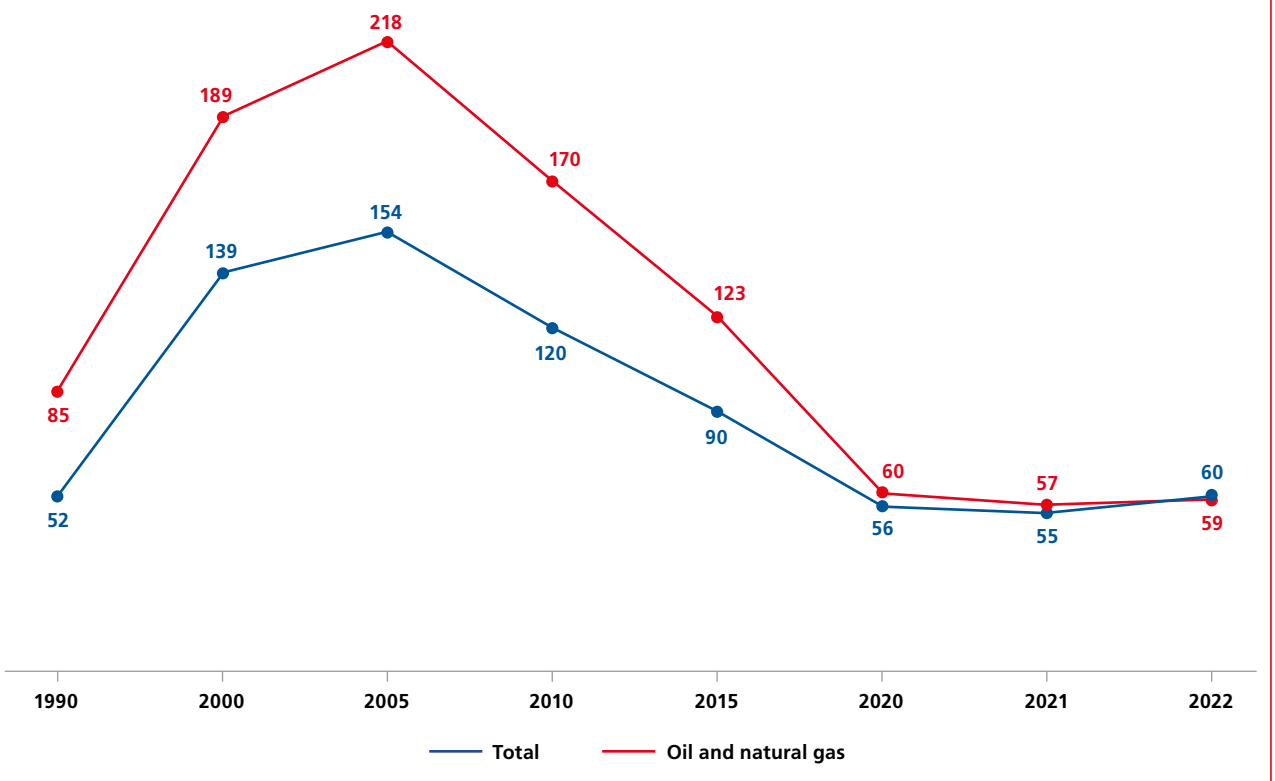
# STATUS QUO ANTE (AS OF FEBRUARY 2022)

The Russian invasion of Ukraine in February 2022 and the subsequent energy crisis did not have a drastic impact on the Danish energy sector – at least not directly. Due to significant investments in renewable energy, high energy efficiency measures, and a relatively low-carbon economy, Denmark has been a regional leader in energy transition for years. Surrounded by the Baltic and the North Seas, Denmark capitalised on the favourable meteorological conditions for wind power generation, with over half of its domestic electricity generation currently coming from wind (Ritchie and Roser 2023).

Albeit decreasing in importance, domestic oil and natural gas production has also played an important role. Since the 1970s, Denmark was heavily reliant on oil and natural gas, which were systematically extracted from the Danish North Sea. The extraction volumes have decreased significantly since the peak of production in 2005, when Denmark produced 289,163 oil barrels per day and 11.7 bcm/y of natural gas, making the small Scandinavian country not only fully self-sufficient, but also a net exporter of oil and gas in the period of 1997–2018. Ageing infrastructure and gradual depletion of the oil and gas fields led to much lower extraction volumes, with the domestic oil production currently covering 53% and the natural gas around 70% of the country's needs (Danish Energy Agency 2023c; Eurostat 2022b).

Together, the historically significant and expanding wind power coupled with access to domestic fossil fuel resources made for a high level of Danish self-sufficiency over the years (see Figure 2). This helped Denmark achieve a certain level of energy self-sufficiency and minimise the repercussions of the EU's energy sanctions on Russia in 2022.

Figure 2
**Self-sufficiency degree in Denmark in 1990-2022.**




Source: Based on data provided by the Danish Energy Agency

Nevertheless, Danish consumers and businesses were hit by high energy prices resulting from the economic impact of the war. The crisis also drew attention to energy import vulnerabilities, prompting a shift in policy focus.

In 2021, Denmark's total dependency on Russian energy imports amounted to 21.1% (below the EU average of 24.4%) (European Commission 2022). The Danish energy mix has been relatively stable with oil ranking as the first source by consumption, followed by wind energy and natural gas, with the latter being overtaken by renewable energy sources (RES) in recent years. In 2021, oil accounted for 39.77%, wind for 22.49%, other RES for 14.95%, gas for 12.41%, coal for 6.88%, solar for 1.79% and hydro for 0.02% of the total share of energy consumption in Denmark (Ritchie and Roser 2023).

Denmark has one of the lowest gas import dependencies in the EU at 28.7%[1] in 2021 (Eurostat 2023; 2022b). Domestically, gas is used for heating by 380,000 households, and approximately 30,000 small, medium, and large businesses (Danish Energy Agency 2022b).

In 2019 Tyra, Denmark's largest oil and gas field, went under maintenance; its reconstruction was prolonged due to the Covid-19 pandemic, pushing back the field's opening into the winter of 2023–2024 (Energinet 2019). That increased the country's gas dependence. Therefore, approximately one third of gas for domestic use had to be imported, while the rest has been covered by a mix of storage reserves, domestic gas, and biogas production.

With a relatively tight gas network consisting of a feeder pipeline to Sweden, a bidirectional pipeline between Denmark and Germany, and a newly constructed bidirectional connection – the Baltic Pipe – that enabled access to Norwegian gas as of October 2022, the gas import possibilities are limited. Hence, from the closure of Tyra to the opening of the Baltic Pipe, all imports were sourced from Germany (Danmarks Statistik 2022). Estimating how much of that gas was of Russian origin however is challenging; most data is generated under an assumption that half of the net imports from Germany are of Russian origin (see Eurostat 2022a). In a statement issued by the German Ministry of Economic Affairs and Climate Action in 2022, it is noted that prior to the war in Ukraine, 55% of gas imports came from Russia, 30% from Norway and 13% from the Netherlands (Wettengel 2023). Some other unofficial estimates were higher, listing 75% of the 'German transit gas' to be of Russian origin (Global Energy Data 2022). According to the estimates made by Bruegel, only around 4% of the total energy consumption in Denmark in 2021 was made up of Russian gas (McWilliams and Zachmann 2022).

Since 2013, Denmark has experienced a substantial increase in biogas usage. Over the past decade, 51 biogas facilities were integrated into the gas system. By 2021, biogas accounted for about a quarter of domestic gas consumption, leading to a significant reduction in $CO_2$ emissions (Energinet 2022). Plans are in place to expand the sector further, aiming to cover 75% of gas demand by 2030 and meet the entire demand by 2034 (Ibid.).

Prior to the war, Denmark primarily imported petroleum from five locations: the United States, Norway, Russia, Nigeria, and Libya (OEC 2023). Total oil and petroleum products (excluding biofuel) import dependency was measured at 55% in 2020; Russian oil accounted for approximately 27.6% of the imports (Eurostat 2022a). With oil being a more palpable commodity – traded on the world market and transportable by multiple means – oil import dependency certainly constituted a lower potential vulnerability, as compared to gas imports, due to vast diversification options. However, the global nature of the oil market presented its own risks. Historical oil crises in 1973–1974, 2000–2001, and 2007–2008 demonstrated that a disruption in one oil exporting country could impact the entire market.

Coal also plays an important part in the Danish energy mix, although its consumption has been gradually decreasing since the 2000s due to the boom in renewables (OECD 2020). Fossil fuel is primarily used for electricity generation and household heating (Danish Energy Agency 2022b). While coal only accounts for 6.88% (2021) of the domestic energy profile, Denmark has been completely dependent on its imports, predominantly from Russia (about 97% of imports), followed by Colombia (European Commission 2022; Danish Energy Agency 2022b; IEA 2017, 70). Among the most notable initiatives to phase out coal is the combined heat and power (CHP) plants' conversion from coal to biomass. What is more, biomass is also used to replace oil and natural gas boilers, in order to reduce greenhouse gas emissions ('Danish Climate Agreement for Energy and Industry 2020'). To speed up the transition to low-carbon technologies, biomass was placed under a zero-taxation scheme, both for district heating and residential use. The rapid roll-out of biomass, however, introduced additional import dependency, especially when it comes to solid biofuels, such as wood chips and pellets. The imports to Denmark have been primarily routed from three locations: Estonia, Latvia, and Russia (IEA 2017). One of the measures in the National Danish Energy Plan (2020–2024) agreed in 2018, enlists a decrease in solid biomass use in CHPs to counter the import dependence of wood (by-)products (Mussatto 2021). In 2021, biomass accounted for 33% of CHP generated heating, followed by waste at 21.2%, coal at 6.5% and natural gas at a mere 3.9% (Danish Energy Agency 2022a).

Denmark's electricity profile is largely dominated by renewables: wind (50%), bioenergy (20%), and solar (4%). However, as renewables constitute a less stable form of power generation that can be affected by weather conditions, e. g., low winds, cloudy conditions, or draughts, it is supplemented with more stable production from coal (15%), gas (6%), and oil (3%) (Table 1).

Over the years, the Danish electricity generation sector has seen significant changes. Coal, dominant in the early 1990s, now constitutes just over 15% of the fuel mix (Ibid.; Table 1).

1 Calculated as follows: total inland consumption observes=100%; (total imports – total exports) =X; X=28,697608843823236%. Data retrieved from: Eurostat, code NRG_CB_GASM.

Table 1
**Electricity mix by source in Denmark**

| Source/year | five-year avg. 2017-21 | 2021 | 2022 |
|---|---|---|---|
| **Wind** | 50.70 | 48.55 | 55.03 |
| **Bioenergy** | 21.33 | 26.38 | 23.10 |
| **Coal** | 15.37 | 13.22 | 10.52 |
| **Gas** | 06.40 | 04.66 | 02.99 |
| **Solar** | 03.40 | 03.96 | 05.78 |
| **Oil** | 03.34 | 03.18 | 02.53 |
| **Hydropower** | 00.06 | 00.06 | 00.06 |
| **Nuclear** | 00.00 | 00.00 | 00.00 |
| **Other RES** | 00.00 | 00.00 | 00.00 |

Source: Ritchie and Roser 2023

The role of biomass has grown substantially, accounting for one fifth of electricity production in 2021, signifying a 109% increase since 1990 (Danish Energy Agency 2022a). Additionally, there has been a shift from large-scale combined heat and power (CHP) plants to smaller-scale generation units.

Renewable electricity generation leads to significant yearly output fluctuations. The Nordic power market at large is strongly correlated with weather conditions, given the dominance of hydropower in Sweden and Norway. Since 2011, Denmark has been a net importer of electricity, with imports varying annually. In 2020 net imports accounted for only 3.6% (Eurostat 2022a), primarily sourced from Norway and Sweden (Danish Energy Agency 2022a), while the export flows are directed to Germany and the Netherlands.

Since 1990, electricity consumption has risen by 11.8%. At present, consumers can be categorised into three main groups: agriculture and industry (34%), households (33%), and commercial and public services (30%). As electrification efforts continue, consumption is expected to grow, while the distribution among the three categories is likely to remain relatively stable.

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

The outbreak of war in Ukraine and the subsequent shift in the EU's energy policy towards Moscow have affected Denmark's domestic energy sector despite its low reliance on Russian energy sources.

The energy crisis made Danish society acutely aware of the dire consequences of the war in Ukraine, as the economic and geopolitical repercussions were brought to its doorstep, influencing public perception of European energy and security politics more broadly. Record-high energy prices affected Danish businesses and society (The Local 2022) and the security dimension of the crisis became blatantly obvious with the explosions along the Nord Stream 1 and 2 natural gas pipelines in late September 2022. These acts of sabotage, just outside of Danish territorial waters, heightened the protection of critical energy infrastructure in Denmark in fear of further escalations.

In terms of immediate policy responses, Denmark has introduced various energy saving measures, encouraging its population to conserve energy to support sufficient energy supply on the domestic market and aid in protecting consumers from high energy bills. Some of the recommended measures for citizens included turning down the heat in buildings, limiting the use of hot water, saving electricity (turning off appliances when not in use, switching off lights if/when not necessary), or using electricity when it is produced domestically, and tracking energy prices. Consequently, apps such as *Min El* that show electricity prices in real time have become hugely popular (Danish Authority of Information 2023). Moreover, a country-wide program aimed at reducing energy consumption across all public buildings was launched on 8 September 2022. The project included measures, such as lowering the heating temperature to 19°C in public buildings, switching off unnecessary lighting (e.g., the logo sign on the building, decorative lights, etc.), and reducing the heating season by 14 days at each end (Danish Authority of Information 2023).

Despite the relatively mild winter season of 2022/2023, low dependency on gas imports, and all the implemented measures, Danish consumers were still hit by the energy price rise, largely due to the closely linked gas markets with Germany. The year 2022 averaged at a gas price of EUR 125/MWh which is five to six times higher than the historical average (Energinet 2023). The government sought to mitigate the impact with several initiatives along the way. From 1 October 2022, the general electricity tax was reduced (by 4 øre[2] per kWh), and the measure extends to the first half of 2023 with the tax rate being temporarily lowered to the EU minimum (from 69.7 øre per kWh to 0.8 øre per kWh). Electricity tax reduction is also being considered for heat pumps. Other discussed measures include diverting some of the windfall revenues from higher energy prices back to consumers.

Diverse financial support schemes were introduced for the most vulnerable consumers affected by rising energy prices in Denmark, including one-time payments in August 2022 for the most disadvantaged households, financial support for pensioners receiving supplementary pension contributions, a possibility for a temporary deferral scheme for the share of household and business costs for electricity, gas and district heating that exceeded the prices in the first quarter of 2021, an increase in the maximum employment allowance for 2022/2023 income years, and a temporary increase of the child and youth benefit paid out in January 2023 (Danish Authority of Information 2023). Approximately 419,000 low-income families have benefited from the one-time compensation for rising energy costs in heating. The government also allocated €13.3 million to municipalities to further distribute the funds to those in need (European Commission 2022).

Concrete policy initiatives were taken to alleviate the energy crisis: For instance, the subsidies for disconnecting from the gas network in 2023 have been increased further by DKK[3] 35 million (€4.7 million) , the fund pool for the roll-out of district heating was increased by DKK 150 million (€20.1 million) in 2022 and by additional DKK 100 million (€13.4 million) in 2023, measures have been implemented to enhance the supply of wood pellets, while the scheme that supports switching to subscription heat pumps by providing grants for the scrapping of oil and gas boilers was increased by DKK 10 million (€1.3 million) in 2022 and extended to include pellet boilers from 1 December 2022 (Danish Authority of Information 2023).

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2 Øre is the centesimal subdivision of the Danish krone (DKK); 1 øre is equal to approximately €0.001.

3 Danish krone: DKK 1 = €0.134078

The solidarity with the EU's shift in energy policy was also visible on the business side. The Danish company Ørsted gradually decreased its energy cooperation with Russia in the months following the outbreak of war. First, Ørsted stopped using the Russian coal and biomass supplies, then it declared that it would ensure none of its direct suppliers for the construction of renewable energy are going to be Russian, and finally the company refused to pay for Russian gas in rubles (Joanteguy 2022). In response to the latter, Russia cut off the gas supply (O'Neill 2022).

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

Following the outbreak of war in Ukraine, and the vast array of measures implemented to enhance Danish energy security, several changes are noticeable. First, the gross energy consumption has decreased from 729 PJ in 2021 to 709 PJ in 2022 (preliminary) (Danish Energy Agency 2023c). Secondly, due to favourable weather conditions, the degree of self-sufficiency rose from 55% to 60%, and hence the net electricity imports amounted to only 5 PJ (18 PJ in 2021, and 25 PJ in 2020) (Danish Energy Agency 2022a). Thirdly, due to the international nature of the energy markets and coincidental good timing of the Baltic Pipe's opening (autumn 2022), energy imports from Russia have been replaced with sources originating elsewhere – although alas, often at a higher price due to the global nature of the energy market. Lastly, the energy sources used in energy generation have been altered: for instance, electricity production from fossils fell from 21.05% in 2021, to 16.04% in 2022; the generation from low-carbon sources has instead undergone an upwards trend, peaking at 83.96% in 2022 (Ritchie and Roser 2023). Although high self-sufficiency in oil, natural gas and electricity production places Denmark among the least energy import dependent states in the EU, the sanction packages also affected the share of fossil fuels in Denmark's domestic power generation in 2022, with the shares of coal (–2.7%), gas (–1.67%) and oil (–0.65%) all decreasing.

Denmark also joined the EU Member States that called for stringent sanction measures against Moscow. The list of sanctioned energy products includes crude oil (from December 2022) and refined petroleum products (from February 2023) (with some exceptions), coal (August 2022), and other solid fossil fuels (European Commission 2023). While limited economic ties with Russia minimised the effect of the EU's new sanction regime on the Danish energy profile, there is one notable exception. Namely, the import of wood chips and pellets from the Baltic States and Russia which were affected by the sanctions is having both direct and indirect effects on energy generation of biomass in Denmark (K. B. Olsen forthcoming). Although wood did not surface in the headlines as another 'energy commodity ban', it occupies a significant share in the Danish heating and electricity generation sectors. The fifth sanction package included the prohibition of wood products (July 2022), alongside cement, asphalt, paper, plastics, and synthetic rubber (European Commission 2023). Largely overlooked, 'wood as a source of energy' was therefore directly affected by the sanctions (K. B. Olsen forthcoming). Moreover, the imports of wood from Latvia and Estonia were primarily in a form of a by-product – a residue from the domestic furniture production. However, as both countries used to rely on wood imports from Russia, Belarus, and Ukraine, the EU sanctions and the war in Ukraine affected this chain, thereby also further exposing Denmark to secondary effects of sanctions (IEA 2017).

The energy sanctions are also indirectly affecting the Danish businesses and society – perhaps most notably as reflected in the high rates of inflation. As it will take time for the (energy) markets to stabilise following the shocks induced by the combined impact of the war, sanctions, energy, and climate crises, the true effects of the current sanction regime against Russia can only be evaluated in the years ahead.

# 4

# MEDIUM- AND LONG-TERM ANSWERS

When it comes to a wider policy outlook in the medium to long term, the clearest energy policy shift in Denmark amid the outbreak of war concerned the acceleration of energy transition in order to boost self-sufficiency, with plans pointing to increased development of biogas, and a phase-out of fossil fuels over the long term, coupled with increased generation of green energy (State of Green 2022). The latter is to be achieved through a fourfold increase in the solar and onshore wind energy by 2030 announced by the Danish government in April 2022, as well as the ambitious offshore projects on the North and Baltic Seas. Denmark envisions a construction of the world's first artificial 'energy islands' that will serve as hubs connecting energy generated from offshore wind with the energy systems. This is the largest construction project in Danish history, costing an estimated €28 billion. The pilot energy island will be located 15 km southwest of the Danish Island of Bornholm in the Baltic Sea with a capacity of 3 GW to be established by 2030 (Danish Energy Agency 2023a). The subsequent energy island project will be erected in the North Sea – approximately 80 km off the coast of Jutland. The initial capacity of 3 GW is expected to become operational by 2033, gradually building up the amplitude leading to 10 GW by 2040 with a possibility of expansion up to 40 GW (Danish Energy Agency 2023b). The islands are envisioned to operate under the Power-to-X technology, which will enable the production of green hydrogen from surplus wind energy that is not possible be stored in large quantities otherwise (Johansen 2021)

The reduction of Russian gas supplies and the resulting uncertainty of energy supply in Europe have increased the risk of power shortages and has had consequences for the heating of buildings, street lighting, and energy consumption all over the EU, and Denmark is no exception (Danish Authority of Information 2023). Boosting the production of green energy serves Denmark's double policy goal of staying on track in the sustainable energy transition while ensuring stable energy supply within a changed geopolitical context. Green energy sources and technologies are particularly important to replace the domestic use of natural gas. In 2022, approximately 400,000 Danish households relied on fossil fuel heating. To reduce the consumption of natural gas, current plans envision the expansion of the district heating grid to allow more households to access green heat in the future – with the last district heating projects to be completed by 2028. Those households who cannot install district heating are either to replace furnaces with green heat pumps, or switch to biogas.

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

Despite the high mobilisation of the Danish government, business, and society amid the ongoing energy crisis, several issues remain. To start with, the planned scale-up of renewable energy generation requires additional regulatory and policy support, as the 2030 targets are quite infeasible given current installation ceilings for onshore wind turbines (State of Green 2022). Moreover, moving some offshore wind projects on-land is problematic, as there are numerous barriers in accessing necessary areas. Although many economic and technological barriers to the development of big wind power projects have been addressed (Nyvold 2019), Denmark often struggles with social resistance to both onshore and offshore wind projects (B. E. Olsen 2022). The majority of local protests come from holiday homeowners concerned with the landscape aesthetics and the drop in their holiday property value once the wind farms are developed in the proximity (Nyvold 2019). This constitutes a major challenge going forward with the ambitious plans to scale-up wind energy fourfold amid the ongoing energy and climate crisis.

The energy crisis also impacted Danish energy transition in other terms, extending the fossil fuel phase-out timeframe and raising concerns over increasing oil and gas production volumes (Slakaityte, Surwillo, and Villumsen 2022, 19). Although that increase is meant to be temporary, the Danish future energy mix rests on the success of the accelerated rollout of renewables, as well as on the energy technologies which are still in the stage of infancy, e. g., industrial carbon capture and storage, carbon recycling, etc. This raises the question of whether Denmark can achieve carbon neutrality by 2050. Nevertheless, Denmark is one of the leading countries in the net-zero transition in Europe and it will retain that position in the future, with wind power expected to play an increasingly important role in the country's path to green future, as outlined in the Danish strategy for carbon neutrality by 2050.

# CONCLUSION

Due to the specifics of its energy mix and low import dependency, the direct effects of the energy crisis in Denmark were limited. Tighter energy-saving measures, favourable meteorological conditions, and reduced fossil fuel use in domestic power generation in 2022 played a role. As such, the main effects of the crisis – although less obvious – owe to the interconnectedness of energy markets and the general cost of living crisis across Europe.

Set to be one of the frontrunners in sustainable energy transition in Europe, Denmark did not shift its main energy policy course during 2022. The geopolitical consequences of the war further accelerated the deployment of low-carbon energy technologies. In response to the ongoing energy crisis, the country implemented various measures to reduce energy demand and improve efficiency in both public and private sectors. Therefore, whereas many other EU states had to redirect large resources to rapidly diversify their energy imports away from Russia, the Danish drive towards energy security continues to rely on increasing self-sufficiency.

Despite the crippling of the energy crisis, Denmark remains steadfast in its green transition agenda and long-term decarbonisation goals. As the country forges ahead with ambitious large-scale renewable projects, the development of new technologies and the evolving landscape of international energy markets will further shape Denmark's path towards a sustainable future in the decades to come.

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# ESTONIA

**by Joanna Lepmets**

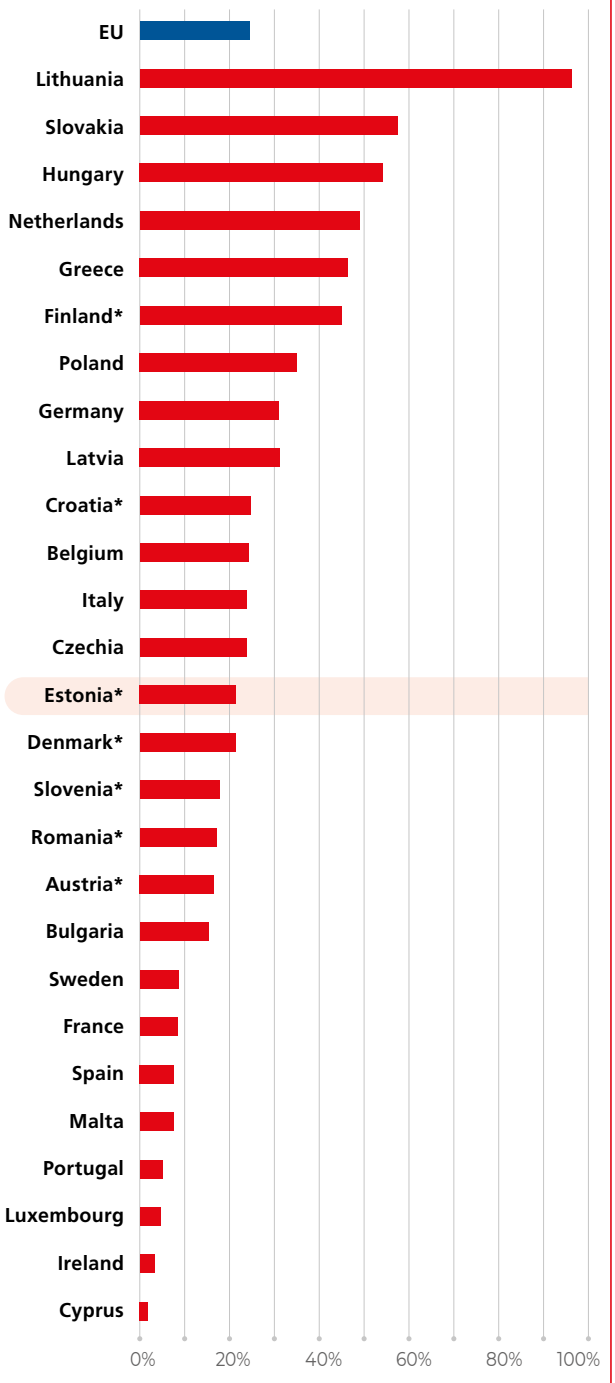
# INTRODUCTION

Prior to the Russian aggression against Ukraine on 24 February 2022, Estonian dependency on Russian energy imports was low with some important exceptions. Due to its Soviet legacy and national pragmatism about the threat of its eastern neighbour, since its independence the main driver of Estonia's energy policy has been energy security. Given this decades-long policy, Estonia is largely reliant on domestic resources for energy production. Russian energy imports made up 10.5 per cent of all energy resources in 2020. However, there are some sectors that are fully reliant on Russian imports, such as heating and industry on natural gas, and transport on oil products. In addition, the Estonian and Baltic electricity systems have been using Russian electricity imports for maintaining the grid frequency with a plan to end this by 2026.

For decades Estonia has been working towards reducing its dependence on Russian energy imports overall. However, finding alternatives for natural gas imports is a complicated issue, since the Estonian gas network, along with its neighbouring countries, is connected to the gas networks of Russia. Access to alternative LNG imports has been limited. Diversifying the source of oil products is not as complicated due to a lesser reliance on existing pipeline networks, but it is very costly. Replacing imports from Russia and Belarus for Estonia would entail 3.8 times the cost.

Within the last 15 months, Estonia suspended direct natural gas imports from Russia and decreased its gas consumption by 26 per cent. Estonia contributed to the building of a new floating storage and regasification unit in Finland, through which it gains access to LNG imports from other countries. Some gas demand was switched to oil shale. However, for the drop in demand for Russian natural gas to be maintained going forward, the economy needs to switch to cleaner alternatives. By February 2023 import and transit of oil products from Russia were stopped. Estonia began to maintain a zero or positive electricity balance with Russian TSO to avoid paying for balancing. Steps were made to start exploring green hydrogen, nuclear and boosting renewable energy production.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO ANTE (AS OF FEBRUARY 2022)

## ENERGY MIX

As a small country, Estonia's total primary energy supply is about 5 Mtoe. The energy mix is relatively unique compared to other EU Member States due to its strong reliance on domestically produced oil shale, which is used for heat, power generation and for liquid fuels. The domestic oil shale is low in energy efficiency and reliance on its use makes Estonia one of the worst performers of the world in terms of greenhouse gas emissions per capita. While the use of oil shale has been declining over decades, due to energy security reasons and lack of other domestic alternatives, the country has continued to rely on oil shale as a major source of energy.

In total, local oil shale makes up about 52 per cent of Estonia's energy mix. The country also has large domestic biomass resources. Bioenergy, which mainly comes from domestic forestry activities and waste, accounted for about 31 per cent of total primary energy supply. The share of renewable energy sources from sources other than biomass (wind, solar, and hydro power) is rather small and growing at a slow pace. Before the war, harnessing the existing potential of wind and solar energy was largely stagnant for a decade due to administrative and political developments. The last wind farm was built in Estonia about a decade ago[1]. Estonia does not have the geological profile for high hydropower potential. Also, Estonia does not have any nuclear capacity to date (Figure 2 and Table 1).

In terms of consumption profile, the major energy sources used before 2022 were oil and electricity, with a combined contribution of 56 per cent of the total final consumption.

1 Orav and Laast, 2021

Figure 2
**Estonian energy mix in 2020 (EU Statistic)**

| | | % of total |
|---|---|---|
| 1 | **Other (oil shale)** | 52.40% |
| 2 | **Natural gas** | 7.7% |
| 3 | **Renewables and biofuels** | 27.4% |
| 4 | **Non-renewable waste** | 0.7% |
| 5 | **Oil** | 5.2% |
| 6 | **Solid fossil fuels** | 0.1% |
| 7 | **Electricity** | 6.6% |
| 8 | **Nuclear heat** | 0.0% |

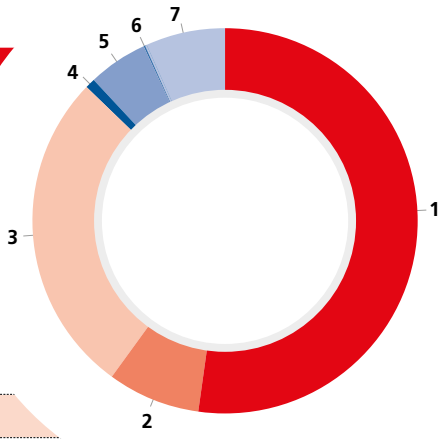



Table 1
**Total energy supply per capita in 2021**

| | Total in TJ | Per capita in TJ | Per capita in GJ |
|---|---|---|---|
| **Production** | 184,532 | 0.1387 | 138.1 |
| **Consumption** | 116,836 | 0.0878 | 87.8 |

Source: Statistikaamet, 2023

While oil was the predominant source of energy in the transport sector, electricity was the primary fuel for the industry and commercial sectors. In the residential sector, the consumption of bioenergy was the most significant (Figure 3).

The residential sector is traditionally the largest energy-consuming sector, accounting for 32 per cent of total final consumption. The residential sector is closely followed by the transport, commercial, and industry sectors. While consumption in the industry sector has been on a decreasing trend over decades, consumption in the residential and transport sectors has remained relatively stable over the last decade (Figure 4).

## ELECTRICITY MIX

The total electricity consumption of Estonia reached 9.6 TWh in 2021. As mentioned above, electricity makes up around 20 per cent of Estonia's energy consumption.[2] By sources of generation, local resources and oil shale also dominate the production of electricity, although until 2021 the share of oil shale was on a downward trajectory. The share of renewable energy in gross final energy consumption has been on an upwards trend, equalling 38 per cent in 2021. The share of renewable energy sources in electricity generated in 2021 amounted to 29 per cent.[3] However, biofuels and biomass account for far more than wind and solar PV (Figure 5 and Figure 6).

Regarding the electricity power grid infrastructure, Estonia along with other Baltic states is connected to IPS/UPS synchronous power grid managed from Moscow. This means the local electricity infrastructure is dependent on dispatches from Moscow in the event of instability in the grid. Through the existing interconnectors, two-thirds of Estonian electricity flows pass through the Russian grid.[4] With the help of EU funding, for decades the Baltic states have been working together with the EU institutions to join the CEN grid, which is managed by the Member States. A Political Roadmap was signed by the heads of states of the Baltic states, Poland, and the European Commission in 2018 and the completion of the synchronisation is envisioned by the beginning of 2026.[5]

2 Statistikaamet, 2023

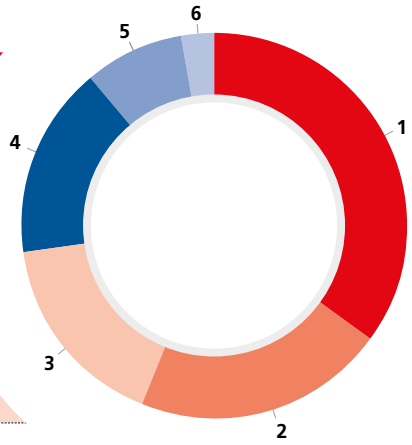
3 Statistikaamet, 2023

4 Härginen, et al. 2021

5 European Commission, 2020

Figure 3
**Total final consumption (TFC) by source in 2020 in TJ**

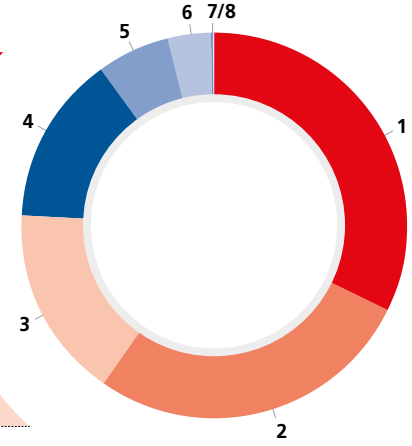
| | | TJ | % |
|---|---|---|---|
| 1 | **Oil products** | 42,749 | 35.10 |
| 2 | **Electricity** | 25,848 | 21.22 |
| 3 | **Biofuels and waste** | 20,368 | 16.72 |
| 4 | **Heat** | 19,310 | 15.85 |
| 5 | **Natural gas** | 10,270 | 8.43 |
| 6 | **Coal** | 3,256 | 2.67 |




Source: IEA, 2023a

Figure 4
**Total final consumption (TFC) by sector in 2020 in TJ**

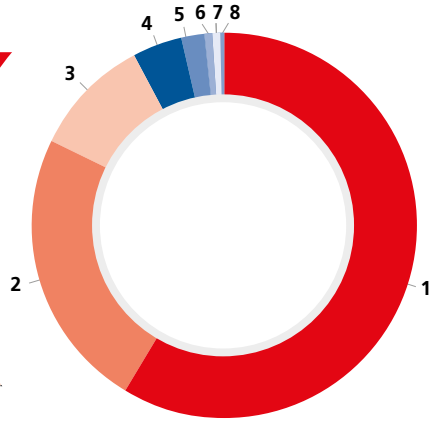
| | | TJ | % |
|---|---|---|---|
| 1 | **Residential** | 39,556 | 32.48 |
| 2 | **Transport** | 33,345 | 27.38 |
| 3 | **Commercial and public services** | 19,749 | 16.21 |
| 4 | **Industry** | 17,114 | 14.05 |
| 5 | **Non-energy use** | 7,405 | 6.08 |
| 6 | **Agriculture / forestry** | 4,606 | 3.78 |
| 7 | **Fishing** | 14 | 0.01 |
| 8 | **Non-specified** | 11 | 0.01 |




Source: IEA, 2023a

Figure 5
**Electricity generation by source in GWh in 2021**

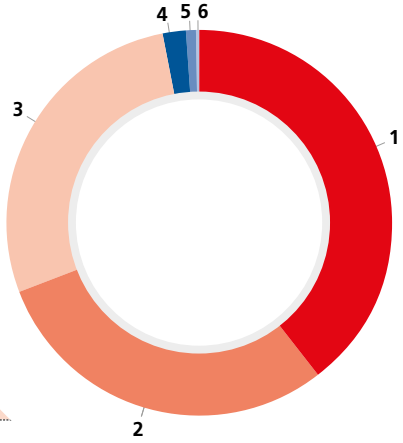
| | | GWh | % |
|---|---|---|---|
| 1 | Coal | 4,289 | 58.67 |
| 2 | Biofuels | 1,730 | 23.67 |
| 3 | Wind | 731 | 10.00 |
| 4 | Solar PV | 305 | 4.17 |
| 5 | Waste | 151 | 2.07 |
| 6 | Oil | 37 | 0.51 |
| 7 | Natural gas | 42 | 0.57 |
| 8 | Hydro | 25 | 0.34 |
| 9 | Nuclear | 0 | 0.00 |




Source: IEA, 2023a

Figure 6
**Structure of electricity consumption in 2020 in TJ**

| | | TJ | % |
|---|---|---|---|
| 1 | Commercial and public services | 10,246 | 39.72 |
| 2 | Industry | 7,664 | 29.71 |
| 3 | Residential | 7,139 | 27.68 |
| 4 | Agriculture / forestry | 487 | 1.89 |
| 5 | Transport | 244 | 0.95 |
| 6 | Fishing | 14 | 0.05 |




Source: IEA, 2023a

In terms of electricity imports, Russia's role has been marginalised over time. Estonia's electricity market is well integrated with Finland and Latvia through the European market coupling, allowing for efficient import and export of electricity. While most of the electricity imports originate from Finland, most of the exports are directed towards Latvia. Estonia's interconnections with these countries also enable it to serve as a transit country for electricity transmission from north to south.[6] Although Estonia has interconnections with Russia, it has not traded electricity with Russia since 2005. This is because other trading options have become more attractive, for example through Lithuania, which has been designated as the main transit country for electricity trade between the Baltic countries and third countries.[7]

It should be noted that before the Baltic states disconnect from the Russian electricity system and are synchronised with the continental European grid, Estonia along with the Baltic states has relied on electricity connections with Russia to maintain a stable 50 Hz frequency in the networks. During the winter of 2021–2022, Baltic States and Scandinavian countries together imported approximately 7 TWh of electricity from Russia.[8] The frequency management reserve services operated by (Russian National Energy Company) INTER RAO cost Estonia, Latvia and Lithuania a cumulative €1–2 million per month before the war.[9]

## DEGREE OF DEPENDENCE ON RUSSIA AS SUPPLIER OF ENERGY AND FUELS

As established, energy independence has been a political priority for Estonia. The reliance on domestic oil shale makes Estonia a net exporter of energy.[10] The energy exports include primarily solid biofuels, electricity, and shale oil produced from oil shale. According to Eurostat 2020 data, Estonia has the lowest energy import dependency out of all the EU countries – 1.4 per cent – measured as the share of total energy needs met by imports from other countries.[11]

6 Konkurentsiamet, 2021
7 IEA, 2019
8 Elering, 2022a
9 Cole, M., 2022
10 IEA, 2023
11 Eurostat, 2023

However, the percentage does not adequately reflect that Estonia is fully dependent on imports for natural gas and liquid transport fuels.[12] Prior to the Russian aggression, Estonia was reliant on Russia for both sources. Limited capacities both to receive gas and to transmit it through the Baltic region have made it difficult for Estonia to replace Russian supply (Figure 7 and Figure 8).

## DEGREE OF DEPENDENCE: NATURAL GAS

Natural gas is not a major source of energy in Estonia. In 2021, the total supply of natural gas equalled about 0.4 bcm and 5 TWh, making up less than 10 per cent of the final consumption.[13] However, it is an important input for industry and district heating. The Estonian gas network is connected to the gas networks of Russia (through the Narva and Värska connection points), Latvia and Finland.

Due to the complete lack of domestic gas production, Estonia has been 100 per cent reliant on Russia for natural gas imports. Until recently, it was dependent on imports of Russian natural gas either through direct interconnections or indirectly through the Inčukalns storage facility in Latvia, where Russian gas is stored during summers for use in winters.[14] The country has been on the lookout for alternatives motivated by energy security concerns. For example, since 2019 the Narva connection to Russia is no longer commercially used, although it can still be utilised to provide technical gas supply to the system operators, allowing gas stations along the pipeline to be fed.[15]

The situation changed from complete reliance in 2014 when the first opportunity for diversification was opened via Latvia to a connection to the Klaipeda liquefied natural gas (LNG) terminal in Lithuania. In addition, in 2020 the Balticconnector gas connection between Estonia and Finland was launched and at the end of 2021, the Estonian and Baltic-Finnish region gained a connection to the Central European gas network through the Lithuanian-Polish connection GIPL, which began to commercially operate in 2022.[16]

Despite gains of diversification of gas sources, in 2020 the share of direct Russian gas in the Estonian wholesale market was 86.5 per cent and increased by 2021 to 93.5 per cent. Note, however, that this number only reflects the direct gas volumes bought from Russia and may underestimate the actual percentage of Russian gas in Estonia's market due to the difficulty in measuring indirect imports from third coun-

12 IEA, 2023a
13 IEA, 2023a
14 Majandus- ja kommunikatsiooniministeerium, 2023
15 Konkurentsiamet, 2020
16 Konkurentsiamet, 2021

Figure 7
**Import dependency in 2020 (EU Statistic)**

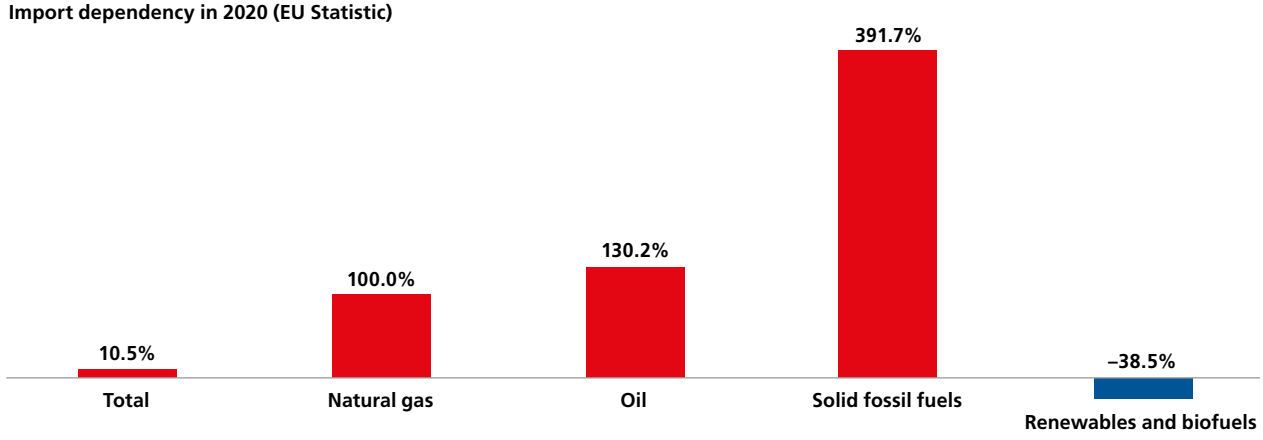
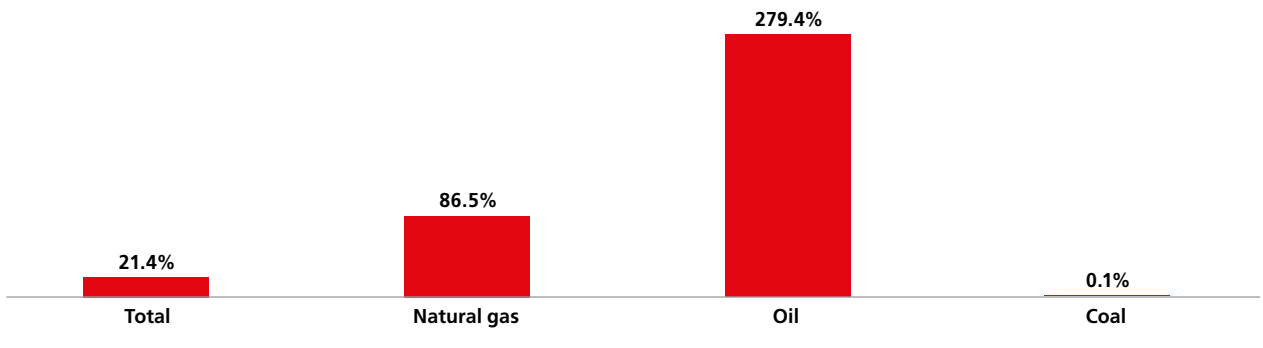



Figure 8
**Imports from Russia in gross available energy in 2020 (EU Statistic)**



tries. The wholesale gas market in Estonia is closely integrated with Latvia and Finland, making it harder to track the origin of gas in the market. For instance, gas volumes from EU suppliers procured in third countries and re-sold in the European wholesale market cannot be accounted for.[17] Therefore, the percentage corresponding to indirect gas purchased from Russia could have been higher in 2020 since the gas that entered Estonia through the Latvian system in 2020 and 2021 could also be largely of Russian origin, but it was not included in the calculation[18] (Table 2).

The impacts of Russia being the main supplier of natural gas are particularly evident in the sectors most reliant on the consumption of natural gas, which in Estonia are industry and district heating. District heating in 2021 was covered 55 per cent by biomass, 20 per cent by natural gas, 15 per cent by waste heat and rest of it from oil shale, peat and other sources[19] (Figure 9).

With the exception of 2021, in Estonia the demand for gas has been declining in absolute volume.[20] Over the last decade, the gas demand for power and heat has fallen by 60 per cent.[21] This is mainly due to fuel-switching to alternative fuels, such as biogas. The gas demand in the industry sector has also fallen by 67 per cent over the last decade.[22] However, alternatives such as scaling biomethane production, electrification, and increasing energy efficiency are expensive and long-term solutions, leaving residential households and industry still reliant on natural gas imports and therefore resulting in exposure to the volatility of natural gas imports from Russia.

## DEGREE OF DEPENDENCE: OIL AND OIL PRODUCTS

Oil makes up more than a third of the overall final energy usage in Estonia. The amount of oil usage has been consistent at approximately 1.4 million metric tons over the last three years, preceding a 2.5 per cent drop in 2020[23]. There is no oil production or processing in Estonia: thus the country relies fully on imports to meet its oil product demand.

Estonia does produce unconventional oil: shale oil through domestic oil shale liquefaction. There are no refineries in the

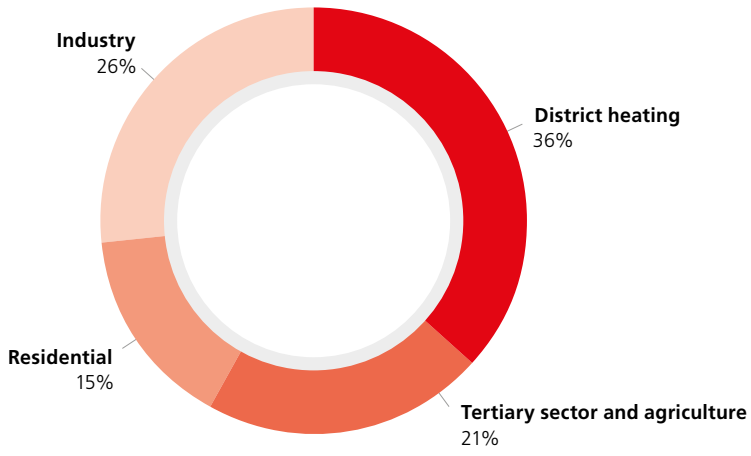
17 Ibid.
18 Ibid.
19 Postimees majandus, 2022
20 Konkurentsiamet, 2021
21 IEA, 2019
22 IEA, 2019
23 Fuels Europe, 2021

Table 2
**Data on Estonian dependency on Russian imported natural gas**

| | 2020 | 2021 |
|---|---|---|
| **Total gas demand (GWh/year)** | 4,480 | 5,196 |
| **Import volume (GWh/year)** | 12,978 | 11,391 |
| **Export volume (GWh/year)** | 8,481 | 6,281 |
| **Share of gas delivered from EU Member States (%)** | 34% | 6.5% |
| **Share of Russian gas import (%)** | 86.5% | 93.5% |

Source: Konkurentsiamet, 2020; Konkurentsiamet, 2021

Figure 9
**Structure of natural gas consumption in 2020 by %**




Source: EIA, 2023a

country, and thus the vast majority of shale oil is exported. It is important to note this, because as per the definition and structure of energy balances set by the International Energy Agency, Estonia's total energy supply of crude oil is considered negative, since it only accounts for imports of crude oil and doesn't take into account the production of shale oil that is exported.[24]

The consumption in Estonia is primarily driven by the transportation sector, which consumes nearly 25 per cent of the total energy consumed. Transport sector liquid fuels are fully imported from abroad. 94 per cent of energy consumption in the transport sector is used in road transport and cars.[25] The total volume is a mix of diesel imports (71 per cent) and gasoline (29 per cent).[26]

Similar to natural gas, Estonia has been relying on Russia for its vast supply of oil products. Prior to the Ukrainian crisis, the oil originating in Russia made up a majority of the motor fuels consumed in Estonia.[27] In total, in 2021 Estonia imported its liquid fuels from Russia, Finland, and Lithuania, and small amounts from Sweden and Belarus. However, Estonia has also been functioning as a transit country for Russian gas to enter the European market, which explains the import imbalance of 279.4 per cent. The transportation of oil products is not as dependent on existing pipeline infrastructure as natural gas imports, and therefore in this case it is much easier to diversify the import sources.

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24 IEA, 2023b

25 Majandus- ja kommunikatsiooniministeerium, 2023

26 Fuels Europe, 2021

27 Voltri, J., 2022

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

**Decision to stop importing Russian natural gas by end 2022:** On 7 April 2022, the Estonian government reached an agreement in principle that Estonia will stop importing Russian gas by the end of 2022. "We must stop buying gas from Putin's regime as soon as we can, since they are using the revenue from sales of it to fund their war against Ukraine," said Prime Minister Kaja Kallas in the government's statement.[28] The sanction to import and buy natural gas from Russia was established in law on 23 September and took effect on 31 December 2022.

**Paving the way for LNG:** The decision to halt Russian gas imports coincided with the agreement between Estonia and Finland to jointly lease a floating LNG terminal to guarantee the supply of gas to both countries. Although Estonia's consumption is much lower than Finland's, it was estimated that cutting gas supplies from Russia would leave the region without gas for nearly six months.[29] The new floating storage and regasification unit, 150,900m$^3$ Exemplar, was provided by US shipowner Excelerate Energy, after it signed a 10-year charter with a joint-venture subsidiary of the national transmission system operators Gasgrid Finland for Finland and Elering for Estonia. Gasgrid Finland agreed to pay 80 per cent of the rental cost, and Elering the other 20 per cent, roughly in line with the expected split of capacity usage.[30]

**Boosting natural gas reserves:** The second decision that allowed the government to declare halting Russian imports by end 2022 was a decision taken at the cabinet meeting to acquire up to 1 TWh of natural gas, which equals approximately 20 per cent of Estonia's annual gas consumption via AS Eesti Varude Keskus, the national party legally obliged to be in charge of ensuring gas reserves. The supply was agreed to be stored in the Latvian gas storage in Inčukalns.[31]

**Stopping payments to Russia for maintaining electricity grid frequency:** While Estonia has not bought electricity from Russia since 2005, Estonia was paying Inter RAO, the Russian National Energy Company, for balancing services to maintain the frequency in their networks. While the contract with Inter RAO for frequency management reserve services was valid until the end of 2022, from 1 June the Baltic Transmission System Operators (TSOs) agreed to stop buying balancing services from Russia by keeping the import-export balance at zero every hour. Erkki Sapp, the head of the energy market department at Elering, Estonia's national TSO, stated that the goal is to not have to make payments to a Russian company.[32] Inter RAO's frequency management reserve services previously cost Estonia, Latvia, and Lithuania €1–2 million per month.

**Fuel switching was made possible for a region with district heating in dire need:** To prepare in time ahead of the heating season in autumn 2022, on 8 July the government allowed and encouraged the City of Narva, Estonia's third largest city, to declare a district-level state of emergency. A tender to procure gas for the winter organised by the city had failed. The state of emergency allowed the city to request authorisation from the Environmental Board to switch to other energy sources, specifically power district heating by using shale oil instead of natural gas.[33] By the Environmental Board's estimates, 200 companies in Estonia were holding an environmental permit to use shale oil and approximately 50 were in the position to use it immediately if necessary. At least one another district heating company used the possibility to switch over.[34]

**EU banned the import of Russian crude oil and oil products:** Estonia complied with the EU sanction that took effect from June 2022. In mid-July, the Tax and Customs Board stated it has not yet seen an impact.[35] Ahead of the sanction taking effect, the import volumes of diesel from Russia went up – in the spring this was almost double the amount needed to cover 20 per cent of Estonia's monthly demand. The major fuel resellers in Estonia all stated that they do not import fuels from Russia. A large part of these Russian imports are expected to pass by the Estonian market and reach target markets within

28 Wrigth, H., 2022a
29 Wrigth, H., 2022a
30 A'Hearn, B., 2022
31 Wright, H., 2022a
32 Cole, M., 2022
33 Vahtla, A., 2022
34 Wright, H., 2022b
35 Raig, T., 2022a

the EU. This is possible, because once diesel and petrol have been imported to Estonia, statistics about where the product is consumed is not collected.[36]. Today, the liquid fuels for Estonia are mainly imported from Finland and Lithuania.[37]

36 Ibid.

37 Majandus- ja kommunikatsiooniministeerium, 2023

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

**Ceasing direct imports of natural gas from Russia and reducing consumption of Russian natural gas:** Looking back at 2022, Estonia did not import any significant amount of natural gas directly from Russia through the Värska connection since April of that year. The yearly gas consumption decreased by 26 per cent compared to 2021 – in 2022, Estonia consumed 3.77 TWh of natural gas, which is the lowest volume in the last decade.[38] However, it is hard to measure the degree of success that the immediate responses to the war had on the achievement of reduction in demand. When Elering commented on the 40 per cent decrease in consumption in May 2022 it stated that it was unclear if this was a temporary shift due to mild weather and other factors or if it indicated a lasting change in consumption patterns, such as some consumers switching from gas to alternative fuels.[39]

**Drop in demand for natural gas was boosted by mild weather conditions:** The average temperatures from February to June 2022 in Tallinn were higher compared to 2021, which is consistent with the relatively mild winter experienced across much of Europe. As Tallinn is home to about a third of the Estonian population, it constitutes a significant portion of the demand. Nonetheless, the temperature rise alone is not sufficient to explain most of the drop in demand.

**Gas companies in Estonia pointed to the extremely high prices of natural gas:** Analysis by the Oxford Institute for Energy Studies points out that gas companies from Estonia and Latvia blamed economic, as opposed to political, factors for their decision to halt imports. Alongside gas, prices for energy in June 2022 rose twice as fast in Estonia as they did in the rest of the Eurozone, leading to an increase in the inflation rate to 21.9 per cent for the year.[40] The Competition Agency points out that the Baltic-Finnish region's gas demand of 60 TWh/y was only ensured by the capacity of the Klaipeda LNG terminal of up to 30 TWh/y and the gas collected in the Latvian gas storage; this contributed to the contraction of supply and very high gas prices.[41]

**Share of Russian oil products decreased, while some transit was possible until February 2023:** The importance of Russian imports has decreased significantly and now accounts for a smaller proportion of overall imports. Instead, Finland and Lithuania have emerged as the main sources of imported diesel and petroleum. However, it is worth noting that Estonia remained a transit country for Russian diesel and the government does not have precise data on how much of the Russian imported fuel is consumed in Estonia. This is due to the fact that imports were allowed to continue under sanctions exemptions until 5 February 2023, and the impact of the new regulations has not yet been assessed. Despite this, there has been a positive development in that fuel makers have reported that Estonian customers are willing to pay a premium for diesel that is guaranteed not to come from Russia.[42]

**Estonia has played a significant role in raising awareness about Russian energy imports and advocating for change:** Since the start of Russian aggression in Ukraine, Estonia has played an important role in the international efforts to reduce reliance on Russian energy imports. Estonia has been among the few EU member states to call for a move away from Russian natural gas and oil products. In December, Prime Minister Kaja Kallas played a key role in ensuring that the price cap on Russian gas remained at 60 dollars per barrel rather than being increased.[43] Although Estonia's own reliance on natural gas did not change drastically from its already relatively low starting point, the country has had an impact on the EU's overall energy mix through raising awareness about the need to move away from Russian energy imports since the war.

38 Ots, M., 2023
39 Elering, 2022b
40 A'Hearn, B., 2022
41 Konkurentsiamet, 2021
42 Raig, T., 2022a
43 Paju, K., 2022

# 4

# MEDIUM- AND LONG-TERM ANSWERS

## MEDIUM-TERM ANSWERS

**Diversification of gas imports via LNG imports:** The quick building of the Finnish LNG port is significant for the diversification of Estonian gas import sources. Finnish Gasgrid has stated that it will not import gas from Russia and its goal is to wean the Finnish market off Russian natural gas.[44] By February 2023, Estonian gas company Eesti Gaas had concluded agreements to deliver a total of ten gas ships by the fall of this year – three deliveries to the port of Klaipeda in Lithuania in winter and seven to the port of Inkoo in Finland in spring and summer, from both US and Norway.[45] However, the existing gas network connected to Russia remains in place; thus, if the price of Russian gas collapses, there could be a resurgence of appetite for Russian imports.

**Disconnecting from electricity grid by 2025 as planned:** The Elering representative added that current plans to decouple from the Russian electricity grid at latest by 1 January 2026 are expected to go ahead as planned.[46] This is because all the investments of the synchronisation project have not yet been implemented. However, since the likelihood of unilateral separation of the Baltic electricity system from the Russian electricity system due to Russia's military aggression, the Estonian and Baltic system managers have been working on mitigating the risks of a unilateral emergency disconnection. For example, contracts have been signed for the provision of rapid frequency reserves with Nordic system managers in the event that the Baltics were separated from the Russian electricity system.[47]

**Recognition of need for more solar and wind:** The total production of renewable energy did not increase in 2022; in fact renewable energy accounted for 34 per cent of electricity production, compared to 38 per cent in 2021. The overall composition of renewables included 54 per cent biomass, biogas and waste, 26 per cent of wind energy, 20 per cent solar and 0 per cent hydro. However, the war brought recognition by the government that the state needs to organise more tenders for development of solar and wind energy potential in Estonia.[48] Therefore, the government documents included a plan to organize at least two more tenders in 2023. In addition, it promises to put in place a plan for the years 2024 and 2025 for the organisation of tenders for the production of at least 1 TWh. Municipalities will be obliged to show areas in the general plan that are suitable for the establishment of renewable energy production.[49]

**Energy consumption reduction:** In 2023, gas consumption has continued to decline – by 35 per cent in January compared to January of last year and 29 per cent in February. Besides the introduction of alternative fuels, the reduction has been achieved through energy saving and the introduction of heat pumps. There were also nationwide awareness raising campaigns about energy savings, and shifting the consumption of consumers to hours of cheap and plentiful electricity. According to the Ministry of Economy's forecast, the consumption in 2023 will still remain at the same order of magnitude as the level in 2022.

## LONG-TERM ANSWERS

On 17 April 2023 a new coalition government took office. The government remains in the hands of prime minister Kaja Kallas and coalition has been formed, consisting of Reform-Eesti 200 and Social Democrats. The new coalition agreement states that the government will view green transition as an opportunity for the economy and environment.[50] The new government has also stated it will develop a long-term vision for energy, which previously has been lacking in the government.

**Oil shale:** During 2022, oil shale stepped in to substitute for some of the Russian gas imports. The coalition declares that it no longer plans to open new oil shale mines and prefers to use the existing mines. According to the assessment of the National Competition Authority, the Estonian oil shale production blocks will play a very important role in our region in the coming years. The analysis reads: "In the long term, this will be very $CO_2$ intensive, but given the shift to timber in newer blocks, their sustainability is en-

44 Kaaver, K., 2023
45 Erilaid, E., 2023
46 Cole, M., 2022
47 Elering, 2022b
48 Puhm, C.-R., 2023
49 Raig, T., 2022b
50 Koalitsioonilepe, 2023

sured for some time."[51] The analyses looking further into the future show that from 2027 Estonian oil shale power plants may no longer be competitive on the electricity market. Therefore, Elering proposes to create a strategic reserve of oil shale production units, as a result of which sufficient production capacities are maintained in Estonia to ensure security of supply.[52]

**Gas grid improvements:** Gas grid improvements remain on the agenda. A more modern gas pipeline network is seen as an opportunity to use more gas with international origins, such as those with better access to Lithuania's Klaipeda LNG terminal, and to avoid price hikes. By 2024, transmission capacity increases are planned at the Karksi and Kiemenai points. In Estonia, gas is primarily used for heating instead of generating electricity, which means that renewable energy sources will have a difficult time replacing gas in these sectors until heat pumps are extensively implemented for heating.[53]

**Renewable energy:** The coalition has stated its intention to treat renewable energy as an overriding public interest. There are plans to speed up the planning, construction, and access to the network of renewable capacities, to set criteria for selecting projects of overwhelming public interest, and for accelerated and simplified construction. The Estonian state has set a goal to produce renewable electricity for its entire electricity consumption in 2030, with the aim of making Estonia a renewable energy exporting country.[54] An initial agreement has been signed with Finland for building a third interconnector between the two countries, EstLink 3, which would increase security of supply in the Baltic region and help the EU achieve its renewables targets.[55] The governing coalition is planning a strategy for increasing the market for biogas and promoting rooftop solar power on residential and industrial buildings.[56]

**Nuclear:** Building a small modular nuclear reactor is being considered as a possibility for the future of Estonia's energy mix for reducing its reliance on imported energy. The Ministry of Environment established a new working group on nuclear energy in April 2021, which is expected to announce the outcomes of its feasibility study on Estonian nuclear potential in the summer 2023. After conducting a spatial analysis, in spring 2023 the group identified at least four suitable locations in Estonia for building a nuclear power plant and a final storage site for spent nuclear fuel.[57]

**Hydrogen:** Hydrogen is seen as one of the ways forward to the future. Estonia joined the European Hydrogen Bank initiative, which aims to stimulate and support investment in hydrogen production.[58] Estonia also announced a "hydrogen valley" project, which brings together around 30 projects mostly in the feasibility stage spanning all aspects of the supply chain, with plans for at least six production facilities, infrastructure including import and export terminals, and end-use applications in transport and heating. Currently most of the projects are in the idea and feasibility phase. The working program for 2023–2028 was finalised in January 2023.[59]

**Energy efficiency:** Renovation of residential and commercial buildings is considered a priority for achieving energy independence and reducing costs for its citizens. The government is committed to supporting this initiative through funding from the European Union, recognising that energy-efficient buildings are key to reducing energy consumption and greenhouse gas emissions.[60]

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51 Konkurentsiamet, 2021
52 Elering, 2022b
53 A'Hearn, B., 2022
54 Elering, 2022b
55 A'Hearn, B., 2022
56 Koalitsioonilepe, 2023
57 Mäekivi, M., 2023
58 European Commission, 2023
59 Vesinikuorg, 2023
60 Koalitsioonilepe, 2023

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

In 2021, Estonia experienced a 28 per cent increase in $CO_2$ emissions, the highest in Europe, and greater than Bulgaria (27 per cent) and Malta (23 per cent).[61] Although Estonia's status as a small country means that its backsliding is not likely to have a significant impact on the EU's climate targets, it is difficult for Estonia to stay on track with its own climate targets. Though the country did experience a significant reduction in annual gas consumption, the shift to oil shale in 2022 due to Russian aggression in Ukraine could have had a negative impact on the country's overall $CO_2$ balance.

Despite these challenges, Estonia is committed to achieving its 2050 target and is focused on solutions that will foster market development in the future and help to minimise similar situations. These solutions include increasing energy efficiency, promoting consumption management and a flexible electricity system, investing in new production units, and raising consumer awareness of energy saving.[62] The government has made energy security its top priority, recognising that the country's long-term economic stability is inextricably linked to its ability to maintain energy independence.

61 BNS, 2022

62 Konkurentsiamet, 2021

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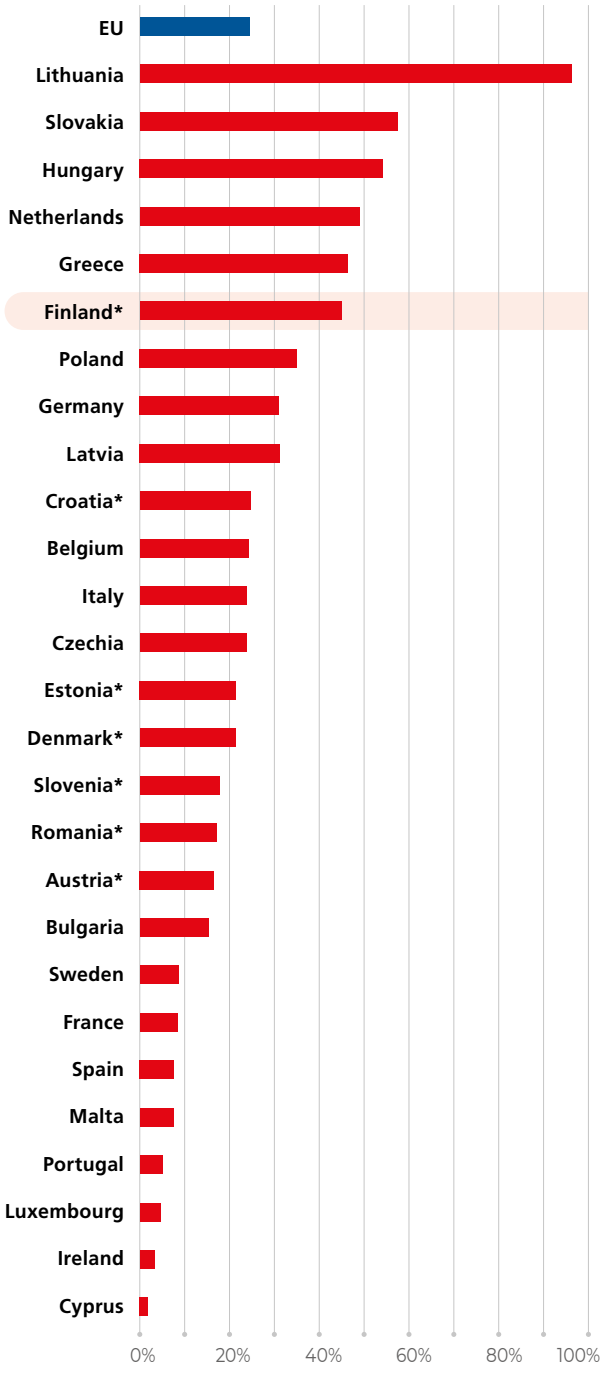
# FINLAND

by Tere Vadén, Antti Majava,
Janne M. Korhonen and Jussi T. Eronen

# INTRODUCTION

In 2022 Finland was seen to be highly dependent on Russian imports. The main points of dependence were considered to be oil and gas in the energy sector in particular, as well as timber for the pulp industry. Russian inputs to the energy system were substantial: over 40 per cent of gross available energy was imported from Russia (cf. Figure 1). Surprisingly, decoupling this strong dependence has been relatively painless. Finland was quick to diversify the sourcing of oil, helped by the technical readiness by the main refinery. The use of natural gas was fairly low compared to Central Europe, and direct gas import via pipeline has ceased, replaced by LNG imports from global markets. The decoupling has been made easier by two factors: a determined national will to decouple and the fact that consumers faced the effects mainly indirectly due to price increases in the global and European markets.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO ANTE (AS OF FEBRUARY 2022)

In 2019, the year before abnormal changes due to the pandemic restrictions, Finnish primary energy consumption was approximately 306 TWh, with oil the single biggest source of energy at 109 TWh.[1] All in all, fossil sources contributed somewhat over half of the total consumption, approximately 169 TWh. Renewable sources contributed 37 per cent of total consumption, with wood fuels alone responsible for 28 per cent (see Table 1).

In the European context, it is noteworthy that the role of natural gas was relatively small, at 19 TWh (or 6 per cent), even though there is a direct gas pipeline from Russia to Finland and another one, BalticConnector, between Estonia and Finland. The situation is largely explained by the fact that natural gas was mainly used in limited amounts in industrial processes (combined heat and power production,

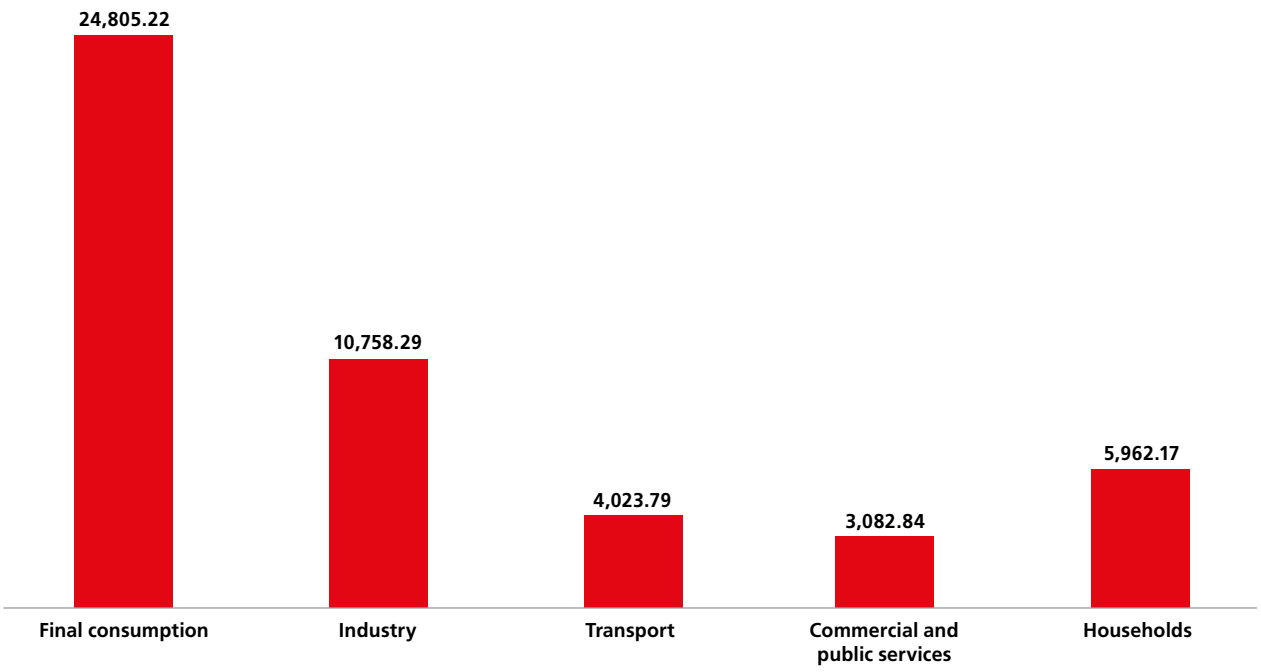
1 This level of consumption is typical for the entire 21st century – 2000: 1 324 PJ, 2015: 1 304 PJ, 2021: 1 360 PJ. Statistics Finland (2020, 2022): https://www.stat.fi/tup/julkaisut/tiedostot/julkaisuluettelo/yene_efp_202000_2020_23210_net.pdf, https://www.stat.fi/julkaisu/cku4c03s803du0b05fxruenwl

Table 1
**Finnish Energy consumption in 2019**

| Energy source | Energy consumption (PJ) | Percentage of total |
|---|---|---|
| **Oil** | 308.5 | 23% |
| **Coal** | 91.4 | 7% |
| **Natural gas** | 72.8 | 5% |
| **Peat** | 56.3 | 4% |
| **Nuclear** | 250.1 | 18% |
| **Hydro power** | 44.2 | 3% |
| **Wind power** | 21.4 | 2% |
| **Wood fuels** | 379.3 | 28% |
| **Net imports of electricity** | 72.2 | 5% |
| **Others** | 68.6 | 5% |
| **Total** | **1,362** | **100** |

Source: Statistics Finland

Figure 2
**Final Energy Consumption by Sector in 2021 (in ktoe)**




Source: Eurostat

refinery and chemical processes) and to some extent in district heating, while use in households (heating, cooking) has been marginal.

In terms of consumption, industry is the biggest sector. Finland's northern location explains the relatively large portion of consumption via space heating at 26 per cent, with transport at around 16 per cent of the final consumption. All in all, energy consumption was 247 GJ/capita (5.9 toe/capita).

In the decades after the Second World War, trade with the Soviet Union was a mainstay of the Finnish economy. In 1989, 15 per cent of Finnish exports went to the Soviet Union, which was its main trading partner.[2] This high share of exports explains in part why the dissolution of the Soviet Union caused an economic depression in Finland in the 1990s. However, trade with Russia eventually picked up again with imports of energy products leading the way.

In imports, the role of oil was paramount, so that during periods of high oil prices, oil and oil products accounted for up to 70 per cent of all imports from Russia; in 2019 the portion of oil was still over 50 per cent of all imports.[3] In addition to providing up to 90 per cent of all oil in energy use in Finland, Russian oil was also an important raw material for Finnish exports. Neste Oyj, of which the Finnish state is a major owner, sold diesel and other fuels refined from oil imported from the Urals. Thus, during some years the single largest export item from Finland in euro terms was petroleum products.[4]

In addition to oil, Finland imported natural gas and coal from Russia. As noted above, the role of natural gas in the energy system was much smaller than in many European countries. Roughly one third of the imported natural gas was used in combined heat and power production and another third in the chemical industry. The forest industry used natural gas, mainly for heat for drying intermediate products. The energy use of coal has been banned by 2029 by a specific climate-inspired law, which has led to a rapid decline in its use. However, some transit of Russian coal has continued during the war.

Finland also imported peat and wood from Russia, and some of the wood was intended for energy use in CHP plants – however, there is no comprehensive data on the portion used for heating and for other purposes. The wood imports amounted to around 10 $Mm^3$ annually. As domestic logging levels have already been relatively high, the discontinuation of imports caused extra pressures, indicated by increases in wood prices.[5]

2 Hukkinen, J. 1990. Suomen vientimenestys Neuvostoliiton markkinoilla 1970–1986. Bank of Finland. https://publications.bof.fi/bitstream/handle/10024/47954/Muut_keskustelualoitteet_14_90.pdf?sequence=1&isAllowed=y

3 Lavikainen, Kasperi Lavikainen, Sini Liukkonen, Merja Myllymäki, Matti Paavonen, Kristian Taskinen 2002. Venäjän merkitys vientimarkkinana supistunut jo vuosia – tuonti tärkeämpää. Tieto & Trendit 28.4. 2022. https://www.stat.fi/tietotrendit/artikkelit/2022/venajan-merkitys-vientimarkkinana-supistunut-jo-vuosia-tuonti-tarkeampaa/

4 Finnish Customs, 2023, 'International trade in goods', https://tulli.fi/en/statistics/statistical-releases

5 Natural Resources Institute, 21.2.2023. 'Wood trade decreased by 12 per cent in 2022'. https://www.luke.fi/en/news/wood-trade-decreased-by-12-per-cent-in-2022-the-highest-price-increase-was-recorded-for-birch-pulpwoodhttps://www.luke.fi/en/news/wood-trade-decreased-by-12-per-cent-in-2022-the-highest-price-increase-was-recorded-for-birch-pulpwood

Table 2
**Contributions of Russian exports to Finnish energy sector in 2019**

| | Total imports to Finland from Russia | % of total imports to Finland in category | Energy use | % of energy use in category |
|---|---|---|---|---|
| **Oil and petroleum products** | 13,574,000 tons | 76 | 72 TWh | 91 |
| **Natural gas** | 2,289,000,000 $m^3$ | 100 | 20 TWh | 100 |
| **Coal and coal products** | 2,007,000 tons | 59 | 8 TWh | 32 |
| **Wood fuels** | 74,000 tons/8.7 $Mm^3$ | 73 | no data | no data |
| **Nuclear fuel** | 21 tU | 38 | 21 tU | 38 |
| **Electricity** | 8 TWh | 33 | 8 TWh | 33 |
| **Electricity** | 8 TWh | 33 | 8 TWh | 33 |

Source: Statistics Finland, Eurostat

Two of the 4 nuclear reactors in operation before 2022 (and continuously running) are of Russian origin (VVER-440), and the fuel for them has been sourced from Russia.

Finally, Finland also imported electricity from Russia, in 2019 around 8 TWh.

All in all, the discontinuation of the imports – with the exception of imports of LNG which have continued – meant a considerable challenge to the Finnish energy system and economy (see Table 2).

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

The immediate political reaction in Finland after Russia's attack on Ukraine was to strive towards energy independence from Russia. Prime Minister Sanna Marin had already announced by 1 March 2022 that the goal is to decouple from Russian energy imports 'as soon as possible'.[6]

With regard to imports of energy products, Finland faced three options: sourcing fossil fuels, wood, and electricity from elsewhere; moving to domestic sources; or cutting demand.

A fourth option – cutting transactions even in the absence of replacement – occurred in the case of a planned nuclear power plant in Hanhikivi, Pyhäjoki. The plant site had been under construction since 2014 by the Fennovoima company, which had agreed to obtain the nuclear technology from Rosatom. At the end of March, the Finnish minister for economic affairs and employment, Mika Lintilä, declared that it would be impossible to give an operating license to the plant.[7] Consequently, Fennovoima terminated its agreement with Rosatom, which in practice stopped the work on the new plant. The cancellation, of course, affects only future energy production, not the current situation.

The biggest item on the list, oil, was dealt primarily by imports from alternative sources. Out of these, Norway took first place with an over 60 per cent share of the imports, with the UK and US as the next biggest sources.[8] Despite increases in the price of oil, consumption in total was essentially unchanged between 2021 and 2022. However, there was some internal shift, as fuel oils replaced some of natural gas use in industry and heating, while the consumption of petrol decreased,[9] presumably due to higher prices that also became a point of discussion and controversy leading up to the elections in April 2023.

The shift to alternative sources was made easier by the fact that the main importer and refiner, Neste Oyj, had already started a project of upgrading its technologies to work with several different types of oil, and not only the Urals variant. In addition to the Neste refinery in Porvoo, the other source for oil products for Finland is a refinery owned by the private company ST1 in Gothenburg, Sweden. According to ST1, even before the war it used oil only from North Sea sources (mainly Norway) and North America, with occasional imports from Africa.[10]

Before the war, the use of natural gas was already in slow decline, down from over 4 $Mm^3$ in 2010 to 2.3 $Mm^3$ in 2019, due to its increasing price. Natural gas via pipeline was used in CHP production and in the chemical and forest industries. In heat and CHP production, both oil and wood were used as replacements for gas. In the chemical sector, Neste Oyj, as the biggest user of natural gas in its refinery in Kilpilahti, switched from methane to propane.[11]

Natural gas was also increasingly sourced as LNG. In early 2022, Finland had two LNG terminals, in Pori and Tornio, and a third one in Hamina was completed and brought into use in summer 2022. With the end of gas imports via pipeline from Russia in sight, plans for increased LNG capacity were made. The chosen model was to hire a FSRU (Floating Storage and Regasification Unit), essentially a ship that functions both as a storage unit and a regasification plant. The FSRU was commissioned together with Estonia, to which Finland has a connection via the BalticConnector pipeline, and placed in Inkoo on the southern coast of Finland, and connected to the national gas grid in early 2023.[12] Imports of LNG by tankers from Russia have continued, as the importer, the state-owned company Gasum, has a take-or-pay contract of unspecified length that it has not wished to break.[13]

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6 Marika Kataja, YLE, 'Marin: Energiariippuvuudesta Venäjään irtauduttava "niin nopeasti kuin mahdollista"', 1.3.2022. https://yle.fi/a/3-12339279

7 Annette Blencowe, YLE, 8.3. 2022, 'Elinkeinoministeri Lintilä Fennovoiman ydinvoimahankkeen valmistelun jatkumisesta'. https://yle.fi/a/3-12349831

8 Finnish Customs, 28.2. 2023. https://tulli.fi/documents/2912305/h3439475/Kuvioita%20Suomen%20ulkomaankaupasta%202022/49cf7a96-5aeb-f511-4592-262e95c6bea4/Kuvioita%20Suomen%20ulkomaankaupasta%202022.pdf?version=1.26&t=1677567608258

9 Information Centre of Road Transport, 12.5. 2023. https://www.aut.fi/tilastot/liikenteen_energiankulutus/liikennepolttonesteiden_myynti#:~:text=98%2Doktaanisen%20bensiini%C3%A4%20myytiin%20tammi,v%C3%A4hentynyt%20vain%200%2C2%20prosentilla

10 Heidi Hammarsten, *Tekniikan Maailma*, 22.10. 2022. 'Mistä öljy tulee?'. https://tekniikanmaailma.fi/lehti/18b-2022/tankkerit-seilaavat-nyt-lannesta/

11 Jarno Hartikainen, *Helsingin Sanomat*, 29.4. 2022, 'Neste varautuu Venäjän öljy- ja kaasuvirran katkeamiseen'. https://www.hs.fi/talous/art-2000008784399.html

12 Matti Virtanen, *Tekniikan Maailma*, 17.5. 2022. 'Venäjän putket poikki – mutta miten?'. https://tekniikanmaailma.fi/lehti/10a-2022/venajan-putket-poikki-mutta-miten/

13 Sammeli Heikkinen, *Apu*. 18.1. 2023. 'Miksi Suomi tuo Venäjältä kaasua vieläkin?'. https://www.apu.fi/artikkelit/venajan-kaasua-tuodaan-suomeen-yha-2023-gasum-kertoo-miksi

Russia invoked Finnish refusal to use routes of payment specified by Russia as reason for cutting the exports of electricity in mid-May 2022. The discontinuation affected the price of electricity somewhat. However, the larger hikes in electricity prices were due to higher prices in Europe later in the year. These pressures were to an extent alleviated by new wind power coming online (altogether 2.43 GW in 2022),[14] and by lengthy test-drive sessions of a new nuclear reactor, Olkiluoto number 3, which finally started regular production in spring 2023. The electricity market and the grid turned out to be quite robust in the absence of imports from Russia, helped greatly by imports from northern Sweden and Norway. However, later in the year problems were created by the coupling to prices in central Europe, which, in turn, were closely coupled with the price of natural gas. When production in Finland and northern Sweden was low, the European electricity prices ended up increasing prices in Finland as well.

The missing imports of wood from Russia were mainly replaced by imports from Baltic countries, and some from Sweden. Overall, there was a small cut in wood imports. These changes led to increases in wood prices, benefiting forest owners.

The tighter market in wood used in CHP plants also prompted demands for increased use of domestically sourced peat. Peat use had fallen drastically up to 2022, as the price of CO2 emissions were making peat uncompetitive. However, only marginal increases of peat use for energy were seen in CHP units, also due to the fact that some of the infrastructure for collecting peat had already been dismantled and the labour directed elsewhere.[15]

All in all, the disruption of energy imports from Russia in 2022 did not cause major emergencies in energy provision for Finland. There were no blackouts, no rationing was needed, and there were no empty supermarket shelves; the problems consumers faced came in the form of higher prices for electricity, heat, and liquid fuels.

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**14** Finnish Wind Power Association, 10.1. 2023, 'Tuulivoimavuosi 2022'. https://tuulivoimayhdistys.fi/ajankohtaista/tiedotteet/tuulivoimakapasiteetti-kasvoi-75-ja-toi-suomeen-yli-29-miljardin-investoinnit#:~:text=-Suomeen%20on%20rakennettu%20vuoden%202022,Suomen%20tuulivoimasta%20on%20kotimaisessa%20omistuksessa

**15** Aino Ässämäki, YLE, 19.4. 2022. 'Turvetuotanto väheni Suomessa ennakoitua nopeammin'. https://yle.fi/a/3-12400943

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

The main consequences for the energy sector have been sourcing oil mainly from Norway, and a rapid decline in the use of natural gas. Industry switched from gas to biogas, wood, and oil use and to some extent electrification. For citizens, the main consequences were price rises and price volatility in oil products and electricity.

In order to help with the price rises and possible scarcities, the government launched an information campaign in the autumn of 2022, designed to curb energy use. The campaign concentrated on suggesting lower temperatures for heated spaces, with the slogan 'down a degree'.[16] Electricity consumption decreased by around 10 per cent in the autumn months of 2022, and, year on year was 6 per cent lower.

During late autumn and winter 2022–2023, there were some price 'shocks' in the Nordic electricity market, with the highest prices (Finland has a unitary price throughout the country) hitting 665.01 €/MWh.[17] It was feared that if these prices continue, both consumers and companies will face insurmountable economic difficulties. In order to help consumers, the government instituted a temporary mechanism for subsidising the highest electricity bills. In the event, the relatively mild weather and build-up of wind power alleviated the situation considerably. In the second half of 2022 the electricity prices for non-households in Finland were the lowest in Europe.[18]

One of the Finnish peculiarities was the epic story of Olkiluoto 3. The nuclear power plant had been under construction since 2005, and at the estimated cost of 11 billion is one of the most expensive buildings in the world.[19] After all the delays, it was expected once again to start producing electricity in 2022 – exactly when there was a huge need for electricity. The national drama of waiting for Olkiluoto 3 to come online continued throughout the 2022–2023 winter. When the third unit finally started regular production in spring 2023, the electricity prices had already been lower for some time, close to previous levels. Ironically, during high levels of hydro power production and near zero prices in the spring of 2023, the unit was working with diminished power to save costs.[20]

16 https://www.astettaalemmas.fi/

17 Fingrid, 30.3. 2023, 'Sähköjärjestelmän toiminta talvella 2022–2023' https://www.fingrid.fi/globalassets/dokumentit/fi/kantaverkko/sahkonsiirto/sahkojarjestelman-toiminta-talvella-2022-2023.pdf

18 Eurostat, 2023, Electricity price statistics, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_non-household_consumers

19 YLE, 12.3. 2022. 'Olkiluoto 3 reactor plugged into national grid, 13 years behind schedule', https://yle.fi/a/3-12356596#:~:text=Olkiluoto%203%20was%20originally%20scheduled,the%20world's%20most%20expensive%20buildings

20 Onni Kari, *Iltalehti*, 18.5. 2023. 'Sähkö on niin halpaa, että Olkiluoto 3 on säästöliekillä.' https://www.iltalehti.fi/kotimaa/a/af3aed45-1a97-4cad--8458-2ae7efd5bb7b

# 4

# MEDIUM- AND LONG-TERM ANSWERS

Finland was one of the countries that was able to (almost) completely and quickly decouple from the use of Russian natural gas. Currently, LNG is still used in some industrial processes that have not been able to pivot their production quickly, and also as maritime fuel. Oil imports ceased quickly, compared to other European countries.

The outstanding problems with regard to discontinuation of imports from Russia are related to the use of wood and electricity. Pressures towards wood use have come not only from energy use, but also from the forest industry, where global demand for pulp, paper, and cardboard has pushed production higher. This has meant that logging levels have increased, which in turn has decreased the level of forest (and, consequently, LULUCF sector) carbon sinks, jeopardising Finland's climate goals.[21] Increased loggings are also a problem for biodiversity, as forest species constitute the majority of endangered species on the national red list.[22] To add to the problem, the rate of annual forest growth, which had been steadily increasing since the 1970s, stopped increasing in the past few years. Given all of these constraints, the amount of sustainably sourced timber has a dynamic but binding upper limit. Within this limit, there is a trade-off between wood use in energy and in other forest industry uses. Currently, there is scientific and political debate concerning the energy use of wood and the climate consequences of lost carbon sinks. For instance, the Finnish Climate Change panel has suggested various possible methods for domestically limiting loggings, including a tax for wood in energy use.

In view of these limitations on wood biomass use, the energy solution that has gained increasing traction is wind power and, as a still small but increasingly important alternative, solar power. Wind power is expected to grow rapidly, necessitating upgrades to the power grid, and solutions for intermittent production, including storage and time-wise flexibility in use. The question of how to guarantee demand for wind power during hours of high production (and, consequently, low price) is crucial for continued strong growth in the wind power sector. Flexible use in industry and by consumers is one solution; another is different ways of storing energy (in batteries, as heat, converted to gas or liquid fuels). Several smaller-scale initiatives are underway in all of these directions, including power-to-X solutions and heat batteries. The relatively extensive district heating networks in cities provide some needed buffers during the colder months.

Hydrogen is seen as one potential solution for storage and utilisation, and as a source for further power-to-X solutions. Finland has a national hydrogen strategy, and two regional initiatives, one around the Gulf of Bothnia and another in south-eastern Finland. Here, too, some small-scale projects are up and running, but large-scale utilisation is still a long way off.

Given the existing levels of nuclear power and use of wood biomass, and the expected growth of wind and solar power production, Finland will decarbonise its electricity production with ease. The main challenge is the availability of sustainably sourced wood, and land-use issues with regard to wind and solar power. The decarbonisation of the traffic sector is a more difficult goal. In its energy and climate policy, Finland has supported the production of biofuels, and Finnish companies like Fortum Oyj, Neste Oyj, and ST1 are some of the leading producers. Like in many European countries, electrification of traffic has picked up pace recently in Finland, but growth rates are still too slow to reach the climate targets. A domestic carbon trading system for the traffic sector has been proposed as a possible solution.[23]

The forest sector is crucial in Finland's energy production and use, as well as for its climate and biodiversity policy. In terms of energy, the forest industry uses around 60 per cent of all energy consumed in industry, but produces only around 9 per cent of value added. Furthermore, more than half of all harvested wood ends up used as energy, either directly or indirectly in the processes of the forest industry. An

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21 The Finnish Climate Change Panel, 2023, 'Suuntaviivoja Suomen ilmastotoimien tehostamiseen'. https://www.ilmastopaneeli.fi/wp-content/uploads/2023/02/ilmastopaneelin-julkaisuja-1-2023-suuntaviivoja--ilmastotoimien-tehostamiseen.pdf

22 Hyvärinen, E. Juslén, A. Kemppainen, E. Uddström, A & U.-M. Liukko (Eds.), *The 2019 Red List of Finnish Species*, Ympäristöministeriö & Suomen ympäristökeskus, Helsinki, 2019. http://hdl.handle.net/10138/299501

23 Finnish Climate Change Panel, 2022, 'Tieliikenteen kansallinen päästökauppa auttaisi Suomea saavuttamaan päästövähennystavoitteet kustannustehokkaasti'. https://www.ilmastopaneeli.fi/tiedotteet/ilmastopaneelin-raportti-tieliikenteen-kansallinen-paastokauppa-auttaisi-suomea-saavuttamaan-paastovahennystavoitteet-kustannustehokkaasti/

economic problem arises if Finland loses forest sinks and thereby fails to reach the goals negotiated within the EU. Finland might need to buy compensating sinks from other member states at a high cost.[24] This has raised concerns that biogenic carbon emissions released by the forest industry should be measured, counted, and priced equally with other industrial sectors that are included in the Emission Trading System. However, such a situation would most likely increase the price of wood drastically, causing major challenges for forest industries. On the other hand, pricing biogenic carbon could encourage the forest sector to increase its energy and resource efficiency as has happened in other industrial sectors.

The share of variable renewable energy sources (wind and solar) is expected to grow rapidly to cover almost half of the electricity consumption in 2030. In order to maintain the power balance, elasticity of demand and price sensitivity of electricity consumption must increase rapidly. This means that the industrial and heating sectors need to be encouraged to invest in new technologies and energy storages.

Finland is tightly connected to the Scandinavian and EU electricity market design and development of transmission infrastructure. With increased investments in variable renewable energy production, Finland is particularly dependent on future development of both transmission capacity and technologies, and the capability that the European market design has in creating incentives for elasticity of demand.

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24 Petja Pelli, *Helsingin Sanomat*, 18.12. 2022. "Hiilinielujen romahdus voi maksaa Suomelle miljardeja euroja jo kolmen vuoden kuluttua". https://www.hs.fi/politiikka/art-2000009272342.html

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

Generally, Finnish energy policy – as well as climate and industrial policies – has adopted a market-based and technology-neutral approach. However, 'silent' energy and industrial policy has supported energy intensive industry, for instance, through lower electricity taxation, and the forest sector enjoys the support of tens of national strategies starting from educational policies up to subsidies and taxation. Currently, the Finnish economy is one of the most energy- and material-intensive in Europe.[25]

In terms of energy policy, the attitude of the government in office between 2019–2023, headed by Sanna Marin from the Social Democratic Party, was mainly reactive – supporting consumers through price spikes with lower prices (via lower biofuel obligations) for liquid fuels and subsidies for high electricity bills.[26] No major moves were made in terms of energy transition – building new infrastructure or abandoning fossil-based ones. At the time of writing, a new government is starting its term, and it is unclear what its approach will be. Out of the right-wing parties that won the election, the moderate Coalition party has expressed support for the climate neutrality goal, including rapid electrification, while the extreme right-wing Finns party has emphasised lower gasoline prices as a major goal.

Given the past (and future?) governments' 'hands-off' approach, it can be expected that from the industry perspective, the EU's Green Deal and green transition strategies are the main drivers for industrial and energy sectors. The energy sector and industry, in general, are taking their cues from the market signals and EU policies. Consequently, there is an increased push for large wind-power parks onshore and offshore, especially in the Bothnian Bay area, and these will involve large-scale land-use decisions. For these companies the main hurdles for expanding infrastructure are local permission processes that often cause delays simply due to lack of employees in permission processing. There is very little possibility for expanding hydropower. At the moment, it also seems that private investors are not planning new nuclear projects. In terms of heat production, the increased pressure on wood availability and the virtual end to peat in energy use has meant that many companies have invested in electric boilers and large-scale heat pumps.

For the climate goals the main impact from Russian energy decoupling is on the LULUCF sector. The increased use of biomass for energy due to higher energy prices and the end of Russian energy imports is increasing the demand for logging. At the same time Finland's ambitious climate targets have relied on a large land sink, where forests have been by far the biggest contributor. During the last decade the LULUCF sink has been decreasing, and has actually turned from carbon sink to source in 2021–2022.[27] This will have an effect on the Finnish climate actions, depending on what options are available for reaching the targets otherwise.

Another issue that brings energy provision and biodiversity to the forefront is the faster push for a green transition. The discontinuation of Russian energy imports necessitates a faster transition, both in electrified production in the industry and in traffic. A green transition will demand large amounts of specific raw materials, and these raw materials will be different than in fossil fuelled societies. There is increased demand for rare earth as well as other metals and minerals, often categorized in the group of 'critical raw materials'.[28] Current production of these materials in Europe is not adequate. This is already pushing European policies towards securing raw materials globally and nationally – meaning opening mines and re-defining regulations. The discussion on the availability of minerals in Finland and the conflict of interest between other sectors of economy, biodiversity, land-use, and mining is picking up speed.

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25 Eurostat, 2023, 'Energy intensity', https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_statistics_-_an_overview#Energy_intensity, Eurostat, 2023, "Material footprint", https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Material_flow_accounts_statistics_-_material_footprints#Material_footprint_of_European_countries

26 Ministry of Economic Affairs and Employment, 2023, 'Lower distribution obligation for transport fuels to continue in 2023'. https://valtioneuvosto.fi/en/-//1410877/lower-distribution-obligation-for-transport-fuels-to-continue-in-2023

27 National Resource Institute, 'Kasvihuonekaasuinventaarion ennakkotiedot vahvistavat: maankäyttösektori päästölähde vuonna 2021, metsät pysyivät edelleen nettonieluna'. 14.12. 2022. https://www.luke.fi/fi/seurannat/maatalous-ja-lulucfsektorin-kasvihuonekaasuinventaario/kasvihuonekaasuinventaarion-ennakkotiedot-vahvistavat-maankayttosektori-paastolahde-vuonna-2021-metsat-pysyivat-edelleen-nettonieluna

28 European Commission, 2023, 'Critical Raw Materials'. https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

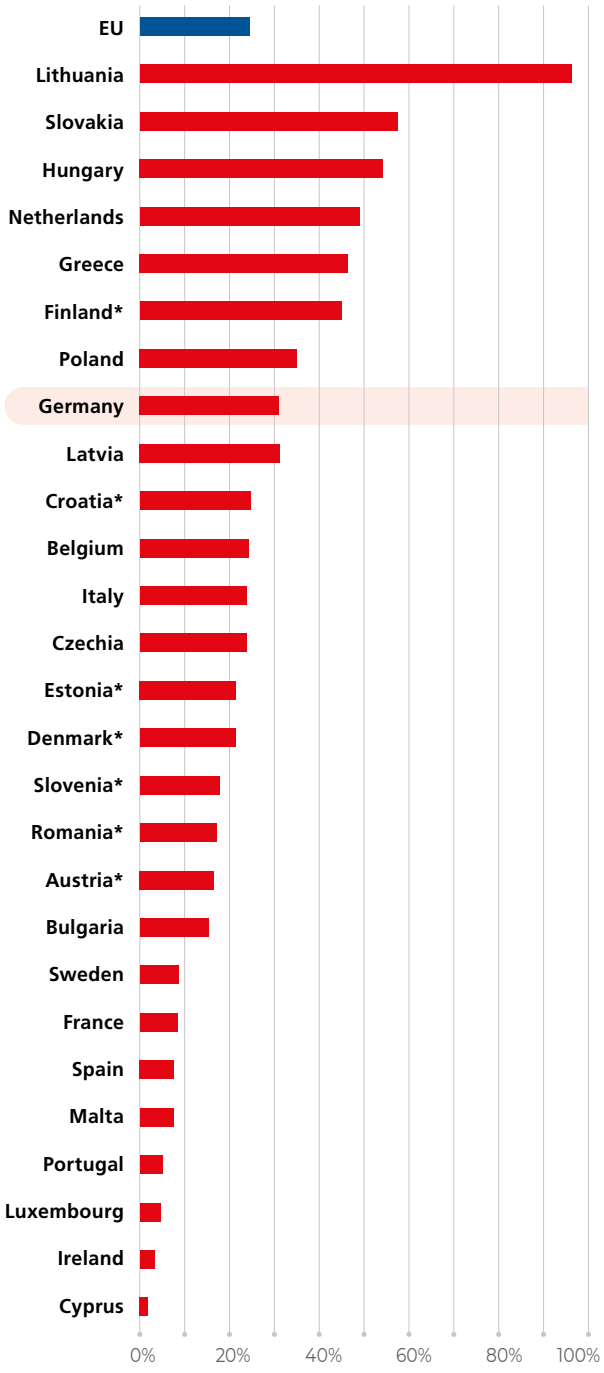
# GERMANY

by Frank Labunski

# INTRODUCTION

In view of the accelerating climate crisis, the Russian invasion of Ukraine highlighted the dependency of fossil fuels on the part of Germany and the European Union (EU). With the priority aim to reduce the import dependency from the Russian Federation while providing energy security and staying on track with climate mitigation efforts, the Federal Government was presented with major challenges. Prior to the war, an approximate 34% of the mineral oil, 53.6% of the natural gas, and 50% of hard coal supplies to Germany originated from Russian sources.[1] As of 2023, however, Germany is independent from Russian energy imports.[2] This paper examines implications of the global energy crisis induced by the invasion on the energy sector in Germany. As a basis for achieving this analysis, a short overview of the energy situation in the country before the war and a demonstration of the provisional conditions is presented. This is followed by an analysis of the main consequences of the war and medium and long-term strategies to reach Germany's climate goals while maintaining energy security. Lastly, foreseeable consequences regarding the European and German climate goals are discussed.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

1 Buttermann (2022): Energieverbrauch in Deutschland im Jahr 2021, p. 2.

2 Federal Government (2023): Energieversorgung in Deutschland, URL: https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/energieversorgung-sicherheit-2040098

# 1

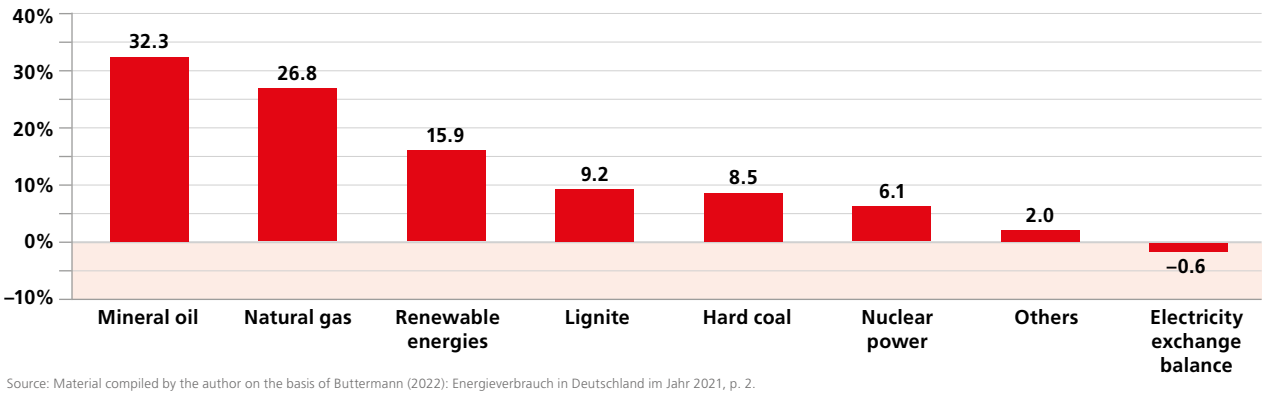
# GERMANY'S ENERGY SITUATION BEFORE FEBRUARY 2022

As the largest energy consumer in the EU, Germany holds a distinctive position within the European energy sector. As a basis for examining the implications of the Russian invasion on the energy sector in Germany, an initial demonstration of the provisional conditions is presented. In the year 2021, Germany had a total primary energy consumption of 12.265 PJ. Figure 2 illustrates the distribution of primary energy sources in Germany's energy consumption for the year 2021.

Approximately 69% of Germany's total energy demand in 2021 was met through imports, amounting to an estimated monetary value of €104 billion (without nuclear fuels). Germany's import dependency is particularly pronounced regarding hard coal, nuclear energy, mineral oil, and natural gas. 100% of the hard coal and nuclear energy, 95% of mineral oil and 89% of natural gas was imported in 2021.[3] According to the data presented in Figure 3, a substantial portion of Germany's energy imports in 2021 is attributed to Russia. In that year, 34% of the mineral oil, 53.6% of the natural gas, and 50% of hard coal originated from Russian sources. Other important importing countries were Norway, the Netherlands, USA, Australia, and Kazakhstan.

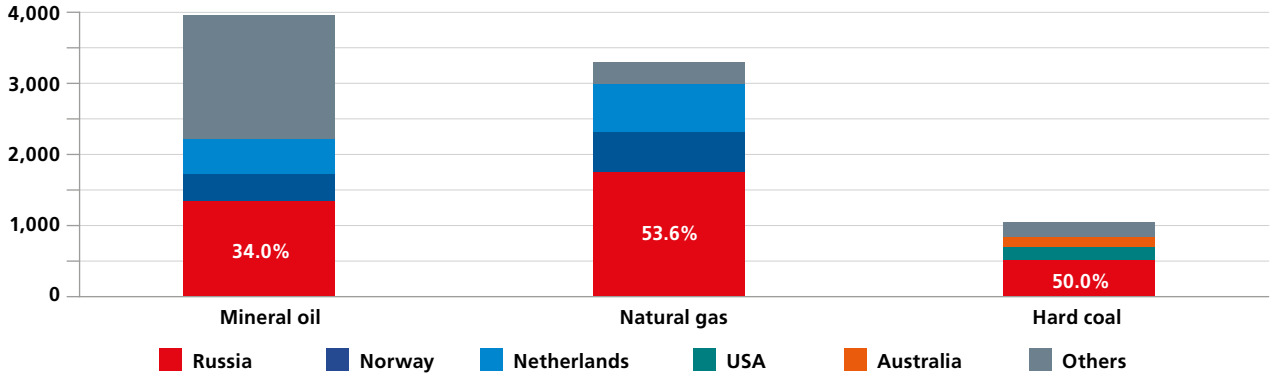
3 Buttermann (2022): Energieverbrauch in Deutschland im Jahr 2021, p. 2–10.

Figure 2
**Primary Energy Consumption by energy source in Germany (2021)**



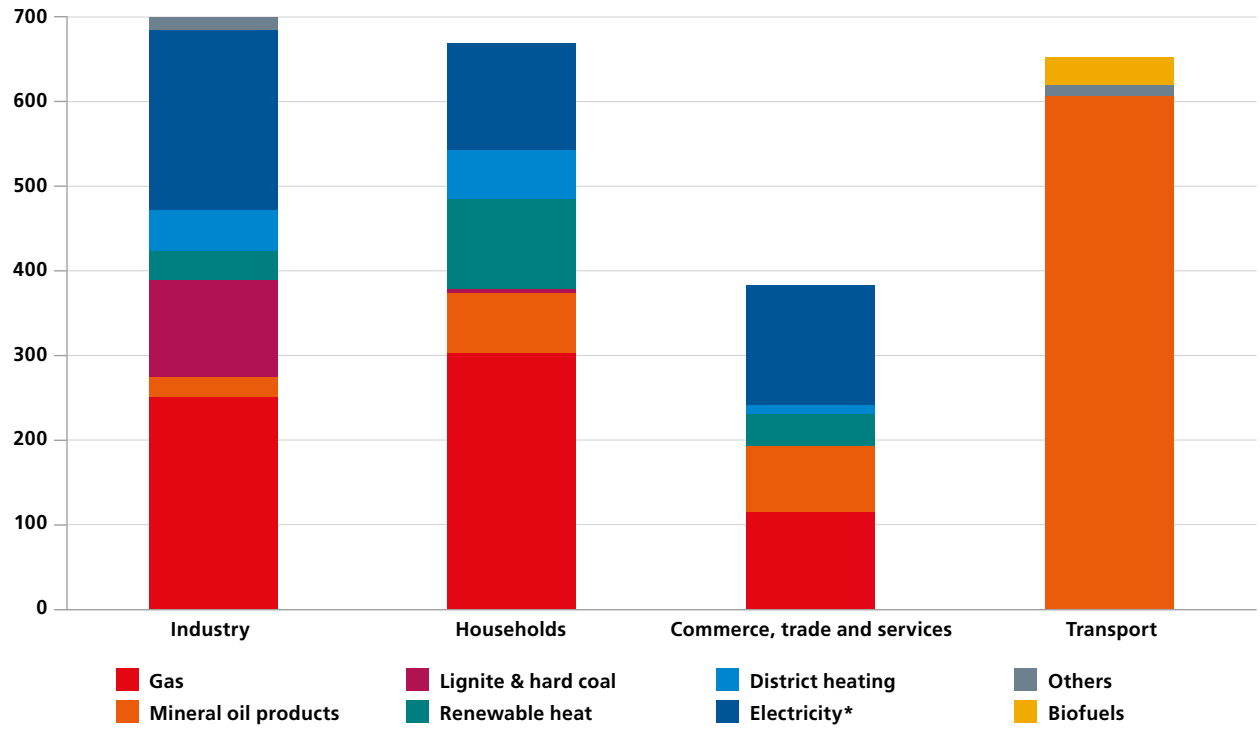

Source: Material compiled by the author on the basis of Buttermann (2022): Energieverbrauch in Deutschland im Jahr 2021, p. 2.

Figure 3
**Import of energy sources by country (2021 in PJ)**




Sources: Material compiled by the author on the basis of Buttermann (2022): Energieverbrauch in Deutschland im Jahr 2021, p. 2–10;
Wettengel (2023): Germany, EU remain heavily dependent on imported fossil fuels; Luderer et. al. (2022): Deutschland auf dem Weg aus der Gaskrise, p. 4.

Figure 4
**Final Energy Consumption by Sector (2021 in TWh)**




* Including renewable energy
Source: UBA (2023): Energieverbrauch nach Energieträgern und Sektoren,
URL: https://www.umweltbundesamt.de/daten/energie/energieverbrauch-nach-energietraegern-sektoren#allgemeine-entwicklung-und-einflussfaktoren

In 2021, 517.7 bn kWh of electricity were fed into the national grid. 57.6% was generated from conventional energy sources (coal 30.2%, nuclear power 12.6%, natural gas 12.6%, others 2.2%) and 42.2% from renewable sources (wind 21.5%, PV 8.7%, biogas 5.8%, hydro power 3.6%, others 2.9%).[4] Upon examining the final energy consumption in Germany, the industrial sector emerges as the largest energy consumer, accounting for 29% of the total. This is followed by private households at 27.7%, the transportation sector at 27.1%, and commerce, trade, and services at 16% (see Figure 4). Within the industry sector, two thirds of the final energy consumption is required for process heat. In private households, space heating accounts for about 70%. Natural gas (approx. 50%) and heating oil (approx. 25%) are the main energy sources. However, renewable heat sources are increasingly used. When comparing the sectors, the commerce, trade, and services sector exhibits the highest proportion of electricity consumption, accounting for 37.4% of its final energy consumption. Additionally, approximately 50% of the sector's energy demand is allocated for space heating purposes. Traditionally, the transport sector relies heavily on mineral oil products (92.5%).[5]

Summarising the energy landscape in 2021, prior to the Russian invasion of Ukraine, Germany significantly relied on energy imports, with Russia emerging as the primary source. In particular the high space heating demand in all sectors and the process heating demand in industry processes were met by fossil fuels originating from Russia. At this point in time, Germany has fostered further gas trading trade relations with Russia, e. g., through the support of infrastructure projects such as Nord stream 2. This project was estimated to increase the import capacity by 55 bcm of natural gas per year.[6]

4 DeStatis (2022): Stromerzeugung 2021: Anteil konventioneller Energieträger deutlich gestiegen, URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2022/03/PD22_116_43312.html

5 UBA (2023): Energieverbrauch nach Energieträgern und Sektoren, URL: https://www.umweltbundesamt.de/daten/energie/energieverbrauch-nach-energietraegern-sektoren#allgemeine-entwicklung-und-einflussfaktoren

6 EU (2021): The Nord Stream 2 pipeline, Economic, environmental and geopolitical issues, p. 2.

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

Germany's substantial reliance on energy imports from Russia, in particular natural gas, caused a huge challenge for the German government when the energy (price) crisis developed. Ensuring energy security despite a drastically reduced import volume from Russia has become a significant concern, given the dependency on Russian energy sources. Additionally, the rapidly escalating prices of natural gas (pipeline and LNG) and gasoline have emerged as a major issue, requiring attention and strategic planning from the government to mitigate the economic impacts and maintain a stable energy supply. Consequently on March 3, 2022 the early warning level[7] and on June 23, 2022 the alert level of the 'Emergency Plan for Gas' were proclaimed.[8] In this chapter, the actions of the Federal government regarding the energy (price) crisis are presented, while the degree of success will be discussed in Chapter 3.

## ACTIONS OF THE FEDERAL GOVERNMENT

### 1. ENERGY SUPPLY

As an immediate response, the federal government initiated gas procurement through the Trading Hub Europe (TBE) starting in March 2022. Based on changes in the 'Gas Storage Law', a legal framework was established to secure a sufficient natural gas storage capacity, with the aim of reaching 90% storage capacity by 1 November 2022. One year earlier, the gas storage capacity was at only 72% on 1 November.[9] Additional loans for the TBE were provided to ensure financial liquidity. In order to reduce gas consumption, coal-fired power plants partly substituted for the electricity generation based on natural gas (see Chapter 3 for details).[10]

Moreover, the federal government provided loans to the trust management Gazprom Germania (GPG), which is active in the business areas of energy trading and natural gas transport and operates gas storage facilities. Therefore, GPG is critical for the German gas infrastructure. Due to the sanctions imposed by Russia against GPG, the insolvency of GPG was likely. To avoid cascade effects on the energy market and to secure the critical energy infrastructure, a loan volume of €9 to 10 billion was provided.[11]

### 2. ENERGY PRICES

Of major concern were the huge energy price spikes in summer 2022 and their implications for the German economy. Therefore, on 8 April 2022 a 'protective shield' for the companies affected by the war was established. In particular, companies that require financial means to cope with the drastically rising gas and electricity prices were provided with financial support and loans. This first of the total of four 'protective shields' had an approximated volume of €7 billion.[12] Starting with the second protective shield, households were supported through individual payments and the temporary reduction of the energy tax, which led to reduced prices of fossil transport fuels. Additionally, a monthly nation-wide public transport ticket for €9 was offered for the same three months in the summer of 2022 as the reduction in fuel taxes.[13] In the light of the rising inflation rate of approximately 8% (Consumer Price Index), the third protective shield was established, with a volume of €65 billion. It included measures focussing on financial relief of households, such as the delay of the planned increase of the $CO_2$ price by one year (2024) and the temporary reduction of the value added tax on natural gas from 19% to 7%.[14] The latest eco-

7 BMWK (2022): BMWK announces early warning level of the Emergency Plan for Gas, URL: https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/03/20220330-bmwk-announces-early-warning-level-of-the-emergency-plan-for-gas-security-of-supply-still-ensured.html

8 BMWK (2022): BMWK ruft Alarmstufe des Notfallplans Gas aus, URL: https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/06/20220623-federal-ministry-for-economic-affairs-and-climate-action--announces-alert-level-of-the-emergency-plan-for-gas.html

9 Bundesnetzagentur (2023): Speicherfüllstände Gas, URL: https://www.bundesnetzagentur.de/DE/Gasversorgung/aktuelle_gasversorgung/start.html

10 BMWK (2022): Habeck: „Wir stärken die Vorsorge weiter und ergreifen zusätzliche Maßnahmen für weniger Gasverbrauch, URL": https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/06/20220619-habeck-wir-starken-die-vorsorge-weiter.html

11 BMWK (2022): FAQ-Liste Gazprom Germania.

12 BMF (2022): Bundesregierung beschließt Schutzschild für vom Krieg betroffene Unternehmen, URL: https://www.bundesfinanzministerium.de/Content/DE/Pressemitteilungen/Finanzpolitik/2022/04/2022-04-08-schutzschild-fuer-vom-krieg-betroffene-unternehmen.html; BMWK & BMF: Schutzschild der Bundesregierung für vom Krieg betroffene Unternehmen, p. 1–5.

13 BMF (2022): Bundesregierung bringt zweites Entlastungspaket auf den Weg, URL: https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Schlaglichter/Entlastungen/schnelle-spuerbare-entlastungen.html

14 BMF (2022): Entlastungspaket 3 – BMF Monatsbericht September 2022, p. 8–11.

nomic protective shield serves to cap the gas, heat, and electricity prices – at 12, 9.5, and 40 Eurocents/kWh for households, respectively, and lower levels for energy-intensive industries; it has a volume of up to €200 billion.[15] However, due to the falling energy prices in 2023, this amount will most likely not be needed. The caps mean that household heating energy is limited to approximately twice the pre-crisis levels, while electricity is capped at around 30% of the increase.

## 3. ENERGY SAVINGS

As the third part of immediate action facing the challenges of the energy crisis, the Federal Cabinet approved two ordinances on energy saving in the short and medium term.[16] The measures in the short term will be discussed in the following while the medium-term measures are part of Chapter 4. Energy-saving measures are recognised as a collective responsibility shared by politics, enterprises, and private consumers as one central element to reduce the import dependency and prevent energy shortage during the winter. For the period of 1 September 2022 until 15 April 2023, measures for energy saving in the building sector were realised.[17] The minimum room temperature of 20°C normally required by the landlords in private rented buildings to prevent mould is no longer binding, which allowed tenants to reduce the room temperature to save energy. In public workspaces the room temperature is not to exceed 19°C, whereas in common spaces where people are not permanently present, heating is banned. Likewise, a heating ban for private swimming pools is in place. Except for safety purposes, buildings, monuments, and advertising spaces must not be illuminated during the night, and if hygiene does not require otherwise, warm water should not be used for the sole purpose of washing hands. Lastly, homeowners are required to optimise their heating systems. [18]

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15 BMF (2022): Wirtschaftlicher Abwehrschirm und Gaspreisbremse: mit Entschlossenheit durch die Energiekrise, p. 8–11.

16 Federal Government (2022): Additional energy saving measures approved.

17 Bundesregierung (2022): EnSikuMaV, p. 1; Federal Government (2023): Maßnahmen zum Energiesparen.

18 Federal Government (2022): Additional energy saving measures approved; EnSikuMaV, p. 4–28.

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

The conflict's repercussions on the German energy market and supply as well as electricity production have wide-ranging implications. Even though Germany managed to ensure energy security for the general public, the initial reduction of pipeline gas imports by Russia to 40% of the previous capacity, followed by import disruptions starting in September 2022, highlighted the extent of Germany's dependency on Russia as a fossil energy supplier.[19] Reducing gas consumption became a major instrument to ensure energy security for the winter. The objective was to achieve a reduction of 20%, surpassing the target of 15% (compared to the average of the last 5 years) set by the EU member states.[20]

As a result of all the measures but also due to a relatively mild winter, Germany was able to avoid a physical gas emergency situation. Gas consumption was in fact reduced by 19.4% (August 2022 to January 2023), and gas storage facilities were still more than 60% filled at the end of the winter.[21] Electricity consumption was also reduced by 1.9% (2022 compared to 2021)[22]. In order to reach this goal, in addition to the measures discussed in chapter 2, a temporary shift in the German energy policy was observed. Fossil fuels (from other than Russian origin) were utilised as a direct substitute for the missing imports. In the light of the legal target to reach carbon neutrally by 2045, the continuous use of fossil fuel would mean a target conflict of ensuring energy security while reaching carbon neutrality. In particular, the Reserve Power Plant Availability Act underwent changes to facilitate electricity production using coal and mineral oil power plants. This modification allowed for the utilisation of coal power plants that were conditionally operational and will be shut down in the medium-term.[23] In total 15 hard-coal power plants with a combined net nominal power of 5,980 MW and one mineral oil power plant (415 MW) were reactivated. The use of these power plants is temporarily limited until 31 March 2024. Additionally, the operation phase of the three last nuclear power-plants was prolonged until 15 April 2023. Due to the ban on purchasing new nuclear fuel, the nuclear power plants were only used in a 'stretch' operation,[24] and since 15 April 2023 there is no longer any nuclear energy generation in Germany.

The rising prices of gasoline, pipeline gas, and LNG, as well as electricity, have had a significant impact on the German economy, although less than expected as a worst case by experts. From August to November 2022, the number of employees with forced short-time working hours increased from 76,000 to 187,000. The majority of these are employed in the energy-intensive manufacturing industry (151,200).[25]

Despite the implementation of various protective measures, as outlined in Chapter 2, the increasing energy prices have emerged as a dominant factor contributing to inflationary pressures in Germany. In 2022, the overall energy product prices increased by +34.7%. In comparison, the average inflation rate was +7.9%. When excluding the impact of energy prices, the overall estimated inflation rate for the period was predicted to be +4.9%.[26] As of May 2023, the inflation rate was at +6.1%.[27]

Despite the ongoing war and challenges posed by the conflict, Germany managed to ensure energy security for the general public. Nevertheless, a temporary substitution of Russian energy imports, especially of natural gas, required the increased import of pipeline gas from Norway and the Netherlands, and of LNG via Belgium, the Netherlands, and Germany's own first two floating LNG terminals installed in just 8 months at the German North Sea coast, as well as some temporary utilisation of $CO_2$ intensive coal power

19 Bundesnetzagentur (2023): Lagebericht Gasversorgung – Stand 29.06.2023, p. 1; BMWK (2022): Weiter niedrige Gasflüsse durch Nord Stream 1, URL: https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2022/07/20220721-bundesministerium-fur-wirtschaft-und-klimaschutz-legt-zusatzliches-energiesicherungspaket-vor.html

20 BMWK (2022): Hintergrundpapier: Energieeinspar-Verordnungen zur Senkung des Gas- und Stromverbrauchs, p. 1f.

21 EC (2023): Commission Staff Working Document SWD (2023) 63 final – Analysis of coordinated demand reduction measures for gas, p. 1–4.

22 DeStatis (2023): Stromerzeugung 2022: Ein Drittel aus Kohle, ein Viertel aus Windkraft, URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2023/03/PD23_090_43312.html

23 Bundesnetzagentur (2023): Ersatzkraftwerkebereithaltungsgesetz, URL: https://www.bundesnetzagentur.de/DE/Fachthemen/Elektrizitaetund-Gas/Kohleausstieg/EKBG/start.html

24 BASE (2023): Der Atomausstieg in Deutschland, URL: https://www.base.bund.de/DE/themen/kt/ausstieg-atomkraft/ausstieg_node.html#:~:text=Der%20Bundestag%20hat%20am%2011.11,und%20sind%20dann%20abgeschaltet%20worden

25 Ifo Institut (2022): Energiekrise lässt Kurzarbeit in der Industrie leicht steigen.

26 DeStatis (2023): Inflationsrate im Jahr 2022 bei + 7,9 %, URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2023/01/PD23_022_611.html

27 DeStatis (2023): Inflationsrate im Mai 2023 bei + 6,1 %, URL: https://www.destatis.de/DE/Presse/Pressemitteilungen/2023/06/PD23_224_611.html

plants. The ongoing expansion of renewable energy sources for power generation and energy efficiency in buildings also made some contribution. Furthermore, massive investments and subsidies were necessary to secure the stability of the national economy.

# 4

# MEDIUM- AND LONG-TERM STRATEGIES

Germany is focusing its medium- and long-term strategies on energy efficiency and renewable energy sources. For example, it is implementing further energy saving measures in the building sector. Based on the ordinance on energy saving in the medium term, homeowners are obligated to control and optimise their heating systems, and enterprises are required to perform energy audits and implement energy efficient measures. Combined with the short-term measures discussed in Chapter 2, the monetary value of the energy savings is estimated at €10.8 billion. These medium-term measures started in October 2022 and are valid for two years.[28] In addition to these measures that are part of the crisis reaction, much stronger energy efficiency measures are in the course of being implemented in order to achieve the climate targets in the buildings, industry, and transport sectors, which will also reduce fossil fuel consumption and imports. Space does not allow us to go into detail in this paper. Germany's long-term energy efficiency strategy is now being implemented through an energy efficiency law. The aim is to reach a reduction of final energy consumption of 26.5% by 2030, compared to 2008, and 45% by 2045.

Regarding the expansion of renewable energy, the aim is that by 2030, 80% of the gross electricity consumption should be supplied by renewable energy sources. Therefore, in January 2023 an amendment of the renewable energy law came into effect. Being one of the largest changes in energy legislation in the recent past, it provides the foundation to reach carbon neutrality by 2045.[29] Table 1 shows the planned installed capacity in GW of onshore/offshore wind and PV until 2040.

The import gap of natural gas originating from missing Russian imports is predominantly being substituted by imports from Norway, the Netherlands, and the US. Furthermore, new LNG contracts have been made with Qatar and Senegal.[30] Due to the missing infrastructure of landing terminals for LNG via ships before the war, the construction of Floating Storage and Regasification Unit (FSRU) and land terminals are being realised. Since the beginning of 2023, two public terminals and one private terminal are operating, which led to a current operating capacity of 13.5 bn. m3 LNG/year. By 2025, the combined capacity of the five public FSRU would reach a capacity of 27 bn $m^3$ LNG/year in addition to 10 bn $m^3$ LNG/year by a privately owned FSRU. With the finalisation of three further land terminals by 2027, the

28 Federal Government (2022): EnSimiMaV, p. 1–10.

29 Federal Government (2022): EEG 2023, URL: https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/amendment-of-the-renewables-act-2060448

30 European Council (2023): Monatliche Mengen an LNG-Einfuhren aus den USA in die EU; Deutsch-Norwegische Handelskammer (2023): Gas für 58 Mrd.€: Deutschland wir Norwegens wichtigstes Exportland; Federal Government (2023): Energieversorgung in Deutschland, URL: https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/energieversorgung-sicherheit-2040098; Federal Government (2022): Partnerschaft auf dem afrikanischen Kontinent ausbauen, URL: https://www.bundesregierung.de/breg-de/suche/bundeskanzler-scholz-in-afrika-2041830; Deutscher Bundestag: Drucksache 20/3896, Die Energiegeschäfte der Bundesregierung mit dem Emirat Katar, p. 1f.

Table 1
**Planned expansion path of renewable electricity (GW)**

| | 2024 | 2026 | 2028 | 2030 | 2035 | 2040 | 2045 |
|---|---|---|---|---|---|---|---|
| **Onshore Wind** | 69 | 84 | 99 | 115 | 157 | 160 | – |
| **Offshore Wind** | – | – | – | 30 | 40 | – | 70 |
| **Photovoltaic** | 88 | 128 | 172 | 215 | 309 | 400 | – |

Source: Material compiled by the author on the basis of § 4 Renewable Energy Law (2023); Offshore Wind Energy Act §1

import capacity would reach 54 bn. $m^3$ LNG/year.[31] The licenses for the operation are valid terminated until at latest 31 December 2043.[32] Conservative scenarios estimate the annual demand of natural gas in Germany in 2030 at 74 bn $m^3$ [33], while strong action towards climate neutrality may lead to lower demands. Even though the terminals are required to be designed to be ready to switch to importing $H_2$ and $H_2$-derivates, such as ammonia, lock-in effects are likely. An import capacity of 54 bn. $m^3$ LNG/year would be higher than the pipeline gas imports from Russia. The German government justifies its plans by fears of disruption of pipeline supplies from Norway, and by the need to provide capacities for supplying neighbour countries in Central Europe.

Since June 2022, a 'National Hydrogen Strategy', with the aim to reduce $CO_2$ emissions in the industry, transport, and energy sector is in place. The $H_2$ demand in 2030 is estimated at 90–110 TWh. By 2030, the national hydrogen generation capacity should reach 5 GW (14 TWh of green hydrogen).[34] Based on the discrepancy between demand and production capacity, the necessity of hydrogen import arises. One of the major partners will be Canada, but projects are also planned with African or South American countries.[35]

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31 BMWK (2023): Bericht des Bundeswirtschafts- und Klimaschutzministeriums zu Planungen und Kapazitäten der schwimmenden und festen Flüssigerdgasterminals, p. 1–4; BMWK (2022): FAQ-Liste Schwimmende Flüssigerdgas-Terminals, p. 3–5.

32 BMWK (2023): Bundeskabinett beschließt Gesetzentwurf zur Änderung des Gesetzes zur Beschleunigung des Einsatzes verflüssigten Erdgases, URL: https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2023/05/20230517-bundeskabinett-beschliesst-gesetzentwurf.html

33 BMWK (2023): Bericht des Bundeswirtschafts- und Klimaschutzministeriums zu Planungen und Kapazitäten der schwimmenden und festen Flüssigerdgasterminals, p. 2.

34 Federal Government (2020): The National Hydrogen Strategy, p. 1–5.

35 German and Canadian Government (2022): Gemeinsame Absichtserklärung zwischen der Regierung der Bundesrepublik Deutschland und der Regierung von Kanada über Die Gründung Einer Deutschen-Kanadisch Wasserstoffallianz, p. 1–5.

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE TARGETS

As part of the European Green Deal, the EU set the target of reaching climate neutrality by 2050.[36] Nevertheless, the war against Ukraine highlighted the dependency of the EU on Russian energy imports. With the RePowerEU plan, an instrument is in place to eliminate this import dependency from Russia by saving energy, producing renewable energy, and diversifying the energy supply. New natural gas sources are secured, e. g., by signing agreements with Egypt and Israel, while strategic partnerships with countries such as Namibia, Kazakhstan and Egypt have been established to secure the import of green hydrogen. By implementing a new storage rule of a 90% storage capacity by 1 November of each year, gas and power shortages shall be avoided. Furthermore, the member states have committed to reducing the energy consumption by 15%, establishing a price ceiling for gas transactions,[37] and investing in renewable energies.[38]

On the one hand, the RePowerEU plan has led to energy savings and renewable energies targets for 2030 in the Energy Efficiency and Renewable Energy Directives that are even higher than the original proposal for climate policy reasons under the Green Deal. This will provide strong synergies between energy security without Russia, and fighting the climate crisis. On the other hand, the 'dash for new fossil gas supplies' that has taken place may create lock-in effects and impede or at least slow down progress in reaching the climate targets.

The same consequences can be stated for the German medium- and long-term policies. While the German climate targets exceed the ambition of the EU, their realisation still provides difficulties. In the transport and building sectors, the national sectoral $CO_2$ reduction targets were not reached in 2021 and 2022.[39] To mention just a few examples of challenges that policy, industry, and society need to overcome: With the implementation of a national ticket for the public transport system for €49 a month, a first measure to increase the attractiveness of public transport has been adopted, even though the motorised individual transport based on fossil fuels still dominates the sector.[40] Although the government also aims for one third of all cars to be electric by 2030, it is still uncertain as to whether that target will be met. In the buildings sector, the Building Energy Act (GEG) could not be passed before the summer break of the Bundestag in 2023 as planned, and in its final version the required minimum share of 65% renewable energies in any newly installed heating systems will be postponed from January 2024 by several years. Experts also fear that the deletion of the binding sector targets by the revision of the Climate Law could generally reduce the national level of ambition, particularly in the transport and building sectors.[41] In addition, the skilled labour necessary for realising the proclaimed targets is missing. Based on a study by KOFA (2022), 216,252 jobs necessary for the expansion of renewable energies are missing in Germany.[42]

Thus, in attaining the national and European targets, major synergies are possible, but lock-in effects due to the construction of LNG infrastructure in combination with a long license time-frame of import contracts are likely, and target conflicts between energy security and climate goals are foreseeable. Based on a scenario analysis of the global gas market, the US is likely to be the largest natural gas supplier of the EU in 2030.[43] However, simply shifting import dependency from Russia to the US should be avoided for both climate and environment protection as well as energy security reasons. The most effective strategy to reach energy independency and greenhouse gas neutrality at both the national and European levels is to focus on energy efficiency and renewable energies. In this respect, it is highly encouraging

36 EC (2019): Der europäische Grüne Deal, p. 2.

37 EC (2023): Infographic - A market mechanism to limit excessive gas price spikes, URL: https://www.consilium.europa.eu/en/infographics/a--market-mechanism-to-limit-excessive-gas-price-spikes/

38 EC (2023): REPowerEU, URL: https://commission.europa.eu/strategy--and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

39 UBA (2023): Treibhausgasminderungsziele Deutschlands; UBA (2023): Klimaschutz im Verkehr, URL: https://www.umweltbundesamt.de/themen/verkehr/klimaschutz-im-verkehr#undefined

40 Deutschlandticket (2023): Das Deutschlandticket ist da!, URL: https://deutschlandticket.de/?gclid=EAIaIQobChMIxZPCp_L-_wIVCn-KGCh1yJQqPEAAYAiAAEgIg8fD_BwE, ADAC (2023): Pkw-Neuzulassungen Juni und 1. Halbjahr.

41 Federal Government (2023): Klimafreundlich Heizen: Neues Gebäudeenergiegesetz, URL: https://www.bundesregierung.de/breg-de/aktuelles/neues-gebaeudeenergiegesetz-2184942; Öko Zentrum NRW (2023): Update zum Gebäudeenergiegesetz; Deutscher Bundestag (2023): Entwurf eines Gesetzes zur Änderung des Gebäudeenergiegesetzes, zur Änderung der Heizkostenverordnung und zur Änderung der Kehr und Überprüfungsordnung, p. 1–11.

42 Kompetenzzentrum Fachkräftesicherung (2022): Energie aus Wind und Sonne, p 4–6.

43 Cam et. al. (2022), Entwicklungen der globalen Gasmärkte bis 2030 Szenarienbetrachtung eines beschränkten Handels mit Russland, p. 16.

that the response of the EU and Germany to the energy crisis was to raise the ambition of getting rid of fossil fuel dependencies more quickly, and fostering renewables and energy efficiency and savings. In addition, Germany stepped forward to an energy transition strategy that minimised general risk by phasing out nuclear power production.

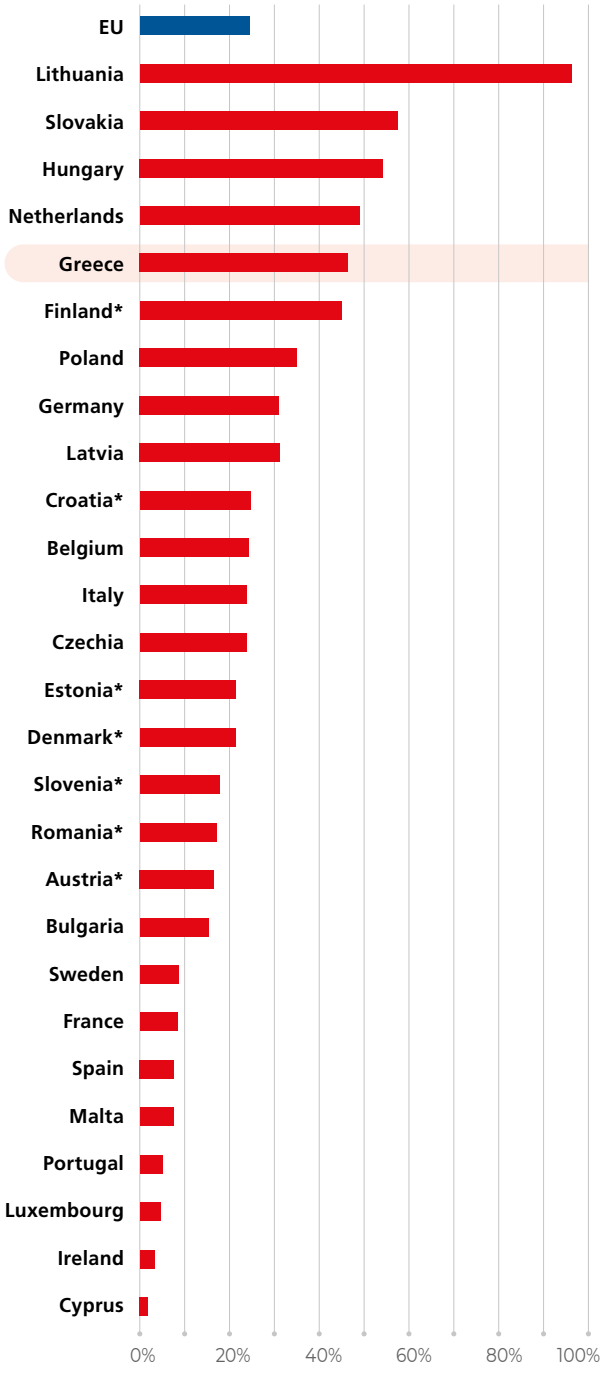
# GREECE

by Georgia Nakou

# INTRODUCTION

Greece's reliance on natural gas as a "transition fuel" left the country highly exposed to Russian energy imports on the eve of the Ukraine war. The efficacy with which the economy adapted to the energy crisis proved to be a valuable learning experience. The ability to adapt to a scenario with less natural gas suggests that further investment in gas infrastructure is not the only, or indeed the best, policy path to decarbonisation.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# BACKGROUND – STATUS QUO ANTE

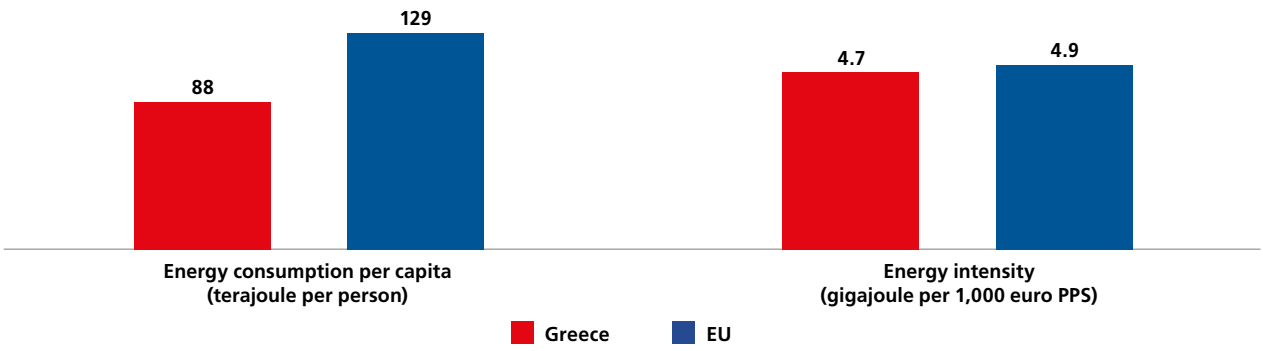
Energy consumption in Greece is among the lowest in the EU, having dropped almost 30 per cent during the financial crisis. In 2020, energy use per capita stood at just under 88 terajoule per person compared to the EU average of 129. The economy, however, is highly dependent on energy usage, with energy intensity measuring 4.7 gigajoule per unit of GDP compared to 4.9 across the EU (see Figure and Table 1).

As of 2021, Greece's energy mix remained heavily dependent on fossil fuels, which made up 82% of the total supply, while renewables (including biofuels) provided 17% (see Figure and Table 1).

Over time, the use of solid fossil fuels (mainly domestically-sourced lignite) has declined from 26% in 2005 to 7% in 2021. Oil and petroleum products have declined from 61% of the mix to 52%, while almost halving in absolute terms from 20 million tonnes of oil equivalent (mtoe) to 12 mtoe.

The same period has seen a massive growth in the use of imported natural gas, which has risen from 7% of available energy to 23%, while the absolute quantity has grown from 2.8 billion cubic metres (bcm) to 6.4 bcm annually (Eurostat 2023).

Figure 2
**Key energy use and energy dependency statistics**




Source: Eurostat 2023

Table 1
**Key energy use and energy dependency statistics**

| | Share in energy mix (% gross available energy) | Imported (% energy) | Imported from Russia (% imports) |
|---|---|---|---|
| **Oil** | 52 | 98 | 20 |
| **Natural gas** | 23 | 99 | 41 |
| **Solid Fossil Fuels** | 7 | 10 | 96 |
| **Renewables** | 17 | | |

Source: Eurostat 2023

Greece's energy dependency on exporting countries has grown from 68% in 2010 to 74% in 2021 (Eurostat 2023), largely as a result of the shift to gas.

Dependency on Russia, however, has been reduced over time both in absolute and in relative terms.

In 2021, 41% of natural gas imports came from Russia, compared to 85% in 2005. In absolute terms, the quantity imported from Russia has remained almost static, averaging around 2.5 bcm annually since the mid-2000s (Eurostat 2023). Russia remained the leading supplier of natural gas in 2021.

Just a month before the invasion of Ukraine, in January 2022, Greece's largest wholesale gas supplier, DEPA Commercial, signed a new contract to source 2 bcm annually of Russian gas from Gazprom until 2026 (Reuters 2022a). Separate agreements by Mytilineos, PPC and the Copelouzos Group (a Gazprom partner) would add a combined 1 bcm annually.

At the same time, however, Greece has been gradually diversifying its sources of natural gas, with pipelines bringing imports from Turkey and, since 2020, Azerbaijan. Around a third of natural gas was imported as LNG in 2021, with the US representing the largest supplier, followed by Algeria and Qatar (IEA 2023).

The Greek "dash for gas" since the early 1990s has been driven by a combination of energy and climate change policy, in which gas is viewed as a "transition fuel', and geopolitical aspirations, according to which successive governments have envisaged positioning Greece as an energy hub for southeast Europe (Nakou 2018).

Oil imports from Russia totalled 6.65 million tonnes in 2021, making up 20 per cent of the total. This marks a decline from the high of around 9 million tonnes which represented just over a third of the total in 2005.

In 2021 Greece imported around 47% of its total energy needs from Russia, compared to around 24% for the EU as a whole, making it among the most dependent countries in the bloc (see Figure 2).

The growth in demand for natural gas in recent years has been driven mostly by its increasingly significant role in electricity generation, where it has largely displaced lignite in the mix. Its contribution has grown from 14% in 2005 to 40 per cent in 2021, while lignite's role has shrunk from 59% to 10%. The contribution of renewables to the electricity mix has risen from 12% to 41% (Eurostat 2023).

In 2021, almost 69% of natural gas imports (4.2 bcm) were used for electricity generation. Industry absorbed only 12.5%, while grid users, including household heating, consumed close to 19 per cent (DESFA 2022).

Oil, which is almost entirely imported by sea, accounts for about half of Greece's energy mix, with transport absorbing about 44%. The transport sector depends on oil for 95% of its energy needs, while it also covers 36% of industry demand, 21% of energy in buildings and 8.5% of electricity generation, mostly on the islands that are not fully connected to the electricity grid (IEA 2023).

At the same time, petroleum products from imported crude make up Greece's largest export sector. In 2021 it exported twice the volume of fuel products than it consumed domestically, worth over €10 billion (Bank of Greece 2023).

Overall, however, the energy balance is negative, contributing to a current account deficit, which was a major factor in the country's recent debt crisis. In 2021, coming out of the pandemic, the goods balance was €26.7 billion in deficit, with the oil balance contributing a deficit of €5.9 billion, making Greece vulnerable to energy price shocks.

## THE POLICY FRAMEWORK

Greece's energy and climate change policy was enshrined in the National Energy and Climate Plan (NECP) (Hellenic Republic Ministry of Environment and Energy 2019), which was adopted in 2019; it formed the basis for the country's first climate law in May 2022, which sets targets for achieving net zero emissions by 2050. Efforts in this direction received a boost from the EU's Recovery and Resilience Facility (RRF), which includes over €10 billion of funding to support the "green transition', about a quarter of the total funding estimated by the government to be needed to hit the NECP's 2030 targets. The bulk of the crisis response measures were laid out in emergency legislation in July 2022.

Key targets include increasing the share of renewable energy to 35% of gross final consumption, 61% of electricity and 42.5% of heating and cooling demands by 2030, and bringing down greenhouse gas emissions by 55% within the same time scale. The EU's adoption of Fit-for-55 and REPowerEU are likely to push some of these targets higher as European goals to reduce emissions and end reliance on Russian energy become more ambitious.

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

## PRICE MANAGEMENT

Government efforts to cushion the impact of global price rises, starting in September 2021, focussed primarily on various forms of support for households in the form of subsidy payments. The government opted for this approach over alternatives such as reducing indirect taxes on energy, which were advocated by opposition parties, on the grounds that the cuts would be regressive, would not be passed on to consumers, and would starve the state of funds.

Between September 2021 and the present day, the government channelled over €9.5 billion into energy support measures, equivalent to over 5% of GDP (detailed in Pierros and Theodoropoulou 2022, and Sgaravatti et al. 2021).

The main funding mechanism for the support measures was the Energy Transition Fund (ETF), initially funded through carbon and RES credits and later expanded through a series of emergency taxes on energy company profits. The initiatives included a windfall tax on the excess profits of power generators, a cap on wholesale electricity prices with the excess directed to the ETF, a retrospective tax on the margins of electricity providers, a 10% tax on natural gas used for power generation, as well as the EU-instigated emergency tax on refinery profits.

In the course of 2022, the ETF raised €5.9 billion, with the remainder supplemented by funds from the regular budget (Hellenic Republic Ministry of Finance 2022). Most funds were allocated to subsidising household electricity and gas bills, with much more modest portions directed to heating and transport fuel subsidies.

Wholesale electricity prices skyrocketed after the Ukraine invasion, peaking at €455 per MWh in August 2022 (IPTO 2023), which made them the highest in the EU. While initial versions of the support were targeted at vulnerable groups, the most extensive response launched in the summer of 2022 was horizontal in nature, effectively offsetting the rise in the unit price of electricity for all consumer groups. Natural gas bill subsidies similarly extended to all residential and business customers regardless of size, means or consumption.

In response to rising oil prices, the government relaxed the criteria for the existing oil heating allowance, a measure designed for vulnerable consumers, to embrace more households, while also providing extra payments to incentivise switching from gas-fired heating back to oil. To alleviate the impact of high petrol prices at the pump, it introduced vouchers known as the "Fuel Pass" funded through the ETF. Refinery profits were subjected to a 33% one-off tax along EU guidelines, with the proceeds used to support the so-called "Food Pass', a subsidy on household food purchases (Reuters 2022b).

Greece continued to import oil from Russia until December 5, 2022, when the EU-wide ban on seaborne imports of Russian crude took effect.

## SECURITY OF SUPPLY

To ensure the security of electricity supplies, in July 2022 the government passed emergency legislation. The law extended the use life of the lignite plants operated by PPC and the associated lignite mines to provide reserve generation capacity in the case of a disruption in natural gas imports. Generators scheduled for closure in 2025 were allowed to keep operating until 2028, and generation from lignite was allowed to increase by up to 50%, while the lignite mines which were already undergoing decommissioning were to increase extraction from 10 Mt to 15 Mt (Kathimerini 2022).

The emergency plans also required certain gas-fired plants to enable switching to diesel, but also made longer-term provisions for renewables, including clarifying the regulatory framework for energy storage.

To secure uninterrupted natural gas supplies, DEPA Commercial signed an agreement with France's TotalEnergies for LNG supplies intended to substitute the totality of Russian natural gas supplies (eKathimerini 2022).

Greece has no strategic gas storage facilities. With the introduction of the EU requirement, it leased 100 mcm in a facility operated by Snam in Italy, with which it is linked via the TAP pipeline.

## DEMAND REDUCTION

Explicit demand reduction incentives were far less generous and proved less straightforward to implement compared to

the price control measures, which effectively subsidised consumption. For example, households were offered an additional subsidy in exchange for cutting electricity consumption by 15% year on year, however the absence of real-time metering in most households made it hard to measure savings.

Mandatory electricity saving measures were implemented only in public sector buildings, specifying minimum and maximum levels for temperature controls and requiring the appointment of energy managers. The government also announced new targets to reduce overall energy consumption by 10% in the short term and 30% by 2030.

Greece agreed to the EU-wide mandatory target of a 15% reduction in natural gas consumption; however, it was able to obtain a derogation according to which it measured the reduction against 2021 consumption rather than the previous 5 years. This reduced its commitment significantly, but as we shall see below it significantly underestimated the potential for national-level cuts.

# 3

# MAIN CONSEQUENCES OF THE SANCTIONS SO FAR

## ENERGY USE

The most significant shift that was achieved in Greece's energy usage in response to the Ukraine crisis was a substantial cut in natural gas consumption, combined with a shift away from Russian gas. Between 2021 and 2022, gas consumption fell by 20%, with cuts achieved across all user groups (Figure 2). Industry cut its consumption by over two thirds, while the power sector used 14% less and grid users (households and small industry) cut their usage by 8%.

Calculations by Green Tank, an Athens-based environmental think-tank, show that over the crucial eight-month period during which the EU obligation was in force (August 2022 to March 2023), Greece reduced total gas consumption by 31.8% compared to the previous year and 20.9% compared to the previous five years, decisively overshooting its targets (Green Tank 2023).

In terms of the sources of natural gas, in 2022, Greece imported just 1 bcm of natural gas from Russia, which equates to 17% of total gas imports (IEA 2023). In the 12 months between February 2022 and January 2023, Greece reduced imports from Russia by almost 72%, compared to the EU average reduction of 37%, while in January 2023 pipeline imports from Russia dipped to zero (Green Tank 2023).

The majority of import substitution came in the form of LNG, which increased its share from around a third of total imports in 2021 to 44% in 2022 (DESFA 2023). The Revithoussa LNG terminal received a total 78 shipments from 10 countries in 2022, compared to 35 from 5 countries in 2021. Imports from the US, the largest source, increased by 63.5% from the previous year to make up just over half of LNG imports.

Given that power generation is by far the biggest consumer of natural gas on a national level, it is notable that natural gas's contribution to the electricity mix fell from 41% to 37% between 2021 and 2022. The portion contributed by renewables jumped from 41% to 47% within a year. Lignite generation also ramped up slightly from 10% to 12%, however the use of oil in the sector halved. Overall, the contribution of fossil fuels shrunk by six percentage points within a year when electricity demand increased as the economy shed the last Covid restrictions.

Despite the shift away from more expensive imported fuels, wholesale electricity prices rose by 139% on an annual basis, making Greece the fourth most expensive wholesale electricity market in the EU in 2022 (ACER 2023). The extreme prices have been blamed on flaws in the implementation of the EU "target model" in the Greek electricity market, which remains highly dependent on spot trading and very exposed to fluctuations in the price of natural gas (Source Material 2022).

The government's choice to tolerate high wholesale prices (in preference to alternatives such as the so-called "Iberian model', which decoupled electricity prices from gas prices) goes a long way to explain the size of the support package necessitated to cushion their effect on consumers.

The shift in energy use is all the more notable given the absence of any mandatory measures at national level to reduce gas consumption, while, to the contrary, household and business gas bills were subsidised. Price increases above the level of government support appear to have provided sufficient motivation for fuel switching and energy saving by both households and businesses. It is also notable that average industrial production in the 12 months to December 2022 grew by 2.3%, suggesting that there was not a corresponding reduction in the activity of industry (ELSTAT 2023), while the economy grew by 5.9%.

## ECONOMY

The economic effects of the crisis have been significant on a macro level. The deficit in the oil balance jumped by 124 per cent to €13.2 billion, which along with natural gas imports drove the goods balance deficit up to €39 billion, a level not seen since the eve of the financial crisis, while the current account deficit shot up by 64 per cent to €20 billion (Bank of Greece 2023).

The effect has dissipated somewhat going into 2023 with the retreat in energy prices. Data from January and February show a halving of the oil deficit, while the goods deficit has shrunk by a third compared to the same period last year (Bank of Greece 2023).

There were some beneficiaries from the energy crisis. The spikes in energy prices led to record profits for companies in Greece's energy sector, including those in the renewables

sector, whose revenues were boosted by high wholesale electricity prices. Greece's shipping sector also experienced a bonanza driven from serving the increased global demand for LNG and crude transport – including, controversially, its willingness to play a leading role in the transport of Russian oil. However, the economic benefits on a national level have been less significant because of the structure and tax status of the industry (Nakou 2022).

Taken as a whole, the success of the policies enacted to tackle the energy crisis was mixed. On a macro level, the government argues that the measures protected the wider economy from fiscal derailment, in spite of the €6 billion added cost of gas imports. The dampening of energy prices through subsidies did not completely shield consumers, incentivising energy saving and fuel switching which resulted in savings well above the European average. Finally, there was no disruption in energy supplies, allowing the economy and society to continue functioning (Tsafos 2023).

Critics, however, have argued that the government's approach has failed to address the regressive impact of inflation. In an economy where real incomes have yet to recover from the economic crisis, with pre-existing high levels of energy poverty, it is argued that the heavy reliance on horizontal subsidies and the absence of targeted measures led to the most vulnerable households experiencing the crisis more acutely. As the authors of one study observe, "government support for households has been important, but inadequate for lower incomes and unnecessary for higher incomes" (Pierros and Theodoropoulou 2022).

# 4

# MEDIUM- AND LONG-TERM ANSWERS

The prioritisation of security of supply above all other energy policy imperatives in response to the crisis created by Russia's invasion of Ukraine has led Greece to speed up some existing initiatives while delaying others. The long-term impact of this short-term reaction remains to be seen. However, some outlines are already visible.

At the same time that it cut domestic consumption, Greece significantly increased its natural gas exports. This was enabled in large part by overcoming the political obstacles that had delayed the opening of the IGB pipeline to Bulgaria. This allowed the export of almost 1 bcm to the neighbouring country in 2022 to plug the gap left by Russian gas, while exports to Italy via the TAP pipeline increased from 6.9 bcm in 2021 to 9.7 bcm in 2022 (IEA 2023). The operators of IGB are now assessing the commercial case for expanding the pipeline's capacity to handle increased export flows (Euro2day 2023a).

Such plans, combined with a planned increase in LNG capacity, would see Greece moving closer to its aspiration to become a regional energy hub. The most mature project in this sector is a new LNG terminal combined with a floating storage and regasification facility (FSRU) at the northern port of Alexandroupolis. Plans include a new gas-fired power plant close to the terminal with the primary aim of exporting electricity to neighbouring countries (Balkan Energy News 2023).

The commitment is less clear for several additional FSRU projects announced in recent months. Out of four units mooted by private developers, three are being reconsidered due to high costs and other issues (Euro2day 2023a). A temporary FSRU leased to add storage capacity at Revithoussa is being decommissioned after six months of operation. This suggests that some of the more bullish plans for natural gas infrastructure hatched at the peak of the crisis are being reconsidered as prices subside from their 2022 highs.

Prospects for strategic gas storage, meanwhile, remain in limbo. The latest attempt to develop the depleted South Kavala gas field, which has a potential capacity of 530 mcm according to official estimates, was abandoned in April 2023 after disputes over the allocation of costs. Press reports suggest the government privatisation fund which owns the site is considering re-launching it as a hydrogen storage facility (Euro2day 2023b).

The plan is in line with a greater emphasis on the future potential of "green hydrogen" and electricity exports, in line with the REPowerEU goals. The Greek hydrogen strategy foresees 1.2 GW of electrolysis capacity for hydrogen generation by 2030 and a €10 billion hydrogen supply chain by 2050, while immediate plans require that all new extensions to the gas grid be compatible with hydrogen transport (Kathimerini 2023). Meanwhile, two proposals have been put forward for electricity interconnectors joining Greece with Egypt (Euro2day 2023c).

The war in Ukraine rekindled Greece's hydrocarbon exploration. In the spring, the government announced plans to test for natural gas reserves in one offshore and five offshore plots, in a bid to lessen the country's reliance on imports (Reuters 2022c). Exploratory drilling due to take place in Epirus as early as 2023 would be the first in Greece in 22 years. Hydrocarbon exploration in Greece has a chequered history, with activity largely driven by political pressure rather than commercial interest. At least one opposition party in the upcoming national elections is pledging to block further extractive activities.

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS

While it is too early to assess the full impact of the emergency measures on Greece's energy and climate change goals, the government has indicated that it committed to its prior targets, including the closure of lignite power stations by 2028.

Our brief observations so far suggest that this would be a missed opportunity, especially as relates to the pivotal role given to natural gas in the green transition. The rapidity with which key sectors of the economy were able to adjust to the prospect of less natural gas should be seen an opportunity to pause and rethink whether further investment in gas infrastructure is indeed, as one senior official put it just weeks before the start of the war, "both rational and unavoidable" (Euractiv 2021).

This question, which some lone voices had already posed prior to the Ukraine crisis (e.g. Doukas and Oikonomou 2021), is all the more relevant given that in a post-Russian-energy world, the price of gas is expected to settle at a new high level, rendering what was already a risky and expensive strategy even more so.

Targets in the NECP include a 50% increase in natural gas use from 2017 levels by households, industry and transport, driving expansion of networks and private investment in equipment like household gas boilers. Despite targeting a 20% reduction in the use of gas for power generation, the plan also foresees the creation of another 2 GW installed capacity by 2030.

The most recent country report by the IEA advised Greek policy makers "to rethink and rationalise the role of gas in its energy sector planning and policies to avoid stranded assets', also suggesting that "investments in expanding the national gas network would be better directed at energy efficiency, renewables and energy storage'.

The experience of 2022 suggests that a realignment of national policy towards less reliance on natural gas is feasible without great economic pain. This should be a prompt for policy makers to "think the unthinkable" and make the best of the available real-world evidence to consider alternative scenarios.

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# HUNGARY

by Dóra Csernus

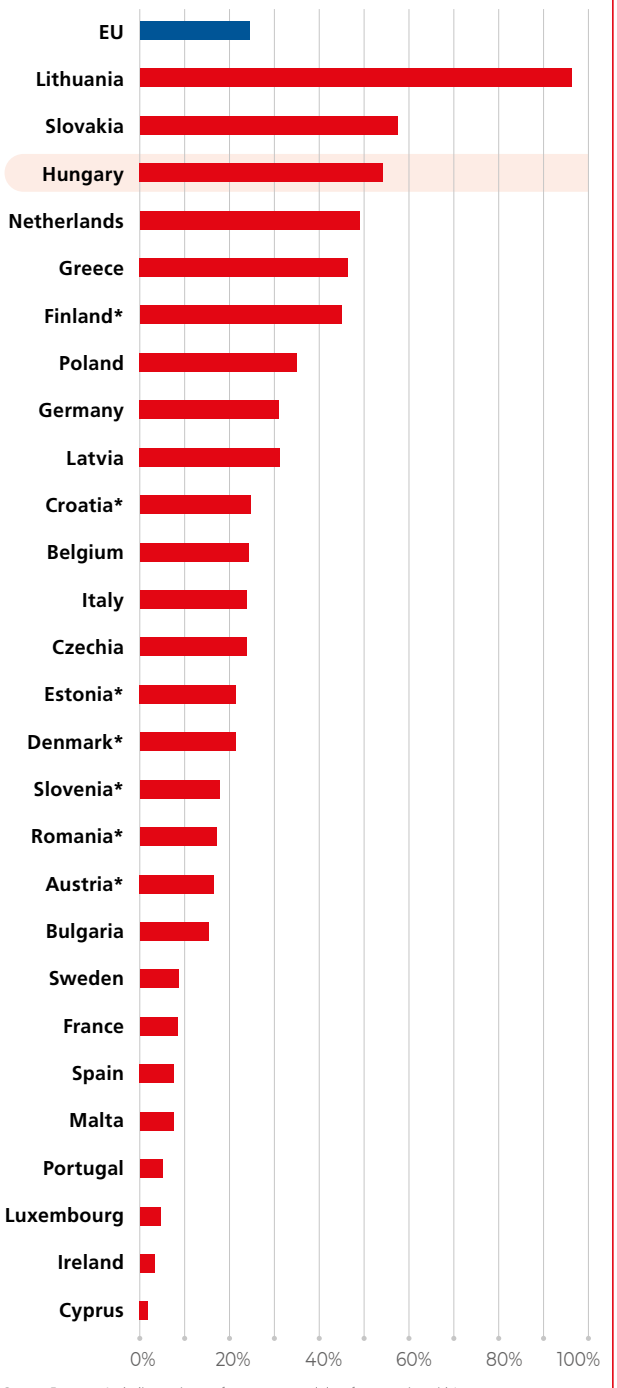
# INTRODUCTION

Hungary is one of the countries that are the most dependent on natural gas and oil imports in the EU, especially on imports from Russia. The energy dependency is above 50 per cent, and more than 90 per cent of oil and natural gas imports came from Russia before the war, making the country very sensitive to the geopolitical developments of the past year.

For the moment, EU sanctions do not cover nuclear fuels, but this topic is also conflictual in Hungary, as 100 per cent of the fuel used in the country's only nuclear installation, the Paks nuclear power plant, comes from Russia. The new nuclear power plant, Paks 2, is under construction with Rosatom as the constructor, although the war makes the feasibility of the project questionable.

Decoupling from Russia is among the objectives of the government, although the level of ambition of this decoupling is not clear. For nuclear energy, Hungary is trying to find new sources of imports, and is considering cooperation with the American company Westinghouse and the French Framatome. For natural gas, Hungary has a long-term contract with Russia, but is seems that with the shutdown of the Nord Stream pipelines, Russia will not be able to supply the contractual quantity, which will speed up Hungary's decoupling from Russia, which is already – slowly – happening with LNG, Azeri, and Romanian imports.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO BEFORE THE WAR

## ENERGY DEPENDENCY

Before the war of aggression of Russia on Ukraine, Hungary was very much dependent on Russia with regard to natural gas, oil and nuclear fuel.

Hungary's energy dependence stood at 56.2 per cent in 2020 and at 53.7 per cent in 2021, which is the last available official data at the Central Statistical Office. If we also include in this figure the nuclear fuel imports used to operate the nuclear plant in Paks, Hungary's energy dependence exceeds 80 per cent.

Before the war, nearly 90 per cent of Hungary's oil and natural gas came from imports, with 64 per cent of imported oil and 95 per cent of imported gas coming from Russia. 100 per cent of nuclear fuels came from Russia.

The situation of households is very sensitive as the building sector is responsible for around 40 per cent of final energy consumption, and around 70 per cent of Hungarian households use solely or partly natural gas for heating. 73 per cent of final energy consumption of households in 2021 was dedicated to heating. Such a great dependency of households on natural gas plus the extremely high dependency on Russia in natural gas consumption leads to a situation that is politically very challenging: the Hungarian population is in a situation where all shortages in Russian gas can be felt immediately.

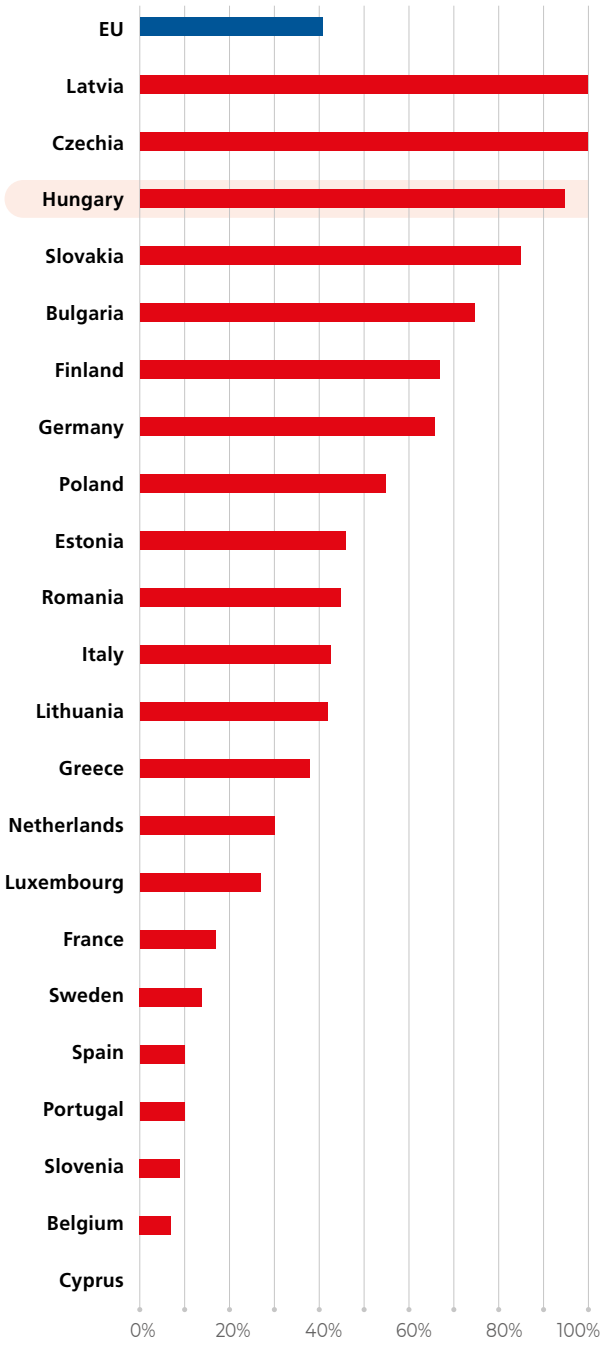
Although nearly the entirety of Hungary's coal imports come from Russia, imported coal represented only 0.6 per cent of the country's coal consumption and the share of coal in primary energy consumption was only 5.1 per cent in 2021.

The share of net electricity imports in Hungary's primary energy consumption was 4.1 per cent in 2021, and the share of imports in final electricity consumption stood at 26.5 per cent.

## ENERGY IN GENERAL

Natural gas has been playing an important role in Hungary's energy mix for decades. Its share in the energy mix was at its maximum in 2003 with around 45 per cent of primary energy consumption, but it is still important today: according to the latest data (2021) it accounts for 34.3 per cent of primary energy consumption.

Figure 2
**EU reliance on Russian gas**
Share in total imports in 2020 of Russian natural gas in %




Source: Eurostat. Data not available for Malta, Croatia, Denmark, Ireland and Austria

The share of oil mostly stagnated in the past 20 years, with a peak in 2019 at a 30.4 per cent share in primary energy consumption and a 29.3 per cent share in 2021.

The share of coal is decreasing and was at 5.1 per cent in 2021 (Figure 3).

Renewable energies are mainly combustible renewables in the country's energy mix.

The share of renewables in Hungary's final energy consumption stood at 12.7 per cent in 2010, rose to 14.5 per cent in 2015, and dropped to 14.1 per cent in 2021[1] (Figure 4).

The population of the country is showing a decreasing trend. According to the 2022 census Hungary's population decreased to 9.6 million people compared to 9.9 million in 2011 and 9.8 million in 2016.

Primary energy production per capita stood at 47,300 Mj while primary energy consumption per capita was 120,300 Mj and final energy consumption was 82,000 Mj per capita (or 1.970 toe per capita). Both in 2020 and 2021, per capita energy consumption in Hungary was significantly lower than the EU average: 1.847 toe per capita compared to 2.027 in 2020 and 1.972 toe per capita compared to 2.165 in 2021.

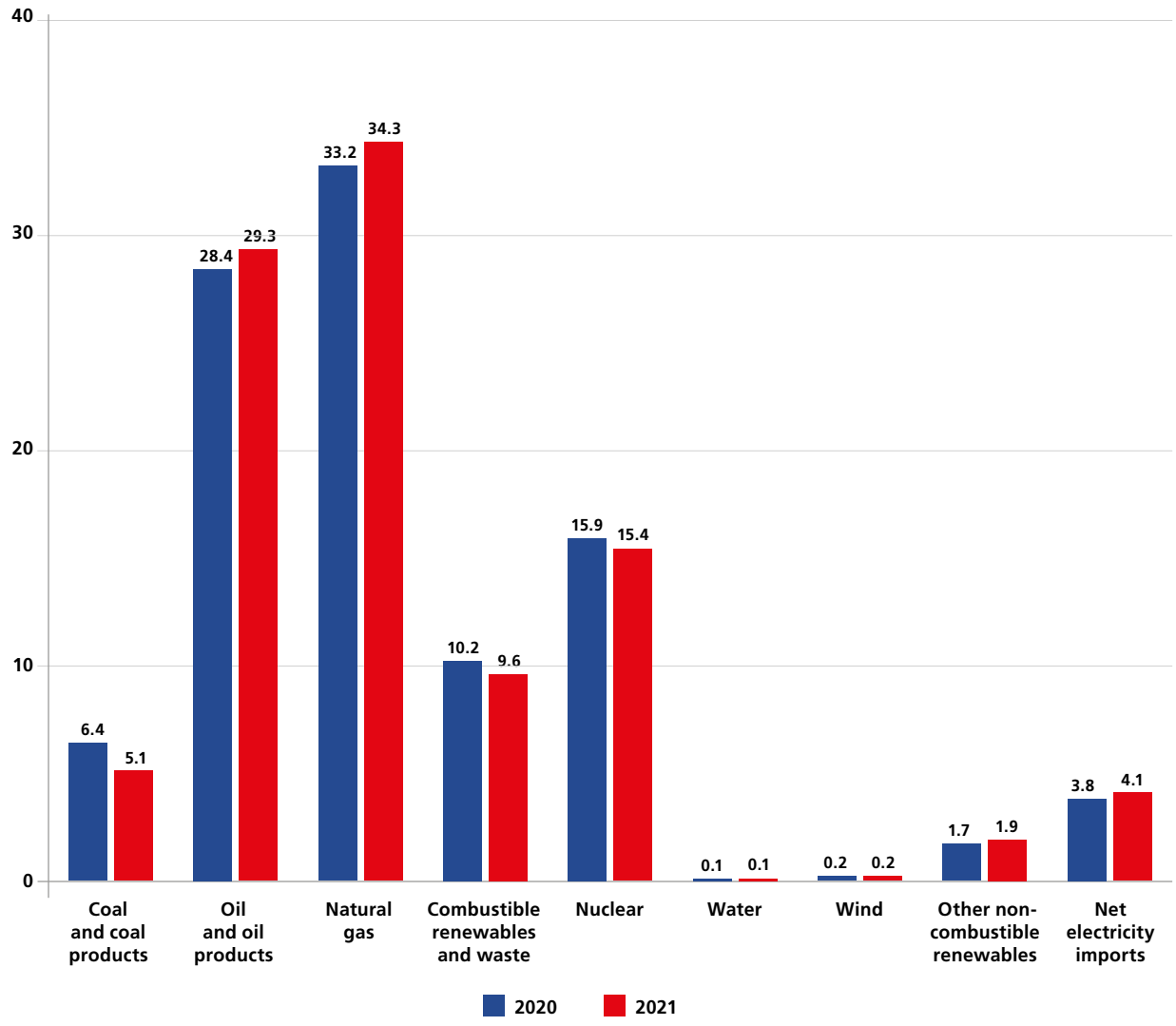
## ELECTRICITY

The share of nuclear energy in electricity production was 44 per cent in 2021, the share of natural gas was 27 per cent, solar stood at 11 per cent, coal at 9 per cent and oil was almost non-existent with its 0.2 per cent share (Table 1).

The share of electricity produced from renewables in our gross final energy consumption was 13.7 per cent in 2021 (Figure 5).

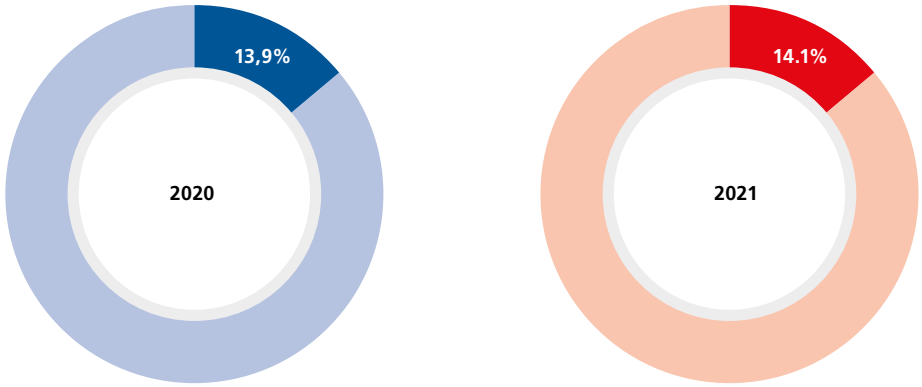
1 https://www.ksh.hu/stadat_files/ene/hu/ene0001.html

Figure 3
**Structure of Hungary's primary energy consumption (%)**




Source: Central Statistical Office

Figure 4
**Share of renewable energies in gross final energy consumption (%)**



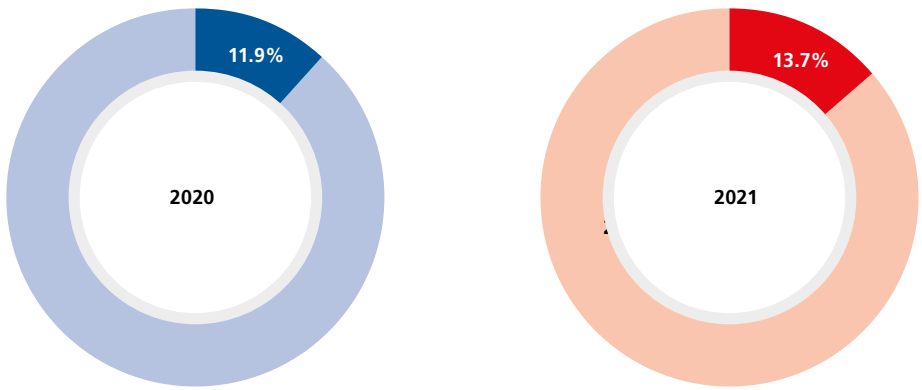

Source: Central Statistical Office

Table 1
**Gross electricity production (GWh)**

| | 2020 | 2021 |
|---|---|---|
| **Nuclear** | 16,055 | 15,990 |
| **Coal and coal products** | 3,826 | 3,105 |
| **Natural gas** | 9,091 | 9,653 |
| **Oil** | 45 | 59 |
| **Biomass** | 1,664 | 1,775 |
| **Biogas** | 324 | 295 |
| **Renewable fraction of waste** | 167 | 161 |
| **Water** | 244 | 212 |
| **Wind** | 655 | 664 |
| **Solar** | 2,459 | 3,796 |
| **Geothermal** | 16 | 12 |
| **Other** | 384 | 398 |
| **Total** | **34,930** | **36,120** |

Source: Central Statistical Office

Figure 5
**Share of renewable energies in gross final electricity consumption (%)**




Source: Central Statistical Office

Table 2
**Net electricity consumption in different industrial sectors (GWh)**

| | Net electricity consumption in different industrial sectors (GWh) |
|---|---|
| **Agriculture, wildlife management, forestry, and fishery** | 845 |
| **Mining** | 131 |
| **Manufacturing industry** | 13,925 |
| **Electricity, gas, heating supply** | 1,168 |
| **Construction industry** | 472 |
| **Commerce, reparation** | 2,080 |
| **Transportation, storage, post, and Telecommunications** | 1,928 |
| **Accommodations and catering** | 600 |
| **Other social or private services** | 1,296 |
| **Households** | 12,198 |
| **Other consumption** | 9,204 |
| **Total net consumption** | **43,848** |

Source: Hungarian Energy and Public Utility Regulatory Authority; https://www.mekh.hu/download/1/72/31000/MEKH_statisztikai_kiadvany_villamos_energia_A4_web_V%c3%89GLEGES.pdf – page 75

If we look at the structure of electricity consumption, the manufacturing industry and households are the biggest electricity consumers in Hungary.[2] In 2021, the structure was as shown above (Table 2).

2 http://www.mekh.hu/download/1/72/31000/MEKH_statisztikai_kiadvany_villamos_energia_A4_web_V%C3%89GLE GES.pdf

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

From the beginning of the war, the government argued that Hungary wants to stay out of the war, and that Hungary cannot support the sanctions linked to fossil fuel imports. The latter was explained by the fact that Hungary is in a special situation stemming from high dependency on Russian oil and gas imports, and moreover Hungary is a landlocked country with fewer opportunities for import and energy carrier diversification.

## PRICE CAPS FOR HOUSEHOLD ENERGY CONSUMPTION AND PETROL

Already before the war, there were two main measures aimed at dealing with high energy prices in Hungary. Both measures were price caps that did not differentiate based on revenues or wealth. These two measures were maintained after the war started (also because one of the key messages of the Fidesz party was that if they were re-elected in spring 2022, the price caps would be maintained), even though this became an increasing burden for the state budget.

From 2013 to August 2022, the end-user energy prices for the residential sector were fixed by law. The fixed end-user energy prices were in effect even when energy prices on the market were lower than the fixed price, but in the past few years, market prices were higher, causing a tremendous loss to the state budget. With the actual energy crisis, keeping the cap on the prices became impossible, even though before the spring elections, the government communicated that the low prices would stay. Despite this, at the end of July 2022, a ceiling was introduced for the amount of energy that can be purchased at the prices fixed by the government. In the new system, there is a so-called "average" consumption level for both natural gas and electricity. Below this level, the subsidised price is kept. Above this level, market prices are used. This measure, introduced within just a couple of days, put millions of households into a very difficult financial situation.

At the end of 2021, the government introduced a fixed end-user price on 95 petrol and gasoline (480 HUF/L = ~1.2 EUR). The related legislation was changed several times, first to stop "fuel tourism" or individual fuel storage: only drivers with individual cars registered in Hungary could buy at the lower price and the lower price could not be used for filling fuel cans. This measure, just like the one on fixed household end-user energy prices, was developed before the energy crisis of 2022, but the government wanted to keep it even when the market prices got higher, thus putting an extremely heavy burden on the Hungarian state budget. This policy worked intensively against energy efficiency and the rationalisation of energy consumption. According to official data, in just 3 trimesters, petrol consumption rose by 40 per cent and gasoline consumption by 36 per cent compared to the previous year. The cap was taken out of the system at the beginning of December 2022, when serious shortages were observable at filling stations: MOL, the Hungarian oil company, was unable to supply enough fuel, and the fuel formerly imported was not available. Imports were not coming to the country anymore since the fixed prices made fuel trade loss-making.

# 3

# MANAGEMENT OF THE SANCTIONS

Hungary managed to negotiate special exemptions from certain elements of the sanction packages decided against Russia. Particularly with regard to energy carriers, Hungary's position is very strict when opposing the EU sanctions. In May of 2022, prime minister Viktor Orbán blocked further steps towards EU sanctions on oil, using the country's veto right. This is how the Hungarian government first managed to reach a deal where it was exempted from the ban of Russian crude oil then a deal where it was exempted from the ban of Russian oil products. The Hungarian oil refinery, the Duna Refinery at Százhalombatta is running on Russian oil blends. Although the technology can be modified to be suitable for the use of different oil blends, this would take a few years. A similar amount of time would be needed for developing capacities that can produce the blended oil needed for the refinery somewhere other than in Russia.[3] In July 2022, Hungary was the only Member State that voted against the EU package that aimed at reducing natural gas consumption, arguing that it was against the country's interests. The government argues that as a landlocked country very much dependent on energy carrier imports, especially Russian imports, Hungary does not have the alternatives that other EU Member States have.

The increase in gas and electricity prices is hitting the society hard, although households are somewhat protected from the shocks with the partly fixed household end-user energy prices. For private companies, skyrocketing energy prices pose an existential threat: many companies had to shut down their activities – temporarily or definitively –because of the high energy bills. According to a new analysis, there have been almost twice as many liquidation procedures against Hungarian companies in 2022 than one year earlier.[4] Local authorities also found themselves in a tricky situation when they lost their protected consumer status in the summer of 2022. Previously, they were also eligible for fixed end-user energy prices that were lower than the market price, but this changed very quickly, leaving local authorities in a situation where they had to close sport centres and cultural centres, limit the lighting of public buildings, decrease street lighting, and close major parts of public buildings to save energy.

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3 https://novekedes.hu/elemzesek/honnan-lenne-olaj-ha-bevezetnek-az-embargot-terkepen-mutatjuk-az-europai-koolajszallitasi-utvonalakat

4 https://www.portfolio.hu/gazdasag/20230405/kozel-duplajara-nott-a-csodok-szama-magyarorszagon-az-epitoipar- van-a-legnagyobb-veszely-ben-607352

# 4

# MEDIUM- AND LONG-TERM ANSWERS

A more structured response to the crisis was presented in July 2022, when the government declared a state of emergency due to the energy crisis and announced a 7-point action plan to increase the country's resilience.

1. Increase in domestic natural gas production.
2. Secure additional gas supply sources and fill up natural gas reserves.
3. Ban the export of energy carriers and firewood.
4. Boost domestic lignite production.
5. Relaunch all the blocks of the Mátra lignite power plant as soon as possible.
6. Start the construction phase of Paks 2 nuclear power plant as soon as possible.
7. Change the system of fixed end-user energy prices for households by introducing an average consumption level above which the consumers have to pay the market price for gas and electricity as well.

Hungary is trying to **diversify** its oil and natural gas import routes:

- The country wishes to secure more **LNG** from the Krk LNG-terminal of Croatia.
- Hungary is trying to reduce and diversify its oil imports; it pushes forward electrification in the transport sector and the expansion of the **Southern Adria Oil Pipeline** to transit oil arriving from Croatia as an alternative to the Friendship Oil Pipeline bringing in Russian oil.
- The country decided to increase its own extraction of natural gas and to search for new import routes. It is considering two new directions for imports: from the **Romanian Neptun Deep** natural gas field and from the **Azeri Shah Deniz 2** gas field. The Romanian route needs a few more years and a lot of investments to be operational; the Azeri route already exists but the capacity of the pipelines must be upgraded, which also requires some time and significant funding.

Although energy efficiency and reduction of the use of fossil fuels are on the table theoretically, not much can be seen in practice. The market price signal is the tool that makes consumers reduce their energy demand, while demand side-management, smart metering solutions, and significant building renovation programmes seem to be missing from the set of solutions really considered by the government.

The new **National Energy and Climate Plan** is being developed giving new modelling numbers for energy planification too. This new planning with background modelling is not due to the crisis but to the fact that the NECPs must be revised this year.

The **energy mix** of the country is also reconsidered in light of the war and the energy crisis.

Hungary announced the construction of 3 new power plants running on **natural gas**. These are said to be aimed mostly at replacing power plants that are becoming obsolete, but what is clear is that the role of gas is not becoming less important in government plants, it is not being phased out gradually as energy security, and the fight against climate change would require doing so.

**Coal** was supposed to disappear from the electricity mix by 2025 when the licence of the only lignite power plant expires, but with the 7-point emergency plan presented in chapter 2, the government decided that it would be kept longer than planned in the electricity system. The Mátra Power Plant can operate only at high costs, as it is obsolete, thus has high maintenance costs, and being the largest carbon emitter in Hungary, it faces high $CO_2$-costs in the European Trading Scheme.[5] Keeping the power plant in the energy mix goes against energy efficiency and the reduction of greenhouse gas emissions.

Wind energy is a special situation in Hungary. Since 2016, there is a law that bans the construction of new wind turbines within a 12-kilometre distance from inhabited settlements. Until now, this meant that there was no area in Hungary where it would have been possible to install new

5 https://english.atlatszo.hu/2023/03/03/this-is-how-is-the-hungarian-government-is-dealing-with-the-energy-crisis/

wind energy capacity. This might change now. The government announced that wind energy will receive a green light again: this is a rational decision considering the energy crisis, but it is also a prerequisite set by the European Commission for Recovery and Resilience Funds to be transferred to Hungary. Although the declaration was made in February 2023, there is still no concrete draft of the new legislation or information about when this new legislation will be passed.

Photovoltaic capacities in Hungary rose from 160 MW in 2015 to 4,000 MW in 2022. Household PV was an important part of that increase and demand for PV systems became more and more important with the increase in fossil fuel prices. Especially when the government modified the system of end-user energy prices, the demand for household PV systems skyrocketed. Causing great surprise and disappointment to the market, the government suspended new connections to the grid for new solar energy installations from November 2022, arguing that the grid was not suitable for integrating more PV-capacities at the moment. This decision put all the PV market actors in a difficult situation: the companies could observe a very significant increase in the demand for new PV systems, and thus they increased their capacities. With the ban on new connections to the grid, the demand for new PV fell sharply and companies had to dismiss people they hired just a few months earlier. Although the ban is supposed to be provisory, the negative effect on the market is already there, and one cannot be sure that qualified workforce will come back to the sector once the ban is lifted, creating a bottleneck in the development of solar electricity systems.

The national strategies are planning more renewables, but with the ban on wind power still in place and the ban on feeding PV into the grid, it is questionable how and at what pace renewables will have the chance to further develop.

As presented in Chapter 1, **nuclear energy** provides almost half of the country's electricity production with the help of the Paks power plant running 100 per cent on Russian nuclear fuel. To decrease this dependency, Hungary is trying to find new sources of imports, and considered cooperation with the American company Westinghouse and the French Framatome. The fate of the new nuclear power plant to be built in the upcoming years is unclear, as Hungary sticks to the original plan of constructing Paks 2 by the Russian Rosatom. The construction of the Paks 2 Power Plant is already in an important delay and its construction does not only depend on the Hungarian government's will but also on the geopolitical situation and on what window of action it leaves for Hungary. The geopolitical situation might easily lead to a situation where Rosatom will not have the possibility to build the power plant, as some elements need to be imported from Germany and France, and there is some resistance from their side. If Rosatom (or another company) cannot build Paks 2, Hungary might find itself in a situation of an electricity shortage at the end of the 2030s when Paks 1, which is currently providing 45 per cent of Hungarian electricity production, will be shut down.

Hungary has had a hydrogen strategy since 2021: it was finalised before the war, but it seems that we can observe a change in pace in the past months when it comes to the deployment of hydrogen. Hungary wishes to accelerate the development of hydrogen projects and use this fuel in transportation, in electricity generation but also to replace some of the natural gas used in sectors where it is difficult to decrease its use.[6] Two green hydrogen projects are entering the trial phase in spring 2023 (in Bükkábrány[7] and Kardoskút[8]).

Finally, what are the government's plans regarding energy efficiency and energy savings? The greatest potential is here, but energy efficiency strategies often fail to lead to concrete steps in Hungary. As mentioned earlier, in Hungary, over one third of final energy consumption is linked to buildings: there is a great potential for energy savings and for greenhouse gas emission reductions in this sector. Although households are using less energy since the system of fixed end- user energy prices was modified, this is still not a structural change, only a change driven by high prices, and there is no sign of a thorough building renovation programme that could lead to substantial reductions in energy consumption.

6 https://greendex.hu/a-vartnal-elobb-johet-el-a-hidrogen-ideje-magyarorszagon/

7 https://www.portfolio.hu/uzlet/20230419/indul-a-magyar-projekt-hatul-sok-a-napenergia-akkor-zold-hidrogent-allitanak-elo-610030

8 https://www.agroinform.hu/program/kiserleti-hidrogen-projekt-indul-a-magyar-foldgaztarolok-igenybevetelevel-62095-001

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

Based on the declarations of different members of the Hungarian government, it considers increasing energy security and decreasing energy dependency more important than reaching the climate goals.

The 7-point-crisis programme and the plan to build new electric power plants running on natural gas do not show a will to solve the problem of energy dependency and that of climate change at the same time. The Hungarian government does not seem (or want) to realise that increasing both energy security and climate security can go hand in hand.

The ban on feeding into the grid for new PV systems also poses a problem, as it is basically stopping new PV developments, which is once again a missed opportunity for increasing energy and climate security at the same time.

Another missed opportunity is hitting the potential that lies in the deep renovation of the building stock: that is, a significant decrease in greenhouse gas emissions and in energy consumption. A long-term building renovation programme would necessitate a long-term vision from the government that takes into account climate goals too, not only energy security.

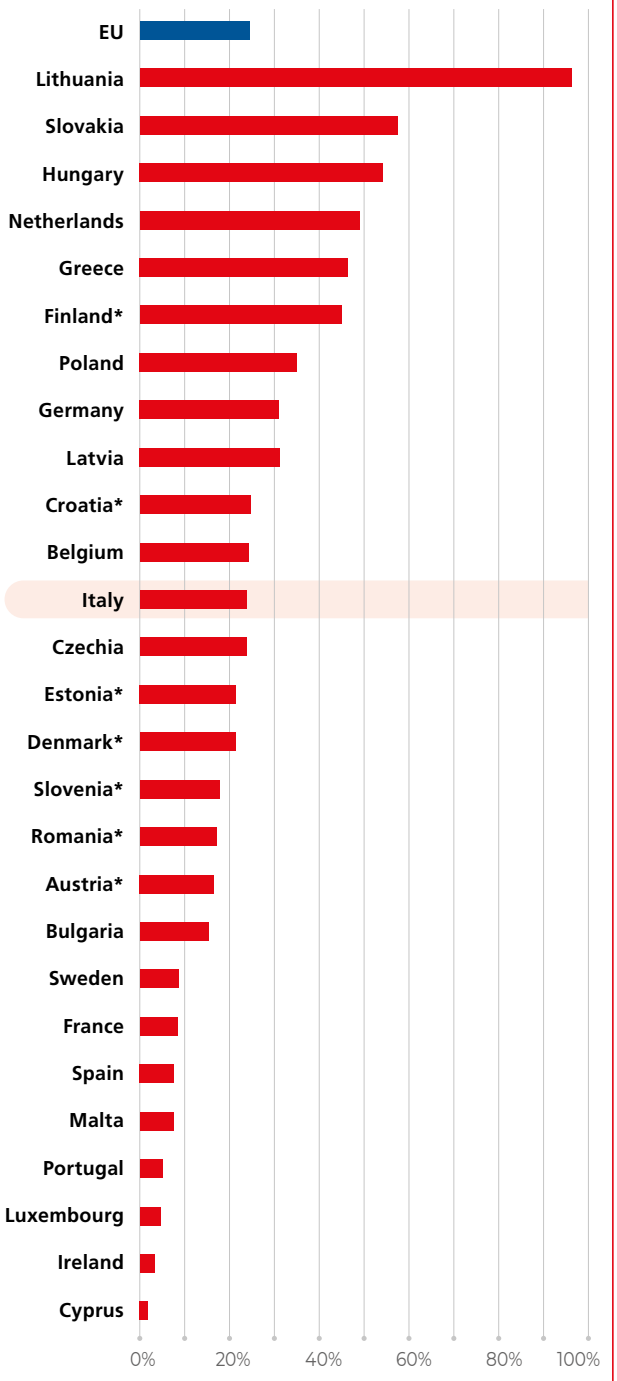
# ITALY

by Francesca Andreolli, Francesca Bellisai, Massimiliano Bienati, Giulia Giordano, Michele Governatori and Davide Panzeri

# INTRODUCTION

The Russian invasion of Ukraine and the energy crisis which came in its wake have produced significant impacts on the energy sector in many EU countries, including Italy. In 2021, prior to the war, Italy was strongly dependent on Russian natural gas imports with around 40% of total gas imports (72.6 billion standard cubic metres) coming from Russia. In 2022 Italy halved its Russian gas imports (to 19% of the total) and, at the same time, tripled its exports. Furthermore, whilst at least one fifth of the electricity consumed in Italy in 2021 was generated with Russian gas, this share was reduced to around one tenth in 2022. The government has drawn up a national plan for the containment of natural gas consumption, with energy bill containment measures in Italy estimated to cost €62.8 billion in the 2021–22 two-year period. This study shows that customers reacted to high gas prices by reducing consumption over and above the European target of 15%, with gas consumption dropping 18.6% from August 2022 to January 2023, in the absence of structural measures.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

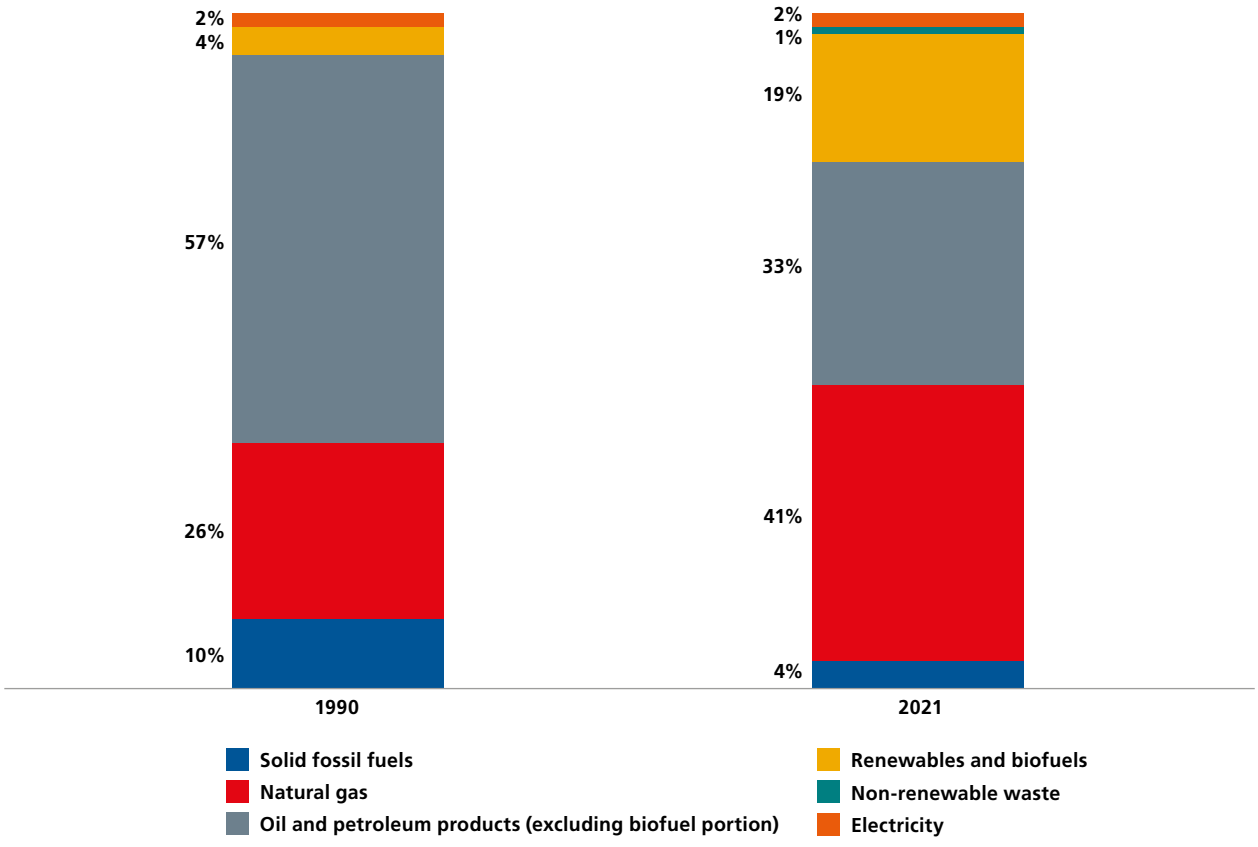
# THE ITALIAN ENERGY SECTOR BEFORE THE RUSSIAN INVASION OF UKRAINE

In 2021, Italian gross domestic energy consumption[1] was 153.7 Mtoe[2]. Fossil fuels were the primary source of energy in Italy, although the composition of the energy mix has changed significantly since 1990, when oil and petroleum products were the main component, followed by natural gas and solid fuels. In 2021 natural gas accounted for the greatest share, with 41% of gross domestic consumption, followed by oil and petroleum products at 33%. That same year renewable energy covered 19% of gross domestic consumption, i. e. 29.9 Mtoe.

Final energy consumption – generally 80% of primary energy – was 113.3 Mtoe in 2021.[3] The share of natural gas, petroleum products, renewables, and electricity was 30%, 34%, 10%, and 22% respectively. Per capita energy consumption in Italy in 2021 was 0.84 toe, slightly down from the pre-crisis figure of 0.87 toe. When compared to other European countries Italy is within the EU average.[4]

1 Gross Domestic Energy Consumption in Eurostat.
2 Mtoe – millions of tonnes of oil equivalent.
3 Source: Eurostat.
4 https://dgsaie.mise.gov.it/pub/sen/relazioni/relazione_annuale_situazione_energetica_nazionale_dati_2021.pdf

Figure 2
**Share of gross domestic consumption by energy source – comparison between 1990 and 2021**




Source: Eurostat

If we look at electrical energy production in detail, in 2021 Italy's net production was 280 TWh.[5] Fossil fuels accounted for 59% and the remaining 41% came from renewable sources (hydro, wind, photovoltaic, and biomass). 77% of the 164.5 TWh of thermal energy was natural gas and 7.8% was coal.

Net of the energy used for pumping (3 TWh), national production covered 87% of the electricity demand, with the remaining 13% (43 TWh) imported: 19 TWh from Switzerland, 15 TWh from France, 5 TWh from Slovenia, 3 TWh from Montenegro and, to a lesser extent, from Greece, Austria, and Malta.

## 1.1 DEPENDENCE ON RUSSIA

### 1.1.1 GAS, PETROLEUM, COAL, AND REFINED PRODUCTS IMPORTS

Prior to the Russian invasion of Ukraine, the Italian energy sector's main Russian import was natural gas. In 2021 Italy imported 72.6 billion standard cubic metres (bn $sm^3$) of methane gas, of which 29 bn $sm^3$ (around 40%) came from Russia. Italy is one of the EU member states which historically imports the largest quantities of natural gas from Russia, whilst its dependence on Russian oil and coal is much lower. In 2021, 193,000 tons of Russian coal (2% of national imports) were imported together with 5.7 million tons of petroleum (10% of the total 57 million tons imported). Material for nuclear energy production is not imported because this technology is not permitted in Italy for power generation.

### 1.1.2 VARIATIONS IN 2022

In 2022 72.4 bn $sm^3$ of natural gas were imported,[6] 19% of which came from Russia. With total natural gas imports virtually unchanged, then, Italy's dependence on Russian supplies has been halved thanks to supplies from other countries via pre-existing infrastructure. Compared to 2021, the national production of gas has remained at around 3.3 billion $sm^3$, while exports have tripled, with 4.6 billion $sm^3$ in 2022 as against a 2021 figure of 1.5 billion $sm^3$. This in an increase of over 4 billion $sm^3$ compared to levels recorded in 2019, which were just 0.3 billion $sm^3$.

This is a figure worth highlighting because it shows that, during the period in which gas was more expensive, Italy bought more than it needed and then re-exported it.

Where petroleum is concerned,[7] in 2022 Italy imported a total of 62.5 million tons (Mt) of crude oil as against a 2021 figure of 57 Mt (+9%), with the percentage coming from Russia increasing from 10% to 19%. In absolute terms Russian imports more than doubled from 5.7 to 12 million tons. The 2022 total import figure is generally in line with pre-pandemic levels, with crude oil imports of 63.2 Mt, and Russian imports accounting for 14% of this.

With regard to petroleum derivatives, semi-finished and finished products, the comparison between 2021 and 2022 shows a slight increase in the totals, from 14.8 Mt in 2021 to 15.3 in 2022 (+3.3%) and a reduction in dependence on Russian imports, from 17.6% in 2021 to 13.7% in 2022. In 2022 the total consumption of petroleum products was 58.4 Mt compared to 55.4 Mt in 2021. Most of this consumption was accounted for by transport, with 67% of the total, against 61% in 2021.

As far as solid fossil fuels are concerned (coal and pet coke), imports increased significantly from 2021 to 2022, from 9.5 to 13.1 Mt. One of the reasons for this was the greater use of thermoelectric coal as a partial alternative to gas when gas prices were exceptionally high. In this case too, imports from Russia, already low, decreased significantly from 193,000 tons (kt) to around 100 kt, i. e. from 2% to 1% of the total.

### 1.1.3 ITALIAN ELECTRICITY GENERATION

In 2021, electrical energy demand was 320 TWh,[8] 51% of which came from non-renewable sources, 36% from renewable sources and the rest from imports. Of the approximately 180 TWh produced from fossil fuels, the lion's share was natural gas, almost all of which was imported. As we have seen with Italian gas imports in 2021, approximately 40% was Russian. Thus it can be said that if the Russian share of gas imports is divided up equally between the industrial sectors consuming it, **at least one fifth of the electrical energy consumed in Italy in 2021 was produced with Russian gas. This dropped to around one tenth in 2022, given the reduction in Russian gas imports as a proportion of total imports.**

In addition to this, electricity generation from coal (which was dependant on Russian imports to the extent shown previously) was of marginal importance in 2021 but increased during the crisis.

5 Source: Terna.

6 Source: Snam.

7 Source: https://dgsaie.mise.gov.it/bollettino-petrolifero

8 Fonte Terna (https://download.terna.it/terna/Terna_Annuario_Statistico_2021_8dafd2a9a68989c.pdf)

# 2

# IMMEDIATE ACTION AFTER FEBRUARY 2022

## 2.1 UTILITY BILL AND FUEL TAX SUBSIDIES

At the national level the Italian government's first priority in the wake of the Russian invasion of Ukraine was safeguarding families and the Italian manufacturing industry from the effects of soaring energy prices. The main energy price containment measures intervened on the tax and on the regulated elements of the bills. Specifically: VAT was decreased to 5% on gas for domestic and industrial use and most general system charges were suspended for both electricity and gas. Reductions in the fuel excise duty rates were adopted in March 2022 and applied right through the year, a reduction of 25 cents for petrol and diesel, corresponding to discounts of 30.5 cents before VAT.

Overall, **public energy bill containment measures in Italy have been quantified by the Italian Parliamentary Budget Office at €62.8 billion in the 2021–22 two-year period.** 16 billion of this went directly to families while other measures applying to both families and business amounted to around 22.4 billion, and the remaining 24.4 billion went exclusively to businesses.

The 5% reduction in VAT on gas for domestic and industrial use is still in force and amounted to 3.1 billion at the end of 2022, according to the Parliamentary Budget Office. Offsetting the general system charges for domestic use and low voltage consumers cost over €11 billion overall prior to the end of 2022 alone. In addition to tariff measures, support to families also included various forms of money transfers to alleviate the pressure of inflation on family budgets.

The Italian government also set up a series of initiatives with a twofold objective: to ensure high storage levels for the winter of 2022–23 and to diversify gas import provenance rapidly. As a whole, the initiatives adopted are designed to replace around 30 billion $sm^3$ of Russian gas with around 25 billion $sm^3$ of different provenance by 2025, while renewable sources and energy efficiency policies fill the gap.

This was the diversification plan set out in the national natural gas consumption containment plan (Table 1).

In the second quarter of 2022, national production went down 0.05 billion $sm^3$ compared to the same period in 2021, while imports from Algeria and Azerbaijan (via the Trans Adriatic Pipeline TAP) increased by only 2.7 billion $sm^3$. By contrast LNG imports increased by 3.3 billion $sm^3$. Consequently, adding up these contributions, in the second quarter of 2022 Italy replaced nearly 6 billion $sm^3$ of Russian gas rather than the 7.5 billion $sm^3$ set out in the plan.

## 2.2 ITALIAN POLICIES IN THE CONTEXT OF EU GAS SAVING POLICIES

In August 2022 the EU adopted an emergency regulation asking member states to voluntarily reduce gas demand by 15% compared to the average levels in the previous five years (2017–22). The Italian government responded with a national natural gas consumption containment plan the goal of which was to save around 8.2 billion $sm^3$ of natural gas, in line with the 15% required by the EU Regulation. The plan was based on:

Table 1
**The national natural gas consumption containment plan**

| | Second quarter 2022 | 2023 | 2024 | 2025 | Provenance |
|---|---|---|---|---|---|
| **GAS** | 6 | 8.9 | 11.9 | 11.9 | Algeria, Azerbaijan (via TAP), National |
| **LNG** | 1.5 | 7.9 | 9.5 | 12.7 | Congo, Angola, Qatar, Egypt, Nigeria, Indonesia, Mozambique, Libya |
| **Total** | **7.5** | **16.8** | **21.4** | **24.6** | |

a) the maximisation of electrical energy production in the thermo-electric sector, using fuels other than gas (especially coal) accompanied by an acceleration of renewable energy uptake in the electricity sector;

b) consumption reduction measures in the heating sector (reduction of the heating season and building temperatures); and

c) a package of measures designed to promote energy efficiency behaviours by means of a special institutional awareness-raising campaign (managed by the Italian agency for new technologies, energy and sustainable energy – ENEA) and behavioural measures. At the same time, the Italian government estimated that the measures already in place should contribute by incentivising the replacement of high energy consumption home appliances and air conditioners with more efficient ones, the installation of new electric heat pumps to replace old gas boilers, the installation of thermal solar panels for hot water production and the replacement of traditional light bulbs with LED bulbs. No additional measures or resources are planned, however, on top of those already made available.

In addition to these measures, in the context of the voluntary reduction of consumption in the industrial sector, the government has launched a production sector debate in order to promote all measures with a low impact on production and, in any case, safeguard strategic sectors by reinforcing the "voluntary interruptibility" scheme already present in the system.[9]

Terna (the Italian electricity TSO) has also carried out auctions relating to electricity consumption reduction by sites consuming at least 1 MW of power, which are paid a fixed rate determined via competitive bidding. For 2023, the auctioned power is 3 GW.

## 2.3 ITALIAN GAS SAVING PERFORMANCE

**Measures adopted in Italy over the last six months have generated consumption reductions above the 15% European target** and in line with the EU average. Gas consumption decreased by 18.6% from August 2022 and January 2023, compared to a European average of 19.3% (Eurostat figures). These savings enabled Italy to reach the European goal of filling gas stocks by at least 90% (they were 95% full at the beginning of the winter thermal season). With 17 billion $sm^3$, Italy is in second place in Europe for gas storage capacity, after Germany.

More specifically, the savings achieved in the individual sectors, and the domestic sector in particular, went beyond IEA forecasts at both the European and Italian levels. **In 2022 Italian gas demand dropped by 9.8% compared to 2021. Total consumption was 68.5 billion $sm^3$ – 7.4 billion $sm^3$ less than the previous year.**

Snam data show a significant drop at the end of the year. From September 2022 to February 2023 consumption decreased 20%, compared to average of the previous three years, and affected all sectors:

- In the **domestic sector**, which recorded **a reduction of 21%** in the period, in addition to mild weather, consumption containment measures (i. e. lowering of indoor temperatures and reductions in the winter heating period) had an impact, which was even larger when it comes to individual energy saving measures prompted by a surge in price.

- A reduction of a similar entity was recorded in the industrial sector, with a certain degree of difference between the various sectors. **The drop in demand (–20%)** was partly due to production cuts which, according to as yet preliminary data, seem to have impacted to a lesser extent than the switch to other fossil fuels and energy efficiency.

- **Gas demand in the thermoelectric sector dropped by 16%** as a consequence of the reduced demand for electricity (–1.5% in 2022 as compared to 2021) and the replacement of gas with coal in electricity generation (*gas-to-coal switch*). Electricity production from coal increased by 34% from September 2022 to February 2023 (+61% in 2022 compared to 2021), offsetting lower hydroelectricity production which fell by 22% in the same period (–38% in 2022 over 2021) as a result of the drought.

**This result is, however, more the result of reduction efforts primarily driven by high energy prices than the outcome of specific energy-saving policies.** The absence in the national natural gas consumption containment plan of high impact and long-term measures capable of incentivising and facilitating structural consumption reduction measures, such as the improvement of the efficiency of public and private buildings or the increase in efficiency/electrification of production process, has meant that the price trends (even when mitigated by government action) were the determinant factor in the reductions. The "110% Superbonus", the sole potentially high-impact measure in this area, was launched in 2020 and modified in the 2023 Budget Law to cover a lower share of costs for recipients. The effectiveness of this measure was, in any case, doubtful, as its effect on the reduction of emissions proved minimal,[10] but there is currently no alternative, better targeted, and more financially sustainable proposal on the table with the potential to make the energy savings of the last winter structural. A revision of the measure should introduce greater energy efficiency requirements, exclude technologies based on fossil fuels and, even more importantly, include a long-term plan capable of guaranteeing adequate reductions in building sector emissions.

9 The service consists of being willing to interrupt consumption when Terna needs to balance the grid. Firms subscribing to this mechanism are paid a fixed annual fee and a variable fee.

10 https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapporto_384_2023_le-emissioni-di-gas-serra-in-italia.pdf

# 3

# PRIMARY EFFECTS OF THE WAR AND SANCTIONS

The energy price shock strongly boosted renewables and energy efficiency without the need for public subsidies, in contrast to a dozen or so years ago when the photovoltaic boom was generously subsidised via the so-called "energy accounts". At the same time, the shock triggered a political reaction which responded to gas scarcity with public investment in gas.

The 9.8% drop in gas consumption in Italy in 2022 is not far from the European average, and the IEA has estimated a reduction of 4.5% in electricity production from gas per year for Italy to 2025 if current policies continue.

In the wake of the Russian invasion of Ukraine and the publication of RePowerEU, **deployment of renewables in Italy accelerated in terms of new installations (which tripled in 2022 compared to the average of the previous ten years)** and the potential remains huge. Elettricità Futura – an energy sector industrial association part of Confindustria – estimated that installing 85 GW in new plants by 2030 is feasible without any public help. In the early months of 2023 the Minister for the Environment and Energy Security, Pichetto-Fratin, announced targets of 10–12 GW of renewable generation installation per year by 2030. But this potential is still being held back by a lengthy and challenging authorisation process and by competition from fossil generation thanks to subsidies which, according to government data, are worth twice as much compared to those destined to renewables. These include the consumption incentives that were introduced at the start of the crisis and have not yet been removed. Subsidies to renewables, by contrast, have further decreased and will continue to do so by design in the near future.

With regard to the electricity generation mix, **coal generation increased by 61% from 2021 to 2022.** This is due both to a governmental consumption reduction strategy designed to maximise electricity production from fuels other than gas, and also to the energy price shock, which made producing electricity from coal plants more profitable than from gas plants. As coal generation increased, **hydroelectric production dropped by 22% from 2021 to 2022 as a result of last year's drought.** If we look in detail at electrical energy production – 276 TWh in 2022 – 64% was produced by fossil fuel sources (12% of which from coal) and the remaining 36% from renewables (hydroelectric, wind, photovoltaic, biomass).[11] Net of the energy used for pumping (2.5 TWh), the national production covered 86% of electricity demand, with the remaining 14% (43 TWh) covered by imports: 19 TWh from Switzerland, 14 TWh from France, 6 TWh from Slovenia, 3 TWh from Montenegro, and to a lesser extent from Greece and Austria.

No significant effects of the sanctions were detected on Italian energy production, on the other hand. The sanctions did not target the gas imports Italy depends on, but focused on nuclear technology and petroleum and its derivatives. Italy does not generate nuclear energy and, whilst Russian petroleum imports increased from 10% to 19%, they accounted for less than a fifth of supplies of a fuel whose contribution to Italian electricity generation in 2020 was around 1%.[12]

11 Source: Terna.

12 Source: Mase metodologia Eurostat (https://dgsaie.mise.gov.it/pub/ben_eurostat/BEN%20-%20Italia%20Metodologia%20Eurostat%201990%20-%202020.xlsb)

# 4

# MEDIUM- AND LONG-TERM RESPONSES

The energy price shock and the need for Italy to free itself of Russian fossil fuel sources, and gas in particular, has resulted in responses which prioritised **replacing Russian gas with gas from other sources rather than efficiency and electrification.** The government issued public guarantees for the purchase by SNAM (the gas TSO) of two floating storage LNG regasification units (FSRU) costing a total of over 1 billion Euros (excluding the grid connection and positioning costs) to be installed at the ports of Piombino and Ravenna.

Initiatives of this sort are in line with the longstanding Italian goal of becoming an energy (mainly gas) hub. The crisis brought this objective back to the fore, so that projects that had been shelved, such as the Algeria-Italy continental pipeline passing through Sardinia (and thus linking up the island with the national grid) are now back on the table. SNAM has also proposed relaunching plans to strengthen the Adriatic corridor for the high-pressure gas network, which successfully went through a consultation at the request of the Energy Authority.

The gas energy hub idea is linked to Italy's ambitions to acquire a key role in geo-economic flows and increase its geopolitical weight in the European balance of power. To this end Italian diplomacy, in conjunction with the main controlled energy company (ENI), has led to the signing of a series of agreements designed to expand fossil fuel projects with various producing countries.

The scale and cost of these for state coffers have not been made public but given the considerable need for investment to launch production in many of these projects and the timeframes involved, there is a high risk that EU decarbonisation targets and the strong downward trend of gas consumption will make many of these stranded assets. The increases in gas exports observed in 2022, in the face of price spikes, also raise the question as to whether the huge public investment in these agreements can be justified by real national energy security needs or whether this is actually a commercial strategy, the purpose of which is to re-export gas to northern Europe, with private risk being absorbed by the public purse.

It should be noted that the argument often made about the investment in gas infrastructure not being at risk of becoming a stranded asset due to its possible future use with hydrogen is fallacious. In reality the infrastructure would need to be updated in order to carry hydrogen, and the costs of this are similar to the costs of building new dedicated infrastructure. It is also unlikely that the needs of a hydrogen network in terms of capacity and geographic paths will closely match those of the existing or planned gas infrastructure.

## 4.1 THE FUTURE ENERGY MIX

Irrespective of the success of this gas-based energy hub project, Italy's real energy mix will actually depend on the choices made by consumers, on energy market design and on private investments including the ones in electricity generation. What is at issue is therefore not, for example, the increase in the share of renewables in end consumption – given the acceleration in renewable plant installation and the statements issued by the Minister for the Environment and Energy Security Gilberto Pichetto Fratin indicating its 2030 targets to install 10-12 GW of new renewable capacity. Neither is the Italian government's commitment to overall decarbonisation of the electricity sector, undertaken on the occasion of the G7 in autumn 2022, in doubt.

**The permanence of gas as a fuel used in plants that also offer grid-balancing services will depend significantly on the extent to which other balancing technologies are integrated into the market's rules and are then actually built. These alternative technologies include various types of energy storage and demand response** (i. e. participation in grid balancing by electricity users via the flexible use of their consumption devices).

The share of electrical energy produced via coal has already diminished due to gas prices normalising and due to the cost of permits to emit CO2 disincentivising it. This should bring an end to the anomalous competitiveness of burning coal compared to gas during the crisis. Italy had originally set a deadline of 2025 for the closure of all coal-fired plants even though the electricity TSO's (Terna) analysis highlights criticalities in terms of grid security in doing so within this time frame in Sardinia, a region which has two coal-fired plants, one of which is considerably large. The draft Italian NECP now includes an exception to coal closure for Sardinia.

# 5

# POSSIBLE CONSEQUENCES FOR EU CLIMATE GOALS

In the context of EU climate targets, we can identify both risks and opportunities following the Russian invasion of Ukraine and the energy crisis it triggered.

On the one hand the changed geopolitical context would seem to have crystallised the idea that renewable energy generation offers significant advantages in terms of energy costs and geopolitical independence. In this sense a speeding up of renewable plant installation would seem to be an established "no regrets" strategy across the whole Italian political spectrum. It should however be noted that the **benefits of energy efficiency continue to be underestimated.** The Italian government is still displaying uncertainty over the future of a wide-ranging measure (however badly calibrated) such as the "110% superbonus", as well as hostility towards European measures regarding efficiency, such as the Energy Performance of Buildings Directive (EPBD). In the absence of adequate measures by the government, it is difficult to see how the significant consumption reduction trends achieved over the last year can be made structural in Italy, with a view of reaching the European energy efficiency and saving targets.

On the other hand, the war and the crisis have brought back into the spotlight a vision of energy security based on the idea that gas has a long-term part to play and that an Italian gas hub in Europe is possible. This has prompted Italy to see the need to break away from Russian gas primarily in terms of replacing the source of gas rather than in consumption reduction terms, a strategy which implies economic, geopolitical, and climate-target-achievement risks. Investing considerable capital in infrastructure and agreements linked to plans for a gas energy hub may serve the purpose of replacing Russian gas in Italy and Europe in the short term, but in the middle and long term its effect is to delay and disincentivise the decarbonisation of the Italian energy and production system, jeopardising the achievement of climate targets. Furthermore, in a European framework which is moving towards a rapid reduction in fossil fuel consumption, such infrastructure and agreements – paid for through public funds – risk not providing a return on the initial investments and becoming stranded assets or even locking in policies inconsistent with the climate targets.

# LATVIA

by Krista Pētersone

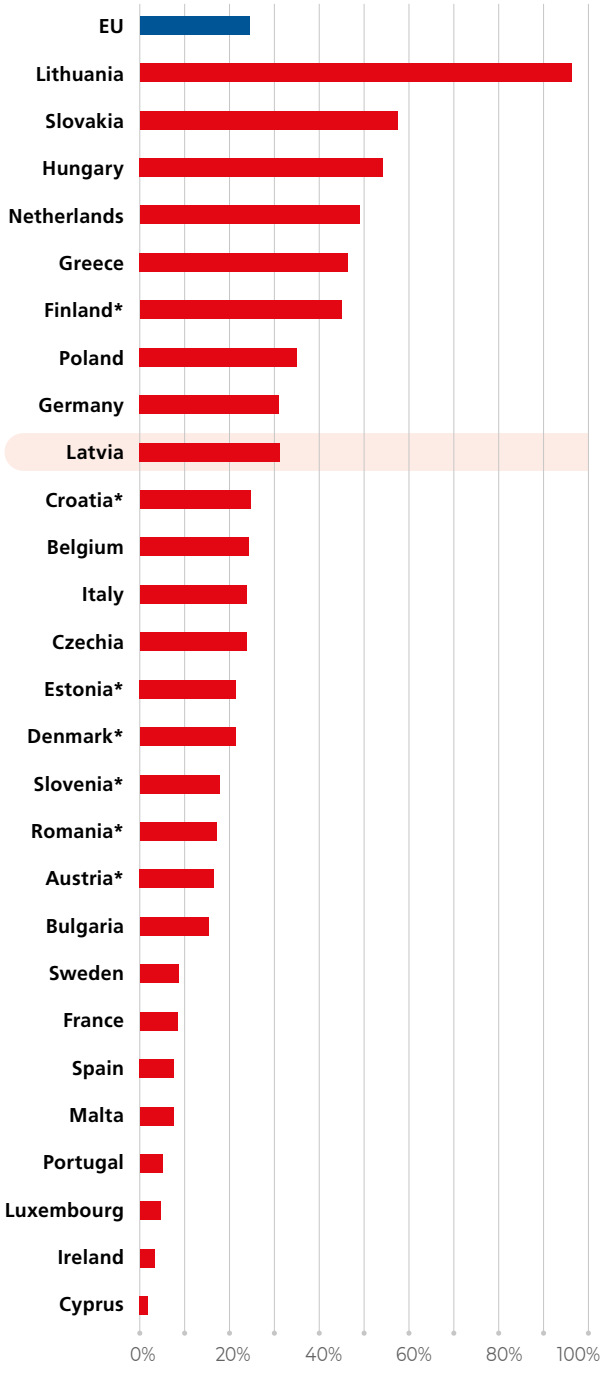
# INTRODUCTION

Dependence on monopolised natural gas imports and transition pathways to renewables-based energy systems have been present on Latvia's political agenda for several decades. Latvia's response to Russia's aggression was almost univocal, and included support for EU-wide economic sanctions on energy imports.

On the practical level, the process of substituting fossil fuels, reforming markets, managing imports and exports of forest biomass, and planning for new renewable power capacities has been more intricate. Price signals played a significant role in reducing energy consumption without experiencing any physical supply shortages during the winter.

This paper presents a concise overview of the recent transformations witnessed in energy systems, supported by data from national statistics for the years 2021 and 2022. It explores immediate policy changes as well as the medium- and long-term implications of energy security and self-sufficiency measures and how they refer to decarbonisation and climate policy goals.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# LATVIA'S ENERGY SYSTEM BEFORE 2022

## ENERGY MIX

With renewable energy sources (RES) accounting for 42% of the gross final energy consumption, Latvia ranked third in the EU.[1] Latvia's high share of RES is based on extensive utilisation of solid biomass and hydropower.[2] However, Latvia's progress in energy transition over time is relatively modest compared to neighbouring countries.[3]

In 2021, petroleum products constituted approximately 33% of Latvia's gross energy consumption, with diesel oil being the predominant fuel type at 23%. Natural gas accounted for 21% of the energy consumption, while solid fossil fuels such as coal and peat played a relatively minor role. Since 2012, the proportion of natural gas in the energy mix had decreased by 5.7%. Fuel wood remained as the primary renewable energy source in Latvia, contributing 32% of the overall energy consumption.[4]

1 Share of energy from renewable sources [NRG_IND_REN]

2 In 2021 consumption of renewables 3% higher than a year ago. Press release. Central Statistical Bureau (CSB). 6 September 2022. https://stat.gov.lv/en/statistics-themes/business-sectors/energy/press-releases/8732-consumption-renewable-energy

3 Share of energy consumption from renewable sources in Europe. EEA. 2 June 2023. https://www.eea.europa.eu/ims/share-of-energy-consumption-from

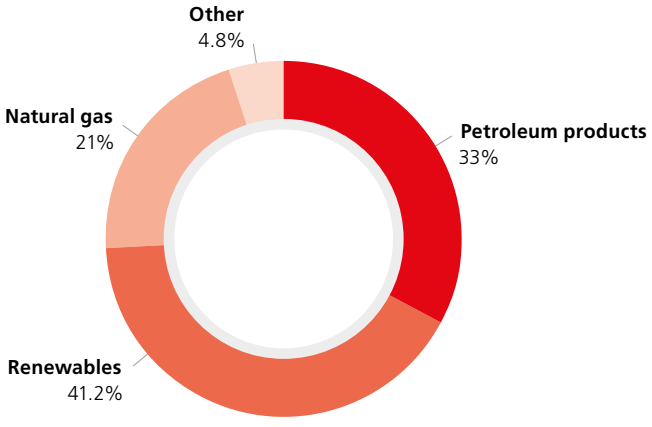
4 Environment of Latvia in Figures 2021. CSB. https://stat.gov.lv/en/statistics-themes/environment/weather-conditions/publications-and-infographics/11014-environment?themeCode=EN

Table 1
**Share of renewable energy in different sectors 2017–2021, %**

| Share of RES, % | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| **Gross final energy consumption** | 39.01 | 40.02 | 40.93 | 42.13 | 42.11 |
| **Electricity** | 54.35 | 53.50 | 53.42 | 53.36 | 51.40 |
| **Heating and cooling** | 54.58 | 55.41 | 57.75 | 57.09 | 57.38 |
| **Transport** | 2.27 | 4.73 | 4.55 | 6.73 | 6.44 |

Source: Data on RES share in Latvia. CSB. https://data.stat.gov.lv:443/sq/17184

Figure 2
**Structure of Latvia's gross energy consumption by resource type, %**




Source: Energy consumption in transport up by 5.3% last year. Press release. CSB. 28 June 2022.
https://stat.gov.lv/en/statistics-themes/business-sectors/energy/press-releases/8685-energy-consumption-2021?themeCode=EN

The role of forest biomass in Latvia's energy production and import-export balances is notably complex. In 2021, Latvia ranked as the world's third largest exporter of wood pellets.[5] But Latvia also imports fuelwood for domestic consumption, especially wood wastes and chips.[6]

The largest shares in Latvia's final energy consumption were held by the household sector at 29% and the transport sector at 28% (see Figure 3). Following closely, the industry sector takes third place with a share of 24%, while the commercial and public sectors combined consume approximately 14% of the energy. Within Latvia's industry, wood processing stands as the sector with the highest energy consumption.[7] Lastly, the energy consumption of the agriculture, forestry, and fishing sectors represents 5% of the total.

A detailed review of Latvia's electricity market is provided by the transmission system operator Augstsprieguma tīkls.[8] In 2021, the largest electricity producers were the gas CHP plants in Riga, followed by the hydropower plants on the Daugava. Electricity exports exceeded imports in spring due to a higher share of hydropower. The largest amount of electricity was imported from July to October.[9]

In the power sector, the main renewable source is hydropower, followed by biomass. Until 2022, deployment of wind and solar energy was very low. The total share of RES in final electricity consumption was above 50% (see Table 1).

Significant developments occurred in the solar energy sector, as the number of household prosumers doubled and reached 2,000 in that year. Since 2021, the main leap took place in small-scale solar generation (up to 11.1 kW). According to national energy statistics, the capacity of wind parks had remained unchanged since 2015 (see Table 2).

In Latvia, household electricity consumption is lower than the EU average of 1.6 MWh.[10] As of 2020, only three countries, namely Romania, Poland, and Latvia, have per capita electricity consumption below 1 MWh. Latvia also has the second lowest motorisation rate in the EU – 404 passenger cars per 1000 inhabitants (EU average is 567 cars). The car fleet is dominated by older diesel vehicles.[11]

5 Country data on wood pellets exports in 2021. Statista. Accessed on 15 June 2023. https://www.statista.com/statistics/477086/exports-of--wood-pellets-volume-by-key-country/

6 Production, imports, exports, and consumption of fuelwood. CSB. https://data.stat.gov.lv:443/sq/17185

7 Latvia's energy consumption up nearly 5% in 2021. LSM. 28 June 2022. https://eng.lsm.lv/article/economy/economy/latvias-energy-consumption-up-nearly-5-in-2021.a463099/#

8 Electricity Market Review, TSO Augstsprieguma tīkls. https://www.ast.lv/en/electricity-market-review?year=2021&month=13

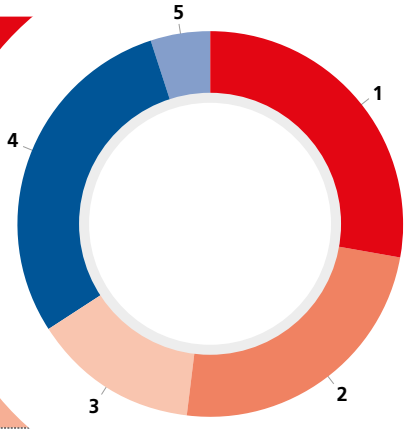
9 Geographic distribution of Latvia's power system, infographics. CSB. https://stat.gov.lv/en/statistics-themes/business-sectors/energy/publications-and-infographics/12557-produced-electricity?themeCode=EN

10 Household consumption of electricity per capita in MWh, 2020. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_and_heat_statistics#Consumption_of_electricity_per_capita_in_the_households_sector

11 Motorisation rate in EU. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Motorisation_rate,_2021_v2.png

Figure 3
**Latvia's final energy consumption in 2021, TJ.**

| | | TJ | % |
|---|---|---|---|
| 1 | **Transport** | 49,616 | 28 |
| 2 | **Industry and construction** | 41,191 | 24 |
| 3 | **Commercial and public sector** | 25,154 | 14 |
| 4 | **Households** | 50,364 | 29 |
| 5 | **Agriculture forestry** | 8,061 | 5 |
| 6 | **Fishing** | 238 | 0 |
| | **Total** | **174,624** | **100** |




Source: Central Statistical Bureau
Note:Latvia's energy consumption up nearly 5% in 2021. LSM. 28 June 2022. https://eng.lsm.lv/article/economy/economy/latvias-energy-consumption-up-nearly-5-in-2021.a463099/#

Table 2
**Installed capacity of wind and solar stations in Latvia, MW**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| **Wind power stations** | 78 | 78 | 78 | 77 |
| **Solar micro-generators and power plants** | 2 | 3 | 5 | 7 |

Source: Renewable energy resources. Statistical database. CSB. https://data.stat.gov.lv/pxweb/en/OSP_PUB/START__NOZ__EN__ENA/?Tablelist=true

Table 3
**Gross electricity production from renewables, GWh**

| | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| **Hydroelectric plants** | 2,432 | 2,108 | 2,603 | 2,708 |
| **Wind power stations** | 122 | 154 | 177 | 141 |
| **Solar micro-generators and power plants** | 1 | 3 | 5 | 7 |
| **Biomass CHP plants and power plants** | 570 | 575 | 520 | 570 |
| **Biogas CHP plants, total** | 374 | 353 | 345 | 292 |
| **Total** | **3,499** | **3,193** | **3,650** | **3,718** |

Source: Renewable energy resources. Statistical database. CSB. https://data.stat.gov.lv/pxweb/en/OSP_PUB/START__NOZ__EN__ENA/?Tablelist=true

## DEPENDENCE ON ENERGY IMPORTS

Latvia's dependence on natural gas imports from Russia was above 90% in 2021.[12] For diesel as the main fuel used in road transport, the main importer was Lithuania, followed by Russia in third place after Finland.[13] Yet in total, Latvia's energy dependence was below the EU average, and it fell from 52% in 2015 to 39% in 2021.[14]

In the past decade, the dependence on fossil gas has mainly decreased due to EU-funded investments in biomass CHP plants and boiler houses for decarbonisation of district heating systems. However, the regional differences among municipalities in share of renewables for heating are significant.[15] Belarus and Russia have also been significant trading partners for forest biomass, especially pellets, chips, and wood wastes. In 2021, almost half of the funds paid for fuel wood imports went to Belarus.[16]

Around 3/4 of the electricity consumed in Latvia was covered by local generation; the largest share of electricity was generated at the Daugava hydro and thermal plants. Less than 1/3 of electricity imports took place through the Latvian-Russian interconnection, while imports from other EU countries (Finland, Sweden, Poland) constituted the rest.[17]

12 Share of gas supply from Russia in Europe in 2021, by selected country. Statista. Accessed on 30 June 2023. https://www.statista.com/statistics/1201743/russian-gas-dependence-in-europe-by-country/

13 Data on diesel oil imports. CSB. https://eksports.csb.gov.lv/en/years/products-selected/import/2005-2023-2021/sp_16/TOTAL

14 Energy dependence is calculated as net imports divided by the sum of gross inland energy consumption plus bunkers. See Environment of Latvia in Figures 2021. CSB. https://stat.gov.lv/en/statistics-themes/environment/weather-conditions/publications-and-infographics/11014-environment?themeCode=EN

15 Generated heat by fuel type in planning regions, municipalities and cities. CSB. https://data.stat.gov.lv:443/sq/17259

16 Fuel wood imports. CSB. https://eksports.csb.gov.lv/en/years/products-selected/import/2005-2023-2021/sp_41/TOTAL

17 Electricity Market Review. TSO Augstsprieguma tīkls. https://www.ast.lv/en/electricity-market-review?year=2021&month=13

# 2

# AD HOC RESPONSES TO RUSSIA'S WAR IN UKRAINE

Since February 2022, the government has been focusing on several new priorities. Firstly, there has been a concerted effort to establish an alternative supply of natural gas by LNG imports. This was prompted by the security of supply concerns and the prohibition of fossil fuel imports from Russia, which came into full effect in January 2023. In the first half of 2022, the state-owned energy company, Latvenergo, secured national gas reserves through the Klaipeda terminal in Lithuania. Subsequently, a long-term contract was signed to ensure yearly reserved capacity.[18]

Secondly, ensuring stability in the power supply became another crucial aspect of energy security, especially for the winter season.[19] All Baltic transmission system operators prepared for emergency situations in within the BRELL ring (Belarus, Russia, Estonia, Latvia, and Lithuania) and joined efforts to speed up synchronisation projects with the European Continental Network.

Third, the government also adopted a new package of emergency measures to alleviate the effects of high energy prices for households and larger consumers.[20] The price caps were set for electricity, gas, and district heating. Next, extra energy saving measures were put forward. Most of them addressed the need for an adaptive heating regime and supported remote work to optimise the use of heated areas.

As part of the RePowerEU plan's emphasis on achieving energy independence, the government sought ways to support the faster deployment of renewable energy and channel public investments towards new projects in municipalities. The search for solutions for energy security led to significant legislative activity, including amendments to the Energy Law and Electricity Market Law. These amendments encompassed several key initiatives, including (1) mandatory payments to municipal budgets from new wind parks, (2) the establishment of basic regulations for energy communities and changes to net accounting for prosumers, (3) the introduction of fees for reserving grid capacity, and (4) the streamlining of procedures for obtaining permits for large-scale energy projects, particularly wind parks.

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18 Klaipėdos nafta AB and Latvenergo AS strengthen energy security in the Baltic region. 30 September 2022. https://latvenergo.lv/en/jaunumi/preses-relizes/relize/klaipedos-nafta-ab-and-latvenergo-strengthen-energy-security-baltic-region

19 Power transmission operators in Nordic and Baltic countries warn of challenging winter. 21 October 2022. https://www.ast.lv/en/events/power-transmission-operators-nordic-and-baltic-countries-warn-challenging-winter

20 Heating aid system supported by Latvian government. 9 August 2022. https://eng.lsm.lv/article/economy/economy/heating-aid-system-supported-by-latvian-government.a468657/

# 3

# SHORT-TERM ECONOMIC IMPACTS AND CONSEQUENCES

## INFLATION

In the second half of 2022, the yearly inflation peaked and remained above 20%, mainly due to the prices of food, transport fuel, and energy-related services. The main increase in consumer prices affected food products (29%).[21] Latvijas Banka estimates that the rise in energy prices for households and businesses cost nearly €1.7 billion in 2022.[22] If the government had not extended financial assistance to households, the energy shock would have been even more distressing. Latvijas Banka's calculations indicate that the partial compensation for electricity, gas, and heating prices led to a decrease in inflation of around 2.5 percentage points in 2022 and contributed to a 0.7 percentage point increase in economic activity. The fiscal implications of government support were significant, as nearly €700 million were spent in 2022 to alleviate the impact of the energy crisis.

The highest gas and electrical power prices were observed in autumn. Consumption of natural gas decreased because of energy saving measures and fuel replacement. In the first semester of 2022, natural gas consumption decreased by 38% (4.8 TWh) compared to the previous years.[23] State aid had a positive impact on mitigating the price effects on household and enterprise levels.[24] The efficiency of the former state support measures will be assessed by the State Audit Office.

## ENERGY IMPORTS

In 2022 Lithuania emerged as the dominant gas importer.[25] Meanwhile, Russia maintained its position as the second-largest country of origin, with a particularly high total price paid for its imports. Despite this change, 2022 saw a record year in terms of costs incurred for importing natural gas from Russia. In 2023, gas imports from Russia have completely ceased. As for liquefied natural gas (LNG), most imports now come from Estonia, although the overall volume is relatively small. Russia continues to be the primary importer of liquefied petroleum gas.

For electricity imports, 2022 was a record year as well.[26] Compared to 2021, the costs of imports from Russia increased almost fourfold. In total costs, the largest share of imports belongs to Estonia. Since the Baltic States are integrated in the BRELL system, disconnection depends on completing the synchronisation project with the continental European power grids. The Baltic transmission system operators hope to finalise it before 2025. While direct trade with Russia has stopped, imports take place for balancing purposes.[27] In 2022, the share of CHP plants shrank by 33%.[28] The main decrease was due to natural gas saving measures. Electricity imports increased by 9%. After hydropower, biomass remained the second largest source of renewable power. In CHP plant operation, biomass surpassed natural gas for the first time. Gas consumption continued to further decrease in 2023 as well.[29]

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21 Last year, inflation was influenced by the increase in world energy and food prices, this year the increase in prices will stabilise. Ministry of Economics. 11 January 2023. https://www.em.gov.lv/ne/article/last-year-inflation-was-influenced-increase-world-energy-and-food-prices-year-increase-prices-will-stabilise

22 How has Russia's invasion of Ukraine affected Latvia's economy? Latvijas Banka. 16 February 2023. https://www.macroeconomics.lv/how-has-russias-invasion-ukraine-affected-latvias-economy

23 Latvia will succeed in cutting gas consumption, experts say. 22 July 2022. https://eng.lsm.lv/article/economy/economy/latvia-will-succeed-in-cutting-gas-consumption-experts-say.a466415/

24 Data on electricity and gas prices for consumers in Latvia. CSB. https://data.stat.gov.lv/pxweb/en/OSP_PUB/START__NOZ__EN__ENC/?tablelist=true

25 Data on natural gas imports. CSB. https://eksports.csb.gov.lv/en/years/products-selected/import/2005-2023-2022/sp_10/TOTAL

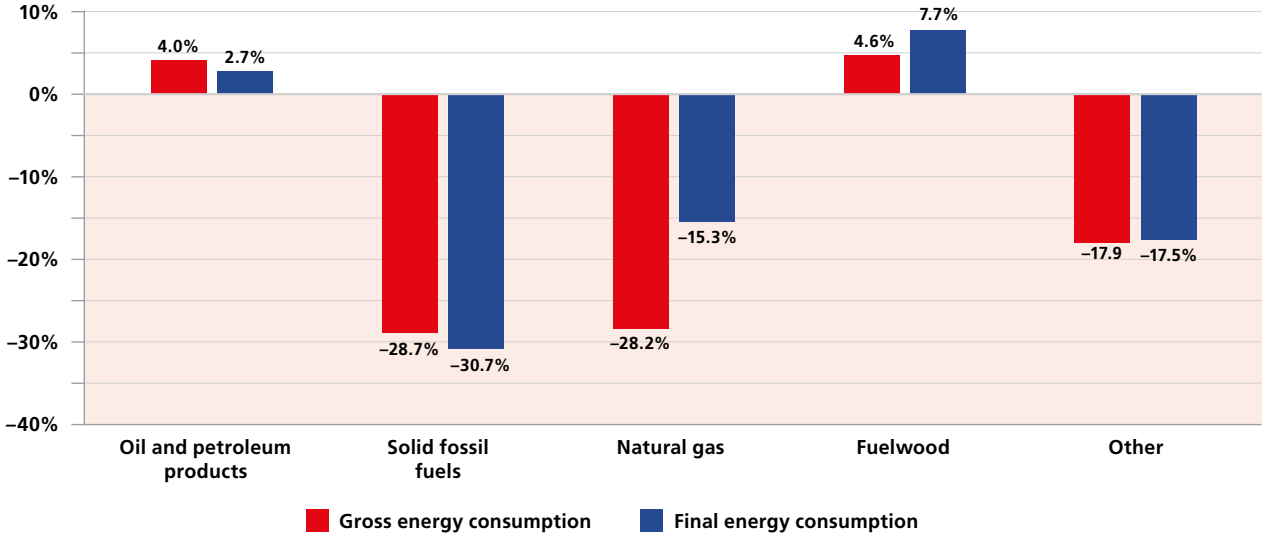
26 Data on electricity import. CSB. https://eksports.csb.gov.lv/en/years/products-selected/import/2005-2023-2022/sp_22/TOTAL

27 Informative report "On Organizing Electricity Trade with Russian Federation and Belarus…" 11 October 2022. https://tapportals.mk.gov.lv/legal_acts/25adb69a-b0f6-4058-b94e-6556b255db61

28 Last year amount of electricity produced in CHP plants fell by 33%, Press release. 5 June 2023. https://stat.gov.lv/en/statistics-themes/business-sectors/energy/press-releases/12343-activities-chp-plants-2022

29 Latvian natural gas consumption continues to decline, LETA. 28 June 2023. https://eng.lsm.lv/article/economy/economy/28.06.2023-latvian-natural-gas-consumption-continues-to-decline.a514573/?utm_source=lsm&utm_medium=article-bottom&utm_campaign=article

Figure 4
**Reduction of natural gas in gross and final energy consumption, 2022**
(change 2022 compared to 2021)




Source: Energy consumption reduced by 2.8% in 2022. Press release. CSB. 28 June 2023. https://stat.gov.lv/en/statistics-themes/business-sectors/energy/press-releases/12336-energy-consumption-2022?themeCode=EN

## SOLAR AND WIND ENERGY DEVELOPMENTS

The growth rate of household prosumers escalated in 2022. By mid-2023, Sadales tīkls, the distribution system operator, reported that the number of solar PV microgenerators had reached 15,000, with a total capacity of 120 MW.[30] In contrast, a notable increase is expected in larger solar power stations in 2023, with up to 900 MW to be connected to the distribution system within a few years. Excess generation is expected to occur when the outputs of solar parks across the distribution and transmission grids are combined (in the summer months the demand side load reaches a maximum of 1,100 MW).

After a pause of several years, a new wind park was opened in autumn 2022: with 14 turbines installed near Ventspils in the Kurzeme region, Targale wind park added 59 MW capacity. In terms of share of wind energy in the electricity mix, Latvia is still in last place among the Baltic countries. However, many new projects are under various stages of development.

30 Number of prosumers reaches 15,000 in Latvia, DSO Sadales tīkls, 26 June 2023. https://sadalestikls.lv/lv/aktuali/elektribu-pasrazojosu--majsaimniecibu-skaits-latvija-sasniedz-15-000

# 4

# MEDIUM- AND LONG-TERM ANSWERS

## NEW SUPPLY ROUTES FOR NATURAL GAS

In early 2022, there was great uncertainty about securing gas supplies for the winter season. The Ministry of Economics and Latvenergo negotiated deals with Klaipeda LNG Terminal and non-EU gas importers. To provide an alternative LNG delivery route in addition to Klaipeda, the government considered two scenarios: (1) cooperation with Estonia and the Paldiski terminal, and (2) construction of a new LNG terminal in Latvia, either at Skulte or in Riga. In summer 2022, the Cabinet of Ministers decided on Skulte as the priority project and its overriding public interest was recognised in law. However, the negotiations with the project developer ended without success because the government did not agree to provide state guarantees. In early 2023, the situation had already changed, and regional overcapacities of LNG were expected. The Skulte LNG project was put on hold.[31]

## ELECTRICITY MARKET

The growth of Latvia's solar prosumer community was further promoted by the state funding schemes for adoption of solar PV, heat pumps, and the replacement of fossil fuel heating systems in private residences. A summary of the implemented projects reveals a notable concentration in suburban areas.[32] Furthermore, energy efficiency programmes aimed at enterprises also incorporated support for the installation of RES technologies.

The issue of insufficient solar and wind power capacity was addressed at the political level, but it was primarily driven by economic interests and the emergence of new investment opportunities. This indicates that the total number and scale of planned solar and wind projects could potentially surpass the current consumption levels after the first large-scale projects are successfully completed within this decade. To align with the RES acceleration agenda outlined in the RePowerEU plan, Latvia has allocated additional funding from the Recovery and Resilience Facility intended to facilitate the modernisation of distribution and transmission grids.

The role of state enterprises was further accentuated when Latvenergo and Latvia State Forests established a new initiative, Latvia Wind Parks, for siting wind parks of strategic importance on public forest lands. Also, the site for the joint offshore wind project with Estonia was selected (ELWIND).[33] In 2023, its environmental impact assessment was launched on the Latvian side.

In the power sector, there is a significant surge in the development of solar and wind capacity. While individual solar projects have shorter timelines, there are long-term concerns regarding the intermittent nature of generation, price fluctuations, investment returns, and grid capacity.[34] Solar energy currently holds a dominant position in terms of reserved capacity, as wind projects are required to complete an environmental impact assessment before applying for a permit.

## TRANSPORTATION DECARBONISATION

The decarbonisation of the transport sector presents significant challenges. Decision makers are aware of the issue, but there is a lack of consensus regarding priorities and the scope of measures to be implemented. Various EU funding programmes have been allocated to promote sustainable mobility. One highly anticipated project is the introduction of new passenger trains, set to commence operations in autumn 2023. The Rail Baltica[35] project has also entered the construction phase, but its complexity and rising construction costs pose potential risks of delays.

As commuting and transit within the Riga agglomeration contribute significantly to car-dependent mobility, the Riga City Council and Riga Planning Region have devised plans to

31 Latvia cancels Skulte LNG project, but the Baltic reliance on gas persists, Emerging Europe, 19 April 2023. https://emerging-europe.com/news/as-latvia-cancels-skulte-lng-project-the-baltic-reliance-on-gas-persists/

32 Data on funding allocated to households with solar PV, Latvian Environmental Investment Fund. Accessed on 1 July 2023. https://ekii.lv/index.php?page=atbalsts-majsaimniecibam

33 ELWIND – joint Latvian and Estonian offshore wind project. Accessed on 15 June 2023. https://elwindoffshore.eu

34 Presentation for the Sustainable Development Commission at the Parliament, 14 June 2023. https://titania.saeima.lv/livs/saeimasnotikumi.nsf/0/948C5732CE5B8C59C22589C80048A6AA?OpenDocument&prevCat=

35 Website of the Rail Baltica project. Accessed on 15 June 2023. https://www.railbaltica.org

encourage a modal shift and implement a low-emission zone by 2027. These measures primarily align with air quality objectives.

## ENERGY EFFICIENCY OF BUILDINGS

The rate of renovating the residential buildings remains low – only 10% of Soviet-era multi-flat houses have been renovated. While the main source of funding has been EU programmes, it has proven insufficient. To address this, the state financial institution Altum has expanded its range of financial instruments, offering loans and capital guarantees. Additional renovation programmes are being financed through the Recovery and Resilience facility and the Cohesion programme.[36]

In addition to financial support, planning bodies and agencies aim to encourage the formation of active owners' associations and facilitate the swift preparation of renovation projects. Even though renewable energy technologies are eligible for funding in EU-funded projects, they are not yet widely implemented in multi-flat apartment buildings. This is primarily due to the lack of comprehensive regulations governing energy sharing mechanisms (collective self-consumption and energy communities).

## ENERGY STRATEGY

In 2023, the revised version of the National Energy and Climate Plan (NECP) will be submitted to the European Commission. The ambition of the NECP drafted in 2019 is below the current market trends. In 2019, the estimated capacity for wind power in 2030 was 800 MW. In 2023, the projected capacity includes 2,000 MW from onshore wind and 1,000 MW from offshore wind. The planned energy mix will depend on the modelling results; the energy scenarios and policy options will be published in the summer. The national RES targets will be aligned with the revised version of the Renewable Energy Directive: ~ 62% RES in final consumption with ~70% in the power sector, ~67% in the heating sector, and more ambitions targets for transport, buildings, and industry.[37]

## NUCLEAR ENERGY

During the drafting of the NECP in 2019, nuclear energy was not a topic of discussion. However, in 2021, there was a sudden increase in interest in nuclear energy as a response to the rising prices of fossil fuels. Since then, several government representatives have engaged in international exchange visits focusing on the nuclear agenda. Additionally, Latvenergo has initiated collaboration with Fermi Energia in Estonia to explore the potential of a joint nuclear project.

In the summer of 2022, the Parliament introduced an amendment to the Energy Law (Article 72), emphasising the importance of evaluating and reporting on a national nuclear energy programme to enhance Latvia's energy independence. The report is required to be submitted to the Saeima (Parliament) by 31 December 2023, considering factors such as the geopolitical situation, energy resource costs, and availability. Despite the growing attention to nuclear options among policymakers and the public, there is a consensus that the country lacks national scientific and technical expertise in this field.

## GREEN HYDROGEN

Several noteworthy developments are taking place in Latvia's hydrogen sector. To foster collaboration among stakeholders interested in building a hydrogen ecosystem in Latvia, a new cooperation platform called the Latvian Hydrogen Alliance has been launched. Firstly, Riga Free Port and the Green Tech Cluster in Liepaja have partnered to participate in the ambitious BalticSea$H_2$ Hydrogen Valley project, supported by EU funding. In addition, both Liepaja and Ventspils ports are planning future projects that combine offshore wind energy with hydrogen technologies. Furthermore, Riga Airport has initiated a hydrogen project aimed at local consumption.

According to the EU's latest revision of the Renewable Energy Directive, the goal is for green hydrogen to account for 1% of transport fuels by 2030. In line with this objective, the Vidzeme Planning Region is implementing the first green hydrogen projects in the transportation sector. The first project, $H_2$Value, involves piloting a hydrogen waste truck in collaboration with the waste management company ZAAO and the Latvian Hydrogen Association. It aims to develop interregional green hydrogen value chains in southern Estonia and north-eastern Latvia. The second project, HyTruck, focuses on establishing the necessary infrastructure for hydrogen refuelling stations dedicated to heavy-duty trucks in the Ten-T network.

## POLICIES TO REDUCE DEMAND

Currently, there is a noticeable absence of long-term policies dedicated to demand reduction, except for a general vision for the transformation required in the transportation and building sectors. Conversely, there is an emphasis on the importance of increasing demand in the industry sector as a prerequisite for the stable development of wind and solar-based power systems.

Various coping strategies have been adopted by energy consumers, and further examination of the effects of state support measures will be carried out by the State Audit Office.

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36 Website of state financial institution Altum. Accessed on 15 June 2023. https://www.altum.lv/en/services/individuals/energy-efficiency-in-multi-apartment-buildings/

37 Ministry of Climate and Energy, Presentation for the Sustainable Development Commission at the Parliament, 14 June 2023. https://titania.saeima.lv/livs/saeimasnotikumi.nsf/0/948C5732CE5B8C59C22589C80048A6AA?OpenDocument&prevCat=

## LONG-TERM CONSEQUENCES

In contrast to other Baltic States, Latvia's government has not published long-term energy scenarios; a vision on a 100% renewables-based power system or total decarbonisation is still lacking. As a part of preparation for the revision of the NECP, the government has commissioned modelling from several research institutes. The cost optimisation models will be used to design the policies and measures in the NECP.

In May 2023, the Parliament of Latvia came up with an initiative for a long-term energy strategy. The political parties signed a memorandum. Although the NECP is based on mid- and long-term goals, it has not been instrumental enough for use in daily politics. According to the Ministry of Climate and Energy, the strategic directions of long-term energy policy will be: (1) closer cooperation with the EU, (2) effective use of common resources, (3) empowerment of active users, and (4) use of nationally produced resources.

The prospects of natural gas phase-out are unclear. The government has not announced strict decarbonisation plans and rather calls for diversity in the energy mix. Several factors will matter, including (1) the price of natural gas and emissions allowances, (2) the further decarbonisation of district and individual heating systems, (3) biomass sustainability criteria and price, (4) exploitation costs and life span of Latvenergo's TEC plant, and (5) base load provision and the Baltic synchronisation project.

While long-term solar energy developments will need surplus local and regional management strategies, the future of offshore wind energy is associated with energy exports either through new grid interconnections or investments in green hydrogen infrastructure. In summer 2022, the heads of states of the Baltic Sea countries signed the Marienborg declaration to support offshore wind deployment; in spring 2023, the Baltic and German TSOs agreed to work on grid development for offshore wind parks.

# 5

# IMPACTS ON NATIONAL CLIMATE POLICY

According to the most recent national inventory report submitted to the UNFCCC, the energy sector is the largest contributor to greenhouse gas (GHG) emissions in Latvia.[38]

In 2021, it accounted for 65.5% of the total emissions. Within the energy sector, a significant portion of emissions came from the Transport sector (45.9%), Other Sectors (22.5%), and Energy Industries (20.4%).

Comparing the emissions in the energy sector to the base year of 1990, there has been a notable reduction of 64%. However, when compared to the previous year of 2020, there has been a 3.6% increase. These fluctuations in GHG emissions can be attributed to economic trends, changes in the energy supply structure, and variations in climate conditions.

Significant changes in the energy mix have played a crucial role in the reduction of GHG emissions over the years. The use of biomass has more than doubled, while the consumption of fossil fuels has considerably declined. Specifically, there have been substantial decreases in the use of liquid fuel (–57.8%), solid fuel (–97.3%), peat (–97.9%), and natural gas (–59.8%) since 1990. As a result, the share of biomass in the energy mix has increased from 8.6% in 1990 to 40.5% in 2021.[39]

More than 80% of Latvia's GHG emissions are not covered by the emissions trading system (ETS). Latvia's goal for GHG reductions in the non-ETS between now and 2030 is 17%. According to the latest inventory and projections, Latvia is not on track to reach the climate goals and additional measures will be needed. In addition to transport sector, agriculture, forestry, and land use change are the most problematic areas, especially depletion of natural sinks. Adoption of Latvia's first Climate Law is expected by end of 2023.

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38 UNFCCC GHG Inventory Data: https://di.unfccc.int/time_series

39 Latvia's National Inventory Report 2023. https://unfccc.int/documents/627724

# 6

# CONCLUSION

The urgency to replace energy imports from Russia have exposed vulnerabilities as well as resilience of Latvia's energy sector and transformation potential of its technical, economic, and social systems. The push from geopolitical events and market forces have shifted further development in favour of renewable energy and efficiency measures. In 2022, EU-wide sanctions and the national-level decisions to diminish the role of imported energy resources did not result in the immediate end of established economic transactions with Russia and Belarus. Record prices were paid for electricity and natural gas imports while restructuring was put in place. It is only from 2023, when financial and physical flows of energy have fundamentally been switched away from Russia.

For energy producers, 2022 was a dynamic year marked by record turnovers. Numerous new projects were initiated to approach the future landscape of a climate-neutral energy system. While the energy scenarios have shifted towards more ambitious renewable energy targets in the mid- and long-term, the specific pathways for phasing out fossil fuels and infrastructure requirements remain unclear.

The revised NECP 2030 will anchor further alignment in Latvia's energy policy with the EU's goals. Significant progress is expected in the renewables sector. However, the decarbonisation of transportation and buildings will present substantial challenges, both in terms of financial requirements and the governance of distributed energy

# LITHUANIA

by Tomas Janeliūnas

# INTRODUCTION

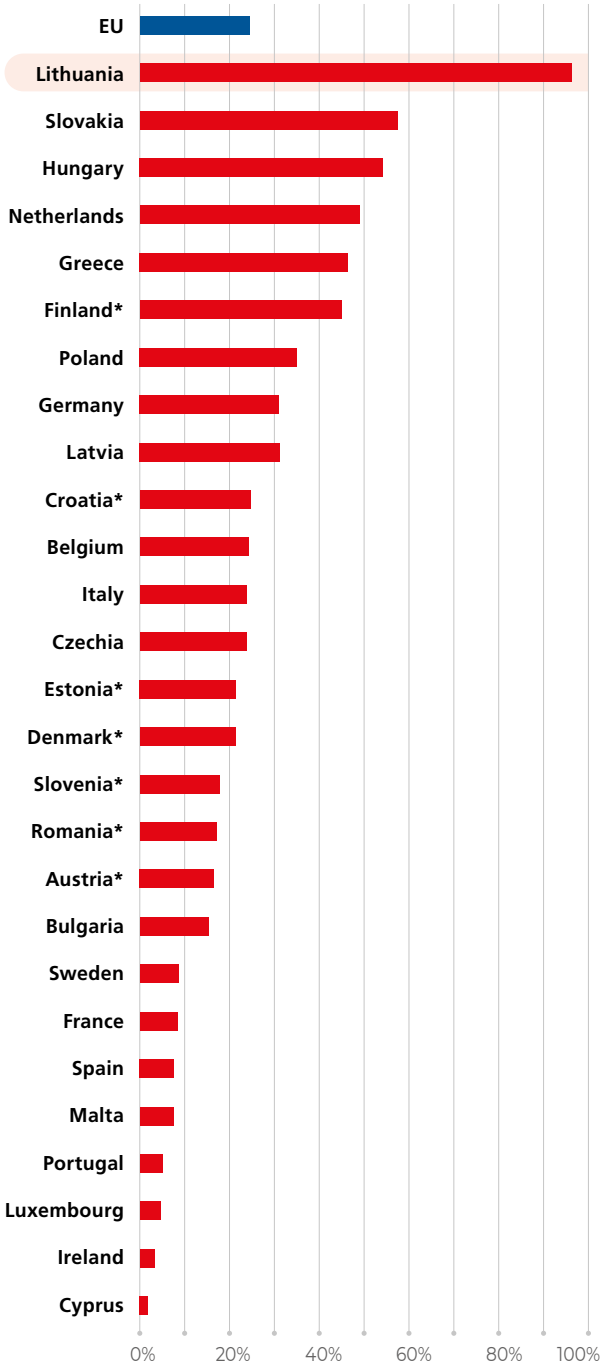
On 22 May 2022 the Energy Minister of Lithuania declared that Lithuania had successfully ceased importing Russian oil, gas, and electricity, making it the first EU member-state to declare itself free from Russian energy just three months after the Russian military invasion of Ukraine. 'Not only it is an extremely important milestone for Lithuania in its journey towards energy independence, but it is also an expression of our solidarity with Ukraine. We must stop financing the Russian war machine,' said Energy Minister Dainius Kreivys.[1]

Lithuania had long been dependent on Russia for its energy needs, even after joining the EU and NATO in 2004, and had one of the highest energy import dependency rates in the EU, almost 70%, with 96.1% of all imported energy originating from Russia in 2020.[2]

Despite having an oil terminal since 1999, and a Floating Storage Regasification Unit (FSRU) that enabled importing gas from global energy markets since 2014, the majority of Lithuania's energy imports still came from Russia. In 2021, Lithuania spent more than €3 billion on Russian oil, gas, and electricity.[3]

The full-scale war in Ukraine prompted almost all EU member-states to minimise their energy dependence on Russia. However, Lithuania became the first country to practically decouple from Russia's energy supply. This achievement was facilitated by the proactive preparation and implementation of infrastructure projects aimed at enhancing energy import diversification.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

1 Giedre Peseckyte, 'Lithuania Now Fully Independent of Russian Energy', www.euractiv.com, 24 May 2022, https://www.euractiv.com/section/politics/short_news/lithuania-now-fully-independent-of-russian-energy/.

2 Eurostat, 'EU Energy Mix and Import Dependency', accessed 18 April 2023, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_energy_mix_and_import_dependency.

3 'Lithuania Pays €3 Billion for Russian Energy – Could the Dependence Be Cut?', lrt.lt, 2 March 2022, https://www.lrt.lt/en/news-in-english/19/1631705/lithuania-pays-eur3-billion-for-russian-energy-could-the-dependence-be-cut.

# 1

# ENERGY SITUATION BEFORE 2022

Lithuania has limited resources for energy production and has been dependent on Russia for energy since regaining independence in 1990. Until 2014, Gazprom held a monopoly on gas supplies, dictating prices and supply terms. In 2014, Lithuania acquired a Floating Storage Regasification Unit (FSRU) to diversify its gas supply. Lithuania has also relied on nuclear energy from the Ignalina Nuclear Power Plant (NPP) since 1984, but agreed to close the plant's two reactors during negotiations for EU accession. The closure of the Ignalina NPP in 2009 made Lithuania a net importer of electricity,[4] and its energy import dependency rose from 48.55% in 2009 to 79% in 2010.[5]

Despite aiming to transition to a zero-carbon economy, Lithuania still relies heavily on oil and gas consumption, which accounted for 62.6% and 15.9% of domestic consumption in 2021, respectively, with only 14.2% coming from renewable sources.

Lithuania's heavy industry is limited, but the chemistry sector stands out with PKN Orlen's ownership of the only oil refinery in the Baltic states (Mazeikiu nafta) and several large fertiliser manufacturers. As a result, Lithuania's industrial consumption of oil and gas is higher than in Latvia and Estonia. The transport sector (38.7% of all final consumption in 2021) and households (28.5% in 2021) consume the most energy. Industry accounts for approximately 18.6% of all final consumption, while services consume 11.3%.

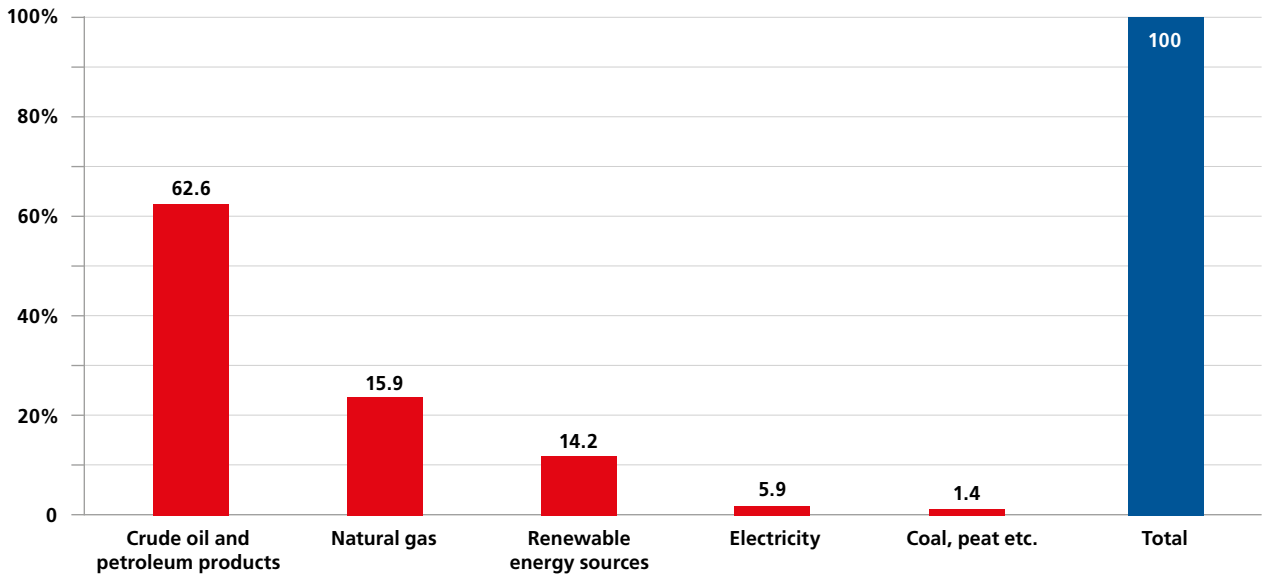
The energy consumption per capita increased steadily in recent years and reached 25.187 MhW per person in 2021, however, this is considerably still less that the EU average – 37.519 MhW per person.[6]

4 International Atomic Energy Agency, Country Nuclear Power Profiles, 'Lithuania 2020', accessed 20 April 2023, https://cnpp.iaea.org/countryprofiles/Lithuania/Lithuania.htm.

5 Tomas Janeliūnas, 'Lithuania: When a Transition to Zero-Carbon Energy Is the Only Option', in *The Palgrave Handbook of Zero Carbon Energy Systems and Energy Transitions*, ed. Geoffrey Wood et al., Palgrave Studies in Energy Transitions (Cham: Springer International Publishing, 2022), 1–20, https://doi.org/10.1007/978-3-030-74380-2_33-1.

6 OurWorldInData.org, Per capita energy consumption, accessed 10 May 2023, https://ourworldindata.org/grapher/per-capita-energy-use?tab=Table

Figure 2
**Structure of gross domestic consumption, 2021**



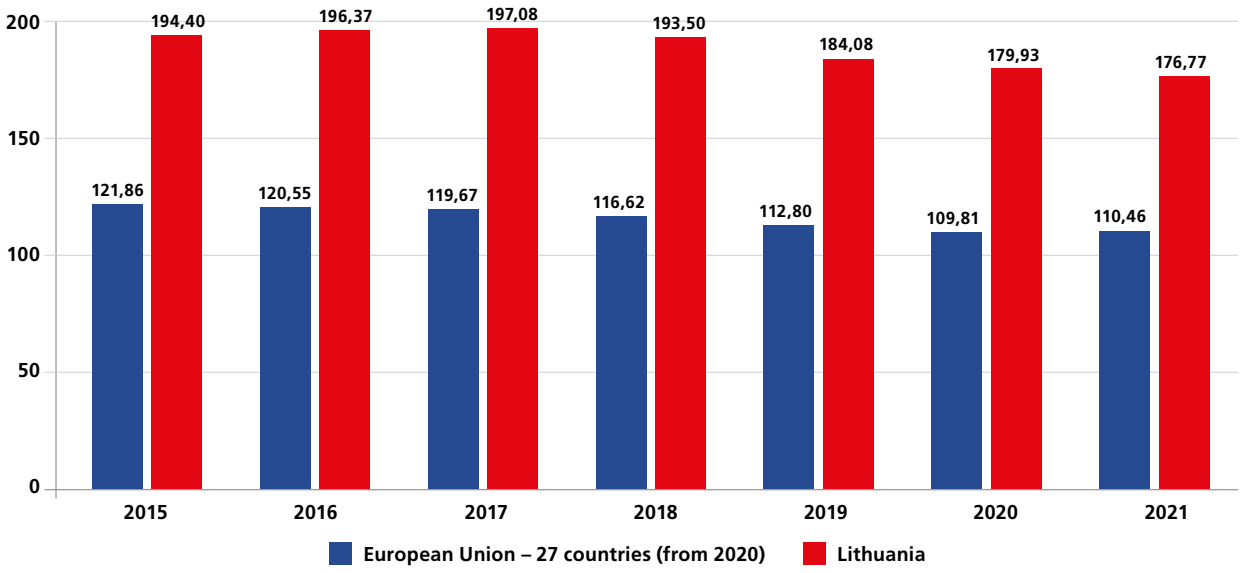

Source: Official statistics portal of Lithuania, *Environment, Agriculture and Energy in Lithuania* (edition 2022) https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/energijos-balansas

Table 1
**Final consumption of fuel and energy by sector, 2020 and 2021 (in Terajoule)**

| | 2020 | 2021 |
|---|---|---|
| **Transport** | 91,690 | 92,775 |
| **Households** | 60,011 | 68,228 |
| **Industry** | 41,068 | 44,632 |
| **Services and other activities** | 24,119 | 27,081 |
| **Agriculture** | 4,758 | 5,102 |
| **Construction** | 1,817 | 1,798 |
| **Fishing** | 36 | 42 |

Source: Official statistics portal of Lithuania, *Environment, Agriculture and Energy in Lithuania* (edition 2022) https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/energijos-balansas

Figure 3
**Energy intensity of GDP (in chain linked volumes, 2015), kg of oil equivalent per thousand euro**




Source: Eurostat, https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_EI__custom_6023708/default/table?lang=en

However, the 'energy intensity' indicator is a more precise way of measuring energy efficiency in relation to economic performance. Although Lithuania has reduced its energy intensity in recent years, it still lags behind the EU average. In 2021, Lithuania used 176.77 kilograms of oil equivalent per thousand euros of GDP, which was 60% higher than the EU average.

Despite the progress made in Lithuania's energy system, the electricity sector remains vulnerable after the closure of the Ignalinas NPP. To address this, Lithuania has focused on connecting with other EU countries to diversify electricity imports. The NordBalt interconnection line, a 700 MW submarine power cable connecting Lithuania and Sweden, and the LitPol Link, a 500 MW electricity link between Lithuania and Poland, were installed by the end of 2015, offering access to the NordPool energy market and the ability to trade electricity with Poland. However, the reliance on electricity imports has hindered the development of Lithuania's domestic generation, including gas-fired power plants and those based on renewable energy sources.[7] As a result, Lithuania's dependence on electricity imports is now among the highest in the EU.

In 2021, Lithuania produced 5,078.6 GWh of electricity while consuming 14,122.3 GWh. This means that the net import of electricity was 9,043.7 GWh, which is equivalent

7 Janeliūnas.

Table 2
**Lithuania's electricity gross consumption, production, imports and exports 2019–2021 (GWh)**

| | 2019 | 2020 | 2021 |
|---|---|---|---|
| **Gross consumption** | 13,315.2 | 13,426.0 | 14,122.3 |
| **Final consumption** | 10,541.1 | 10,355.3 | 11,154.2 |
| **Gross production** | 3,971.6 | 5,517.5 | 5,078.6 |
| **Import** | 13,385.1 | 11,260.7 | 11,915.6 |
| **Export** | 4,041.5 | 3,352.2 | 2,871.9 |

Source: Official statistics portal of Lithuania, *Environment, Agriculture and Energy in Lithuania* (edition 2022) https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/energijos-balansas

Table 3
**Gross production of electricity by type of installation, 2017–2021 (GWh)**

| | 2020 | 2021 |
|---|---|---|
| **Public CHP plants** | 1,941.2 | 1,735.1 |
| **Autoproducer CHP plants** | 609.1 | 504.6 |
| **Solar thermal electric plants** | 128.8 | 190.8 |
| **Hydroelectric plants** | 300.5 | 383.7 |
| **Hydro pumped storage** | 779.6 | 710.2 |
| **Wind turbines** | 1,551.7 | 1,361.7 |
| **Other plants (which use energy from chemical processes)** | 206.6 | 192.5 |

Source: Official statistics portal of Lithuania, *Environment, Agriculture and Energy in Lithuania* (edition 2022) https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/energijos-balansas

to 64% of the gross consumption.[8] The top electricity suppliers for Lithuania in 2021 were Sweden (3.7 TWh or 31% of all imports), Latvia (2,5 TWh or 21%) and Russia, including Kaliningrad (2.0 TWh or 16.8%).[9] Lithuania used its link with Poland mainly for exporting electricity.

While it is producing a modest share of electricity compared to gross consumption, the domestic electricity generation sector is moving quickly towards renewables. In 2021, 48% of total electricity production was from renewable energy sources (wind, solar, and hydro plants), while in 2022, it reached almost 60%.[10]

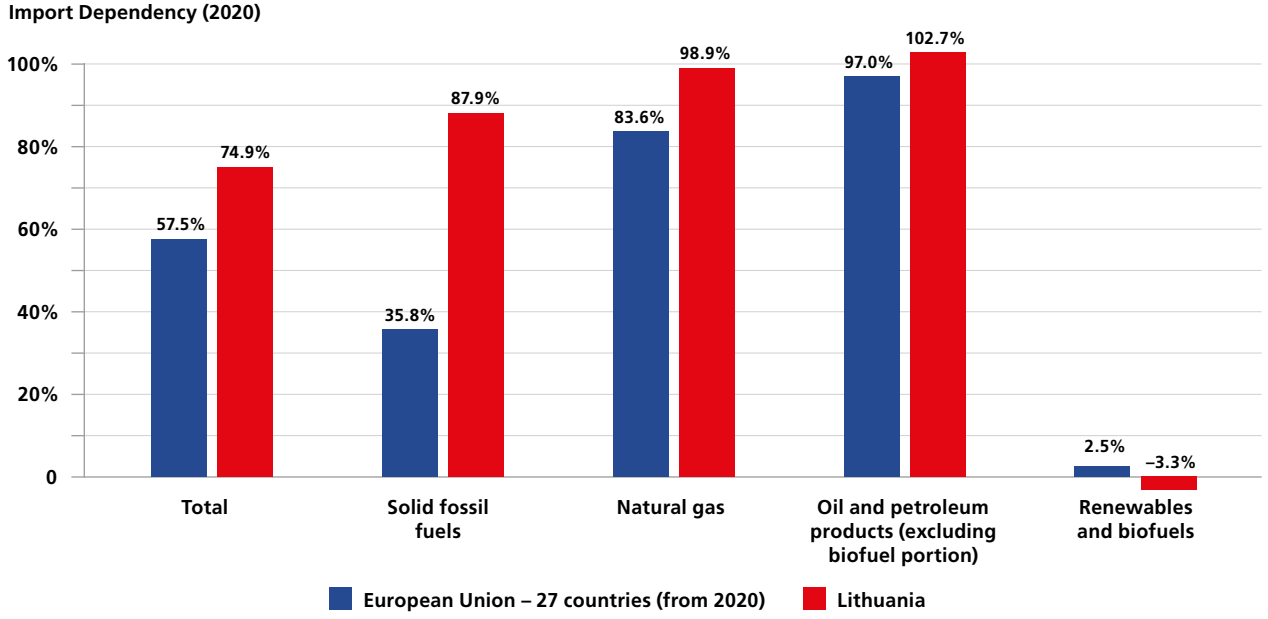
Until 2022, Lithuania's dependency on Russian energy imports was very high. Despite declaring a goal to diversify energy imports, the majority of energy and fuel imports still

8 Official statistics portal of Lithuania, Environment, Agriculture and Energy in Lithuania (edition 2022), accessed 20 April 2023, https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/energijos-balansas.

9 „Litgrid": augant ekonomikai, 2021 m. elektros vartojimas Lietuvoje buvo didžiausias per 30 metų, 15min.lt accessed 10 May 2023, https://www.15min.lt/verslas/naujiena/energetika/litgrid-augant-ekonomikai-2021-m-elektros-vartojimas-lietuvoje-buvo-didziausias-per-30-metu-664-1645766?utm_medium=copied.

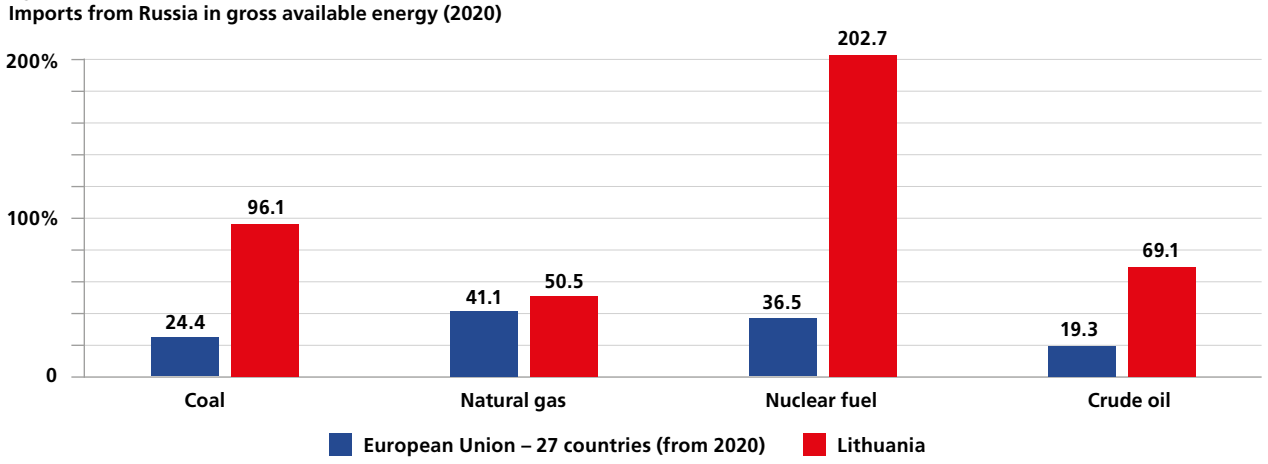
10 „Litgrid": 60 proc. pernai Lietuvoje pagamintos elektros energijos – iš atsinaujinančių išteklių', lrt.lt, 10 February 2023, https://www.lrt.lt/naujienos/verslas/4/1887046/litgrid-60-proc-pernai-lietuvoje-pagamintos-elektros-energijos-is-atsinaujinanciu-istekliu.

Figure 4
**Import Dependency (2020)**




Source: Eurostat, https://ec.europa.eu/eurostat/statistics-explained/images/2/24/EnergyMixDependencyImports_25-03-2022.xlsx

Figure 5
**Imports from Russia in gross available energy (2020)**




Source: Eurostat, https://ec.europa.eu/eurostat/statistics-explained/images/2/24/EnergyMixDependencyImports_25-03-2022.xlsx

came from Russia. Eurostat calculated that in 2020, 96% of carbon-based fuel imports in Lithuania's overall energy mix came from Russia, the highest rate among EU states (see Figure 5). With a total import dependency rate of almost 75% in the energy sector (see Figure 4), it can be inferred that Lithuania was almost entirely reliant on Russia to meet its energy needs.

However, the situation may not be as dire as it seems. The high level of dependency on Russian energy imports is partially due to the operation of the Mazeikiu Nafta oil refinery, which used Russian crude oil in excess of domestic Lithuanian needs. Mazeikiu Nafta distributed its refined oil products to other Baltic States and Poland, leading to an oil import rate from Russia of more than 200% of Lithuania's needs. Since the closure of the branch of the Druzba oil pipeline leading to Lithuania in 2006,[11] all crude oil has been acquired through a sea-based oil terminal on global market terms. Similarly, the LNG terminal started operation in 2014 and has the potential to cover all of Lithuania's gas needs. Nevertheless, the nominal value of Russian energy imports was still significant, with Lithuania paying approximately €2.7 billion for Russian oil products, and an additional €140 million and €180 million spent on Russian gas and electricity, respectively, in 2021.[12] This comprised approximately 8% of all Lithuanian imports, making Russia the third-largest import partner in 2021.[13]

11 'Russia Won't Re-Open Oil Pipeline, Lithuania Says', *Reuters*, 11 October 2007, sec. Oil Report, https://www.reuters.com/article/lithuania-russia-oil-idUKL1159854520071011.

12 LRT.lt, 'Lithuania Pays €3 Billion for Russian Energy – Could the Dependence Be Cut?'

13 Ministry of Foreign Affairs, Republic of Lithuania, 'Export, Investments and Tourism Promotion. Trade and Economic Relations. Economic Diplomacy', accessed 21 April 2023, https://urm.lt/default/en/economic-diplomacy/trade-and-economic-relations/export-investments-and-tourism-promotion.

# 2

# POLITICAL AND OPERATIONAL RESPONSES AFTER FEBRUARY 2022

Lithuania had long expressed concerns about the potential for Putin's aggression, but Russia's military attack on Ukraine in February 2022 came as a surprise. However, tensions had already escalated due to the energy war between Russia and the EU, which began in 2021. Gazprom, a major Russian gas supplier, was accused of market manipulation and withholding gas supply volumes from the European market, which contributed to the natural gas price crisis in Europe during the 2021–2022 period.[14]

The Lithuanian government and top energy companies quickly stopped importing Russian fuels, even before any EU-level sanctions were imposed on Russian energy. This decision was influenced by strong political and societal support for Ukraine in Lithuania. The boycott of Russian energy became a major point of focus for Lithuanian foreign policy, and there was a lot of public pressure, particularly through social media, on businesses to stop working with Russian companies.

As a result, the import of main energy sources from Russia decreased rapidly. By 2022, the share of crude oil imported from Russia had fallen to 17.1% of the total import, compared to almost 80% in 2021. The import of gas fell from 69% to 42%, and the electricity import was just 6.9% of the total import (see Table 4).

In early March 2022, the Lithuanian operator of the LNG terminal stopped accepting LNG cargoes from Russia's Novatek after the EU imposed sanctions on the Russian oli-

14 Vladimir Milov, 'European Gas Price Crisis: Is Gazprom Responsible?', *European View* 21, no. 1 (1 April 2022): 66–73, https://doi.org/10.1177/17816858221084761.

Table 4
**Gross production of electricity by type of installation, 2017–2021 (GWh)**

| Imports of fuel and energy resources, (natural units) | 2022 | | 2021 | |
|---|---|---|---|---|
| | | Share of Russia, % | | Share of Russia, % |
| **Hard coal, thous. tonnes. TOTAL** | 336.4 | | 224.4 | |
| **Russia** | 254.4 | 75.6 | 224.4 | 100.0 |
| **Liquefied petroleum gases, thous. tonnes. TOTAL** | 130.8 | | 55.5 | |
| **Russia** | 72.4 | 55.4 | 8.9 | 16.0 |
| **Road diesel (with biofuels), thous. tonnes. TOTAL** | 698.6 | | 642.2 | |
| **Russia** | 34.6 | 5.0 | 386.8 | 60.2 |
| **Crude oil, thous. tonnes. TOTAL** | 8,188.9 | | 8,006.6 | |
| **Russia** | 1,397.3 | 17.1 | 6,399 | 79.9 |
| **Natural gas, GWh. TOTAL** | 62,119.6 | | 53,445 | |
| **Russia** | 26,008.2 | 41.9 | 37,032.8 | 69.3 |
| **Electricity, GWh. TOTAL** | 11,165.3 | | 11,915.4 | |
| **Russia** | 770.8 | 6.9 | 2,047 | 17.2 |

Source: calculated by author, data from Official statistics portal of Lithuania, https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S1R134#/

garch Gennady Timchenko.[15] Lithuanian companies also cut off imports of pipelined Russian gas in April 2022 and, since then, procured all its gas (mainly from the US) through the Klaipėda LNG terminal. The Lithuanian Parliament passed a law in June 2022 prohibiting gas imports from Russia and other countries considered a threat to national security.[16] That became a point of no return for Lithuania regarding pipeline-gas trade with Russia. However, Russian gas is allowed to transit through Lithuania to Kaliningrad, ensuring that only the volume needed for transit is transported.

PKN Orlen, the Polish energy firm running the oil refinery Mazeikiu Nafta, halted the purchase of Russian crude oil on the spot market in March, with no Russian oil deliveries to Lithuania since April.[17] This switch encouraged the Lithuanian government to lobby for a Russian oil embargo across the EU.

On 22 May 2022, the Nord Pool power exchange ceased trading with Russian electricity suppliers due to payment failure risks.[18] Consequently, Lithuanian customers stopped receiving Russian electricity as of May 2022, which usually accounts for 15–20% of all Lithuanian electricity imports. Belarussian electricity was also banned in 2020 following the launch of the Astravyets nuclear power plant, which is considered unsafe.[19]

International sanctions imposed on the Russian financial sector further aided the efforts to detach from the Russian energy sector, reducing the flow of money to the Russian budget. Lithuania's heavy reliance on energy imports and the post-Soviet infrastructure networks connecting it with Russia meant that decoupling from Russian energy sources came at a cost. The decision to construct an LNG terminal in 2014 sparked controversy due to high LNG prices compared to pipeline costs, adding extra fees to Lithuanian consumers' gas bills. However, the project served as an insurance policy, and according to the Financial Times, 'the insurance policy has been cashed in.'[20]

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15 Klaipėdos Nafta, 'KN Suspends Acceptance of Novatek's Cargoes at Lithuania's LNG Terminal', accessed 22 April 2023, https://www.kn.lt/en/news/news/kn-suspends-acceptance-of-novateks-cargoes-at-lithuanias-lng-terminal/5141.

16 'Lithuania Bans Russian Gas, Leaves Exception for Transit to Kaliningrad', lrt.lt, 28 June 2022, https://www.lrt.lt/en/news-in-english/19/1728613/lithuania-bans-russian-gas-leaves-exception-for-transit-to-kaliningrad.

17 'Lithuania Breaks Free from Russian Energy – DW – 05/10/2022', dw.com, accessed 22 April 2023, https://www.dw.com/en/how-lithuania-is-freeing-itself-from-russian-energy/a-61738474.

18 'Russia's Inter RAO Says Nord Pool Will Halt Trade for Its Subsidiaries', *Reuters*, 20 May 2022, sec. Energy, https://www.reuters.com/business/energy/russias-inter-rao-says-nord-pool-will-halt-trade-its-subsidiaries-2022-05-20/.

19 'Lithuania Stops Power Trade with Belarus as Nuclear Plant Comes Online', *Reuters*, 3 November 2020, sec. Oil report, https://www.reuters.com/article/litgrid-belarus-idINL8N2HP35A.

20 Richard Milne, 'Lithuania Proves Prescient on Risk of Russian Energy', *Financial Times*, 28 November 2022, sec. EU energy, https://www.ft.com/content/52626e1c-0731-43db-a755-4b7680949cc2.

# 3

# SHORT-TERM IMPACT OF ENERGY DECOUPLING FROM RUSSIA

The major impact on energy prices in Lithuania came from global and European-level market conditions after February 2022. The increase in gas and electricity prices in the second half of 2022, compared to the previous period in 2021, was huge. According to National Energy Regulation Council of Lithuania, the average weighted price of imported natural gas in the second half of 2022 was 149.65 EUR/MWh, or 2.8 times higher than in the second half of 2021.[21]

Limiting electricity imports from Russia and Belarus contributed even more to price surges in 2022, with Lithuania and Latvia recording the highest electricity prices on the Nord Pool exchange on a number of days in the summer. Consequently, electricity prices have been reflected in the inflation rate, which reached 21.4% in November 2022, one of the highest rates among the European Union countries.[22] The electricity price on Nord Pool, LT zone, reached their peak in August, when the monthly average was 480 euros/MWh.[23]

There were also some positive trends shown for the Lithuanian gas sector. In May 2022, the gas interconnection between Poland and Lithuania (GIPL) started operations, allowing Lithuanian-imported LNG to flow to Poland. The finalisation of the gas interconnection has become all the more critical following Russia's unilateral decision to disrupt gas supplies to Poland. As a result, Lithuania, for the first time, became a significant player in gas transit to the other EU countries. The Lithuanian LNG terminal increased its operational efficiency almost to the maximum and became a gate for LNG import not only to Latvia and Estonia but also to Poland. Natural gas transportation to EU countries in the second half of 2022 reached 15,445 GWh and, compared to the second half of 2021, increased 11.4 times. The Lithuanian operator of the liquefied natural gas system gasified 19,080 GWh of natural gas in the second half of 2022, i.e. 2.7 times more than in 2021. That resulted in 34% greater revenue in the second half of 2022 compared to the same period in 2021.[24]

However, despite the politically celebrated 'full decoupling' from Russian energy import, some trends showed the opposite. As Reuters announced in 2023, Russia more than doubled its liquefied petroleum gas (LPG) sales to the Baltic states in 2022.[25] LPG, mainly used as fuel for cars, heating, and in the production of other petrochemicals, has been exempt from Western sanctions imposed against Russia and accounted for only a tiny part of the total fuel imports in Lithuania. And still, the LPG supplies to Lithuania from Russia jumped 8.5 times to 72,000 tonnes in 2022, forcing the Lithuanian Ministry of Energy to look for excuses and public explanations. 'The import of Russian LPG and the business relations with Russia are to be seen as a moral issue, and the managers and shareholders of these companies could themselves comment more on the maintenance of business relations with Russia in these times of unprecedented war in Europe,' commented the Lithuanian Ministry of Energy.[26]

The Lithuanian government implemented several measures to compensate affected consumers to address the rapidly increasing gas and electricity prices. For example, the revised 2022 state budget allocated €973 million for anti-inflation measures, of which around €570 million was set aside for household customers affected by the energy price increase. The proposed substantial package of financial support to address the energy price increase was described as one of the largest in the EU, measured as a share of GDP.[27]

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21 National Energy Regulatory Council, 'VERT Skelbia 2022 Metų II Pusmečio Gamtinių Dujų Rinkos Stebėsenos Ataskaitą', accessed 22 April 2023, https://www.regula.lt/Puslapiai/naujienos/2023-metai/2023-04-19/vert-skelbia-2022-metu-ii-pusmecio-gamtiniu-duju-rinkos-stebesenos-ataskaita.aspx.

22 Eurostat, 'Annual Inflation down to 10.1% in the Euro Area', 12 2022, https://ec.europa.eu/eurostat/documents/2995521/15701156/2-16122022-AP-EN.pdf/4eaa941a-8c7d-af89-37da-f29f1167c24c.

23 Nord Pool, Market Data, accessed 10 May 2023, https://www.nordpoolgroup.com/.

24 National Energy Regulatory Council, 'VERT Skelbia 2022 Metų II Pusmečio Gamtinių Dujų Rinkos Stebėsenos Ataskaitą'.

25 'Exclusive: Baltic States Bought Twice as Much Russian LPG Last Year - Traders', *Reuters*, 26 January 2023, sec. Commodities, https://www.reuters.com/markets/commodities/baltic-states-bought-twice-much-russian-lpg-last-year-traders-2023-01-26/.

26 'Lithuanian Ministry Says Businesses Are Responsible for Increased Russian LPG Imports - LRT', accessed 22 April 2023, https://www.lrt.lt/en/news-in-english/19/1880326/lithuanian-ministry-says-businesses-are-responsible-for-increased-russian-lpg-imports.

27 'Lithuania Offers a Large Support Package on Energy Prices', euronews, 7 September 2022, https://www.euronews.com/2022/09/07/lithuania-offers-a-large-support-package-on-energy-prices.

One of the consequences of the tremendous increase in electricity prices was a rapid growth of business and household investments in solar energy. According to a report by Ember, solar generation in Lithuania increased by over 120% in 2022 on a year-over-year basis, making it the top country in the EU with the highest solar capacity growth.[28] This was the result of a successful model introduced by the Lithuanian government a few years ago, intended to support residential investment in photovoltaic generation. The Lithuanian government has decided to increase the 2022 budget for solar rebates by €35 million (originally, it had earmarked only €5 million) after the initial phases of the program showed substantial success among homeowners.[29] Although in nominal terms, the share of solar power plants is still not large, in 2022 the number of generating consumers in Lithuania increased by a factor greater than two. At the beginning of 2023, there were 42,000 producing consumers (or 'prosumers') in Lithuania, and the total power reached 572.3 MW. For comparison, in January 2022, there were 15,000 prosumers whose total photovoltaic generation amounted to 261.8 MW.[30]

Overall, the war in Ukraine and sanctions on Russian energy sources significantly impacted gas and electricity prices in Lithuania, similar to the trend across Europe. Still, there was no energy shortage or tension regarding the capability to find an alternative gas or oil supply, as the infrastructure was already in place. Moreover, in some cases, the rapid detachment from Russia and the energy price shock even had positive effects, such as an increased efficiency of Lithuanian LNG and gas transit operations and a much more rapid growth of solar power plants.

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28 Simon Yuen, 'EU Solar Generation Increased by 24% in 2022, Capacity Additions to Accelerate by 2026 - Ember', *PV Tech* (blog), 31 January 2023, https://www.pv-tech.org/eu-solar-generation-increased-by-24-in-2022-capacity-additions-to-accelerate-by-2026-ember/.

29 'Lithuania Devotes €40 Million for Solar Rebates in 2022', pv magazine International, 3 February 2022, https://www.pv-magazine.com/2022/02/03/lithuania-devotes-e40-million-for-solar-rebates-in-2022/.

30 The Government of the Republic of Lithania, '2022 metais dvigubai išaugo gaminančių vartotojų skaičius', accessed 25 April 2023, https://enmin.lrv.lt/lt/naujienos/2022-metais-dvigubai-isaugo-gaminanciu-vartotoju-skaicius.

# 4

# MEDIUM- AND LONG-TERM ANSWERS

It is somewhat paradoxical, but the energy crisis in 2022 did not change the fundamental direction of Lithuania's energy strategy.

For a long time, Lithuania had planned to increase its independence from Russia's energy resources for strategic purposes. In the last decade, the most critical strategic energy projects and investments were intended for this purpose. Currently, almost all energy diversification infrastructure projects have already been completed.[31] Therefore, it is symbolic that it was in April 2022 that Lithuania finalised the gas infrastructure diversification and connection to the European networks project (interconnection Lithuania-Poland, GIPL). As a result, since 2022, Lithuania can satisfy its gas import needs without Russia.

The last massive investment project to complete the disconnection from Russian energy is the synchronisation of the power grid with continental Europe. The Baltic states still operate as a part of the BRELL (Belarus-Russia-Estonia-Latvia-Lithuania) grid, and Moscow controls the frequency of the network. Lithuania, Latvia, and Estonia intend to complete the synchronisation project (supported by the European Commission) by 2025.[32] However, the war in Ukraine and the greater impulse to speed up the complete disengagement from Russia have encouraged Lithuanian politicians to strive for an even quicker completion of the project. Lithuania aims to formally disconnect from the BRELL frequency support agreement in 2023 and synchronise with continental Europe in 2024. One of the critical steps was the isolated operation test, which took place on 22 April 2023.[33] This test confirmed that, if necessary, Lithuanian electricity networks can function without frequency support from Moscow. However, Latvia and Estonia are not yet in a hurry to speed up synchronisation and claim that all the necessary infrastructure strengthening works have not yet been completed.

Although from 2022 till early 2023, the Lithuanian government did not adopt any new official medium or long-term energy strategies, it did make certain political efforts to increase the pace at which the already settled targets transitioning to zero-carbon energy would be reached.

In 2022, the government allocated an additional €1.12 billion for investments in energy independence, including funds to subsidise 30% of the renovation of multi-apartment building projects; to promote the private purchase and installation of solar power stations; and to support business initiatives for the deployment of solar, wind farm, and electricity storage batteries and hydrogen production equipment from renewable energy sources.[34]

Following the REPowerEU strategy prepared by the European Commission, on 7 September 2022, the Lithuanian government approved the national plan for increasing energy efficiency. The proposed measures would allow spending on energy costs to be reduced by €800 million within two years. However, such calculations regarding potential energy cost savings may be viewed as overly optimistic. In principle, the government can only control measures implemented by the public sector to increase energy efficiency. It is planned that by obliging public sector institutions to reduce energy consumption by 20% in the next two years, implementing the proposed recommendations and using support for increasing energy efficiency, the costs of electricity and heating in the public sector will decrease by €100 million. In total, €1.3 billion will be allocated for increasing energy efficiency through support measures in 2021–2027, of which €207 million will be allocated to the public sector, €900 million to residents, and €225 million to businesses.[35]

In 2022, the Ministry of Energy initiated the review and update of the National Energy and Climate Action Plan. The draft of the updated NECAP must be submitted to the European Commission by 30 June 2023. The revised plan could

31 Janeliūnas, 'Lithuania'.

32 Maris Andzans, 'The Baltic Road to Energy Independence from Russia Is Nearing Completion - Foreign Policy Research Institute', accessed 25 April 2023, https://www.fpri.org/article/2022/05/the-baltic-road-to-energy-independence-from-russia-is-nearing-completion/.

33 'Lithuania Completes Electricity Grid Test, "Giant Step towards Energy Independence"', lrt.lt, 24 April 2023, https://www.lrt.lt/en/news-in-english/19/1969404/lithuania-completes-electricity-grid-test-giant-step-towards-energy-independence.

34 Ministry of Finance of the Republic of Lithuania, 'The EUR 2.26 Billion Package Presented to Counter the Effects of Inflation and to Strengthen Energy Independence', accessed 25 April 2023, https://finmin.lrv.lt/en/news/the-eur-2-26-billion-package-presented-to-counter-the-effects-of-inflation-and-to-strengthen-energy-independence.

35 Ministry of Energy of the Republic of Lithuania, 'Vyriausybė pritarė energijos taupymo priemonių planui', accessed 25 April 2023, https://enmin.lrv.lt/lt/naujienos/vyriausybe-pritare-energijos-taupymo-priemoniu-planui.

include additional measures that would help speed up the implementation of the set goals and meet the ambitions of the European Commission with regard to the REPowerEU.

However, some planned works have been postponed due to the upheavals in 2022 and the need to respond to short-term crises. For example, the original plan was to prepare the National Hydrogen Development Guidelines by the end of 2022 – the first national-level strategic document to define the goals of hydrogen production, transportation, and consumption in Lithuania. However, the guidelines were still not finalised by 30 April 2023. On the other hand, some practical steps have been taken: in December 2022, Lithuanian transmission system operator Amber Grid, together with Gasgrid Finland (Finland), Elering (Estonia), Conexus Baltic Grid (Latvia), GAZ-SYSTEM (Poland) and ONTRAS (Germany) signed a cooperation agreement on the implementation of a cross-border project, the Nordic-Baltic Hydrogen Corridor. The project aims to connect Northern Europe's green energy production regions with Central Europe's main consumption centres, especially Germany. The project is expected to be completed by 2030.[36] The international tender for a pre-feasibility study was launched in April 2023.

36 Amber Grid, 'Amber Grid Launches International Tender for Hydrogen Corridor Pre-Feasibility Study', accessed 26 April 2023, https://www.ambergrid.lt/en/for-media/news/amber-grid-launches-international-tender-for-hydrogen-corridor-pre-feasibility-study/825.

# 5

# FORESEEABLE CONSEQUENCES CONCERNING EU CLIMATE GOALS AND TARGETS

The Lithuanian government endorsed the REPowerEU plan and renewed ambitions set by the European Commission to reduce the EU dependence on Russian gas and oil imports and to move more quickly with the green transition. In February 2023, the Council of the European Union and the Parliament officially approved the REPowerEU plan, according to which Lithuania is to be provided with a new €194 million grant to strengthen the energy system's resilience, security and sustainability. As the Minister of Finance Gintarė Skaistė explained, the Lithuanian government has set ambitious goals to produce all the electricity consumed in Lithuania from renewable resources by the end of the decade and to become an electricity exporting country.[37] This target is highly ambitious, considering that for the last few years, about 60–70% of gross electricity consumption comes from imports.

The government is currently working on supplementing the 'New Generation Lithuania' plan (adopted in 2021) to include a special REPowerEU section. The updated plan foresees using additional funds from the REPowerEU initiative and the borrowing option provided by the Economic Recovery and Resilience Facility and investing about €1 billion more in energy independence, renewable energy resources, and energy efficiency. The additional measures include, but are not limited to, the development of energy production from renewable resources, the development of energy infrastructure networks, increasing energy consumption efficiency in buildings, the decarbonisation of industry, and support for clean transport.[38]

It is hard to predict the potential success of the announced ambitions, but Lithuania demonstrated reasonable progress in increasing the share of renewable energy sources (RES). The initial target for 2020 was to reach 23% of RES in gross final consumption, but this target had already been attained in 2014. In 2021, the total share of energy from renewable sources in gross final consumption was 28.1%.

However, as noted in the country's report by the International Energy Agency (IEA), progress in energy efficiency has slowed down, as in other IEA countries. Lithuania did not meet its 2020 final energy consumption target of 4.3 million tonnes of oil equivalent (Mtoe). Additional measures are needed and envisaged, notably in building renovation and the transport sector. For 2030, the target is 4.5 Mtoe of final energy consumption.

According to the National Energy and Climate Action Plan (NECAP) for 2021–2030, Lithuania set the target to reach a 45% share of RES in final energy consumption by 2030.[39] A bit later, the 'New Generation Lithuania' plan set a higher goal – to reach 50% RES by 2030. It is likely that after updates of the NECAP in 2023, most of the energy and climate goals will be adjusted accordingly to higher ambitions set out in the REPowerEU.

Lithuania's most significant renewable energy potential comes from solid biofuel: firewood, wood, and agricultural waste used for fuel. In 2021, the largest amount was used for producing electricity and centralised heat supply (54.4%) and in households (33.1%). In 2021, the production of heat by energy producers which use firewood and wood waste accounted for 64% of total heat produced by power plants and heat plants and 14.4% of electricity produced by power plants.[40]

The year 2022 showed a record increase in electricity production from renewable sources. The total electricity production of Lithuania in 2022 reached 4,250 TWh (9.4% less than in 2021). Solar generation increased from 0.157 TWh to 0.273 TWh, wind generation from 1.355 TWh to 1.513 TWh, and generation from hydroelectric plants increased from 0.380 TWh to 0.457 TWh. And the same time, thermal generation shrank from 1.722 TWh to 1.161 TWh. The total energy produced by renewable resources was 2,545 TWh per year, or 59,9% of all electricity production in Lithuania.[41] However, it was just about 23% of all total electricity needs of Lithuania last year.

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37 Ministry of Finance of the Republic of Lithuania, 'For Strengthening of Lithuania's Energy Independence – Additional EUR 194 Million from the EU Budget', accessed 29 April 2023, https://finmin.lrv.lt/en/news/for-strengthening-of-lithuanias-energy-independence-additional-eur-194-million-from-the-eu-budget.

38 Ministry of Finance of the Republic of Lithuania.

39 Ministry of Energy of the Republic of Lithuania, 'National Energy and Climate Action Plan of the Republic of Lithuania for 2021–2030', 2020, https://energy.ec.europa.eu/system/files/2022-08/lt_final_necp_main_en.pdf.

40 Official statistic portal of of Lithuania, 'Renewable Energy Resources - Oficialiosios Statistikos Portalas', accessed 29 April 2023, https://osp.stat.gov.lt/lietuvos-aplinka-zemes-ukis-ir-energetika-2022/energetika/atsinaujinantys-energijos-istekliai.

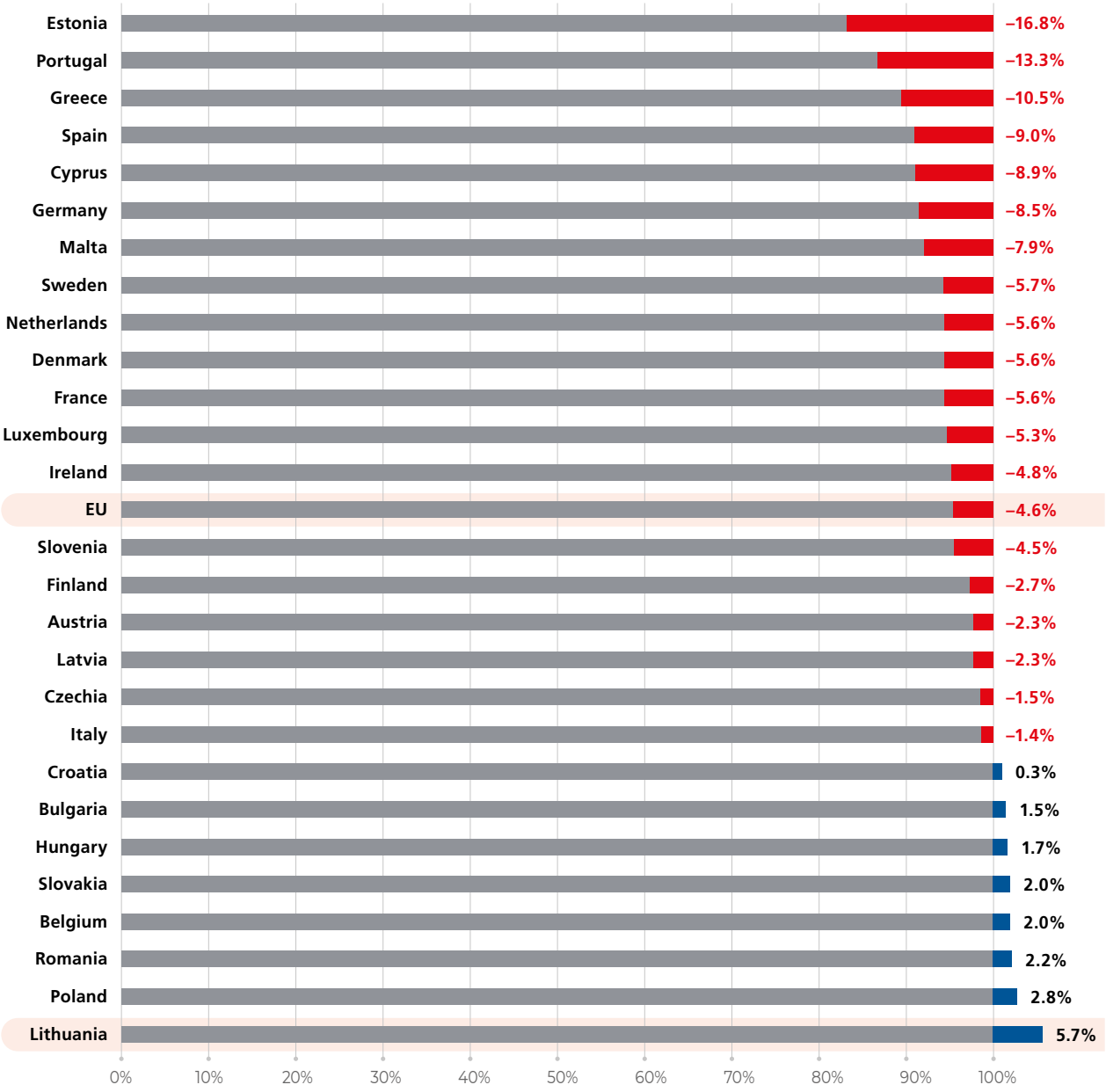
41 Lrt.lt, '„Litgrid"'.

Table 5
**The share of energy from renewable sources, %**

| | The share of energy from renewable sources in gross final consumption of energy | The share of final consumption of energy from renewable sources for heating and cooling | The share of gross consumption of electricity from renewable energy sources | The share of final consumption of energy from renewable sources in transport |
|---|---|---|---|---|
| **2021** | 28.1 | 48.62 | 20.92 | 6.69 |
| **2020** | 27.36 | 50.23 | 20.17 | 5.5 |
| **2019** | 25.47 | 47.38 | 18.79 | 4.04 |
| **2018** | 25.51 | 46.02 | 18.41 | 4.33 |
| **2017** | 26.04 | 46.5 | 18.25 | 4.29 |

Source: Official statistics portal of Lithuania, https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S1R127?hash=7811fded-51bd-405c-9cac-4bdc636ddbbd#/

Figure 5
**Changes in energy efficiency (2021 primary energy consumption compared with 2017–2019 average**




Source: Eurostat, Energy efficiency statistics, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_efficiency_statistics#Final_energy_consumption_and_distance_to_2020_and_2030_targets

The biggest expectation regarding a breakthrough in green energy is associated with two large offshore wind farms. The country's first two offshore wind farms will have a total capacity of 1400 MW and are expected to be fully commissioned by 2030. The two wind farms could produce up to 6 TWh of green electricity, covering approximately half of Lithuania's current electricity demand.[42]

However, as noted in the country's report by the International Energy Agency (IEA), progress in energy efficiency has slowed down. As a result, Lithuania did not meet its 2020 final energy consumption target of 4.3 million tonnes of oil equivalent (Mtoe). Additional measures are needed and envisaged, notably in building renovation and transport. For 2030, the target is 4.5 Mtoe of final energy consumption for Lithuania.[43] That will be a considerable challenge, as in 2021, the final energy consumption was 5.66 Mtoe, and the direction is negative: when comparing 2021 with the 2017–2019 average, primary energy consumption in Lithuanian increased by 5.7% – which was the most significant increase in the EU.[44]

In conclusion, Lithuania coped well with the task of diversifying energy imports. The sanctions for Russia became a good opportunity to take advantage of the completed infrastructure works before 2022. However, the trend towards increasing energy efficiency and achieving climate neutral energy is too slow. The electricity and gas price shock in 2022 forced businesses and households to save more on electricity, gas, and heat, and the government introduced almost mandatory energy saving requirements for public institutions. However, this trend may not be sustainable. Huge government compensations and a significant drop in energy prices in early 2023 could push consumers back to their old habits again. This means Lithuania will have considerable challenges in increasing energy efficiency by 2030 and attaining other green energy transition goals.

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**42** Adnan Memija, 'Lithuania Launches First Offshore Wind Tender', *Offshore Wind* (blog), 30 March 2023, https://www.offshorewind.biz/2023/03/30/lithuania-launches-first-offshore-wind-tender/.

**43** International Energy Agency, *Lithuania 2021 Energy Policy Review*.

**44** 'Energy Efficiency Statistics', accessed 30 April 2023, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_efficiency_statistics.

# POLAND

by Magdalena Maj

# INTRODUCTION

Polish energy dependence (defined as the share of net imports relative to gross available energy) was 42.8% in 2020. It was the highest for oil and petroleum products (96.9%) and natural gas (78.3%). Among renewable energy sources and biofuels that share was 3.3%, and only 0.3% for solid fossil fuels. Poland's largest energy import partner was Russia, which supplied 35% of Poland's gross available energy. Energy imports from Russia as a share of the gross available energy was 35%; of this share, oil accounted for 76.3%, natural gas 45.4% and coal 13.4%. Among all energy imports, the share of natural gas was 54.8% and crude oil was 72%.

Despite the large volumes of thermal and coking coal Poland imported from Russia (almost 8.5 million tonnes in 2021), in April 2022 – without waiting for the reaction of the European Union (EU) – the Polish government passed a law banning the import and transport of Russian fuel. The last transports were registered in May 2022. Despite concerns, Poland has become completely independent of Russia in coal imports. Due to the impossibility of rapidly increasing domestic coal production before the upcoming heating season, the State Treasury was instructed to import coal from countries other than Russia, replacing it with supplies from countries like Colombia, Indonesia, and South Africa.[1]

Oil imports from Russia had already been declining in the years proceeding Russia's full-scale war against Ukraine, but the pace of diversification has increased since then. From February 2023, Russia stopped exporting oil to Poland via the Friendship pipeline. Alternative supplies come primarily from Saudi Arabia. The infrastructure in Gdańsk is capable of receiving enough oil not only for Poland but for several other countries in the region.

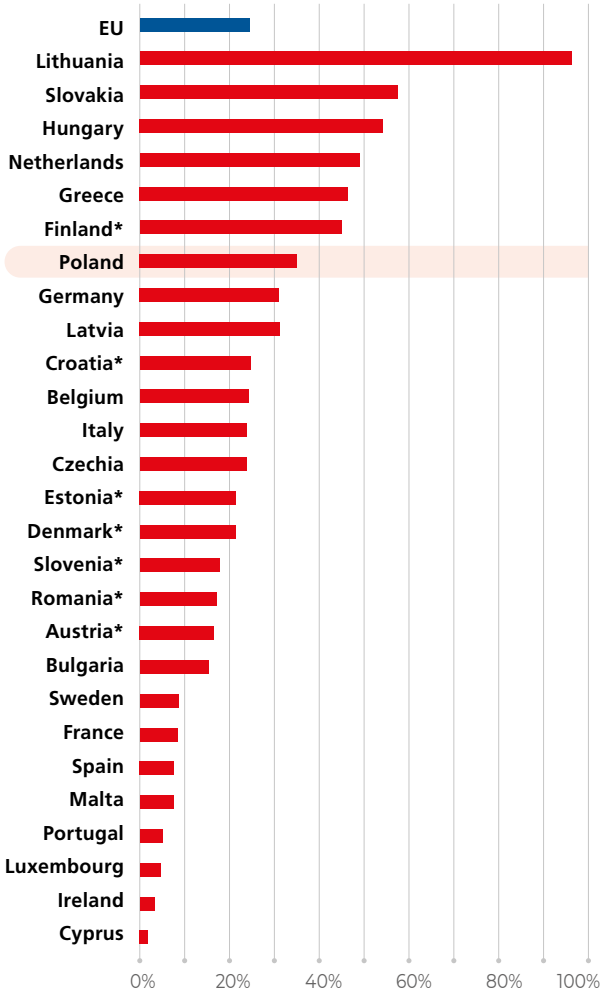
The year 2022 was a watershed year for the Polish gas sector, as import sources, prices, consumption volumes and the direction of gas flows changed. In 2021, Russian gas accounted for about 87% of all gas imported into Poland, including shipments to Germany via the Yamal pipeline (without this, it amounted to over 50%). In 2022, this amount dropped sharply to 20% and in the first financial quarter of 2023 Poland did not import any Russian gas. Liquified natural gas (LNG) and gas imports via Baltic Pipe accounted for 85% of imports during this time.[2] The Polish natural gas company Gaz-System intends to assess the level of market interest in exporting regasified LNG to Slovakia, Lithuania, Denmark, Germany, the Czech Republic, and Ukraine.[3]

1 'Raport podsumowujący interwencyjny import i dystrybucję węgla kamiennego w sezonie grzewczym 2022/2023' (2023). Departament Analiz i SprawozdawczoŚci, Ministerstwo Aktywów Państwowych. Accessed 04 June 2023. Available at: https://www.gov.pl/attachment/f6eead22-16a1-489f-93bc-83fe58471d7c.

2 European Network of Transmission System Operators for Gas (ENTSOG) data platform; https://transparency.entsog.eu/#/map.

3 https://www.gaz-system.pl/pl/system-przesylowy/inwestycje/terminal-fsru.html

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO AS OF FEBRUARY 2022

In 2021 Poland had a population of 37.91 million. The gross available energy in Poland in 2020 was 4603.2 PJ or 121 GJ per person. The dominant sources are solid fossil fuels and oil and petroleum products (see Figure 2 below).

Polish primary energy production amounted to 2538.6 petajoules (PJ) (an increase of 2.5%), yielding 67 gigajoules (GJ) per person. The most important energy source acquired was hard coal, with a 53.6% share. The second most important carrier in terms of extraction was lignite (brown coal), with a 17.5% share. The share of natural gas in extraction was 5.6%, crude oil 1.5%, and others, largely renewable energy carriers 24.3%. Energy consumption, on the other hand, was 4590.5 PJ, or 121.1 GJ per person in that same year. Of this total amount, consumption of oil and petroleum products was 1361.7 PJ, or 35.9 GJ per person.

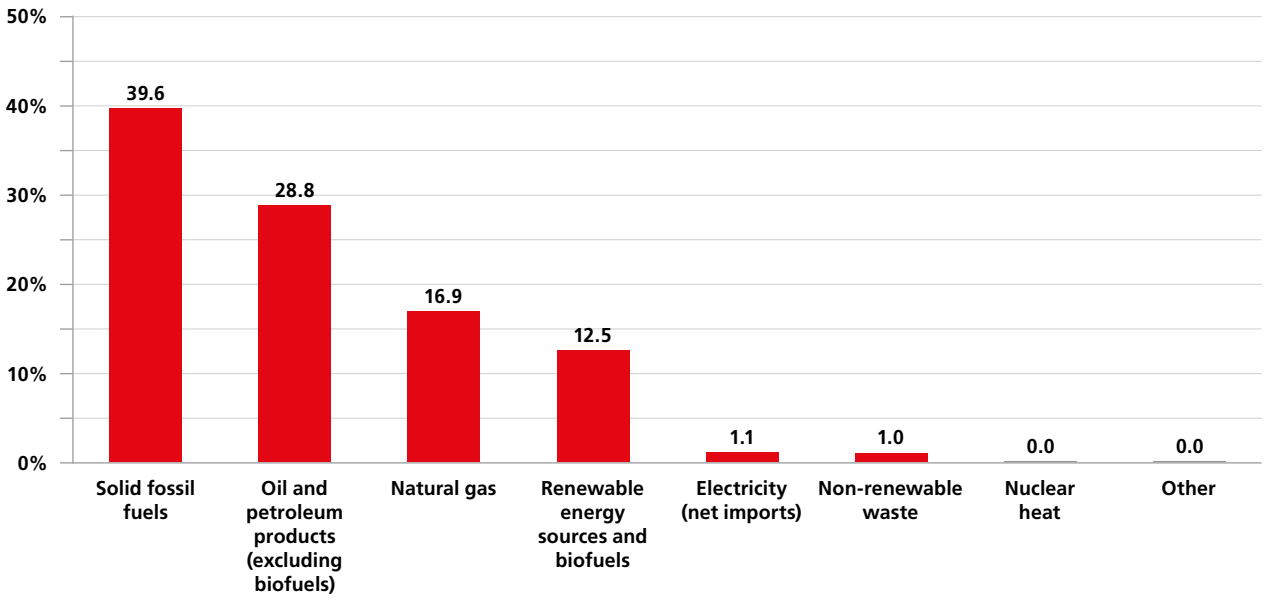
Renewable sources, i. e., hydro, wind, solar, geothermal, biofuels, and renewable municipal waste accounted for 21.3% of primary production, according to Eurostat data. Biomass comprised the largest share of renewable energy production (69.4%).

Eurostat data show that electricity accounted for 25.7% of primary energy production, and of that share, 17.4% was produced from renewable energy sources. Among fuel production, hard coal accounted for the largest share (45.7%), followed by lignite (25.5%) for a total of 71.2%. The most important renewable energy carriers were wind energy (9.0% of all electricity produced), biomass and biogas (4.4%) and photovoltaic (2.2%). Gaseous fuels accounted for 8.8%, run-of-river hydro 1.3%, pumped hydro 0.4% and other fuels 2.6%.[4]

Electricity is produced primarily in power plants, where the volume of production amounted to 141.3 Terrawatt-hours (TWh), accounting for 78.7% of total electricity production. The efficiency of these power plants is 42.5%. Industrial power plants with an average efficiency of 58.1% generated 15.1 TWh, accounting for 8.4% of total production. The remainder of the electricity production comes from inde-

4 CSO (2022), *Fuel and energy economy.*

Figure 2
**Energy mix expressed as the share of fuels relative to gross available energy in Poland in 2020**




Source: Eurostat; https://ec.europa.eu/eurostat/statistics-explained/images/2/24/EnergyMixDependencyImports_25-03-2022.xlsx

pendent power plants, primarily utilising wind.[5] In 2021, total electricity imports into Poland amounted to 15 TWh, with the largest shares being imported from Germany (58%), Sweden (23%), and Lithuania (11%). Ukraine, the Czech Republic, and Slovakia accounted for the remainder of imports.

Poland's gas import dependence (net imports relative to consumption) in 2021 was 78%. The Russian share of Polish net imports was 74%, while the share of imports from Russia in domestic consumption was 56%. Qatar (13%) and the United States (9%) were also significant gas suppliers. Poland's share of Russian oil in total consumption and imports has fallen by about 30% over the past decade to just over 60% in 2021. The Russian share of Polish oil and petroleum imports accounted for around 60% of total imports. The other major exporters to Poland are Saudi Arabia and Norway.

In 2021 Poland imported 12.75 million tonnes of solid fuels, of which hard coal accounted for 97%. Most imports came from Russia (65%), with other supplies being imported from Australia (16%), Colombia (5%), the Czech Republic and Kazakhstan (4% each) and the United States (3%). Coal from Russia was mainly imported by private entities for households, sensitive entities, and local heating plants. Due to the physical and chemical parameters of coal, only a part of the domestic output can be used for household needs. Poland primarily produces thermal coal, which is not suitable for combustion in household furnaces. According to the Industrial Development Agency, the percentage of thermal coal production was 77.1% of total coal extraction in 2021.[6]

5 https://stat.gov.pl/obszary-tematyczne/srodowisko-energia/energia/gospodarka-paliwowo-energetyczna-w-latach-2020-i-2021,4,17.html

6 https://www.gov.pl/attachment/f6eead22-16a1-489f-93bc--83fe58471d7c

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

As early as 14 April, the President of Poland signed a law on special solutions to prevent support for aggression against Ukraine, one day after it was passed in the Parliament.[7] The law banned the importation and transport of coal and coke from the Russian Federation and Belarus into or through Poland. In 2021, imports of these two categories from Russia were 8.3 million tonnes and 65,000 tonnes, respectively. In 2022, coal imports dropped from 850,000 tonnes in January to 20,000 tonnes in May, and coke from 8,000 tonnes in January to 4,000 tonnes in April.[8]

In Poland, there was a high risk of coal shortages during the winter, but this was mitigated by the action of state-owned companies. The government ordered two state-owned companies – Węglokoks and PGE Paliwa – to import at least 5 million tonnes of coal from other destinations, including Colombia, Indonesia, and Australia.

From 22 September 2022, the government has made it compulsory for coal companies to register on the portal ciepło.gov.pl, which aims to provide information for customers on where to buy the cheapest coal.[9] Inspections of some entities by the Office of Competition and Consumer Protection (OCCP) showed that the reason for higher coal prices in 2022 was mainly due to increased purchase costs incurred by these entrepreneurs after 24 February 2022, and therefore after Russia's aggression against Ukraine.[10]

While domestic refineries primarily bought oil from Russia in 2022, these supplies decreased over time. Poland imported 11.5 million tonnes of Russian Export Blend Crude Oil (REBCO) in 2022, which was about 3.5 million tonnes less than in the previous year. REBCO's share of supply was 42% in 2022 versus 61% in 2021. The government declared at the end of March 2022 that it would also make efforts to stop importing oil from Russia by the end of the year. Forward supply contracts expire at the turn of this year and next, and the government has no plans to sign new ones. However, Transneft has already discontinued oil supplies to Poland via the Druzhba pipeline in February 2023. Poland had already abandoned ad hoc purchases from Russia under so-called spot deals. Poland's largest oil company Orlen imported less than 10% of its crude from Russia in February of this year.[11]

Poland is strengthening cooperation with other oil producers. It is also anticipating increased capacity to import and store oil through the expansion of the storage base in Gdańsk by two tanks with a capacity of 100 thousand $m^3$ each, as well as expansion of the Oil Terminal in Gdańsk to the capacity of 765 thousand $m^3$. The largest transshipment base is Naftoport in Gdańsk, which last year was used at 45% of its handling capacity. Naftoport is sufficient to meet the demand for oil in Poland, and oil supplies to Lithuania, Latvia, Estonia, the Czech Republic and partially to Germany would also be unthreatened (which is happening already). The largest alternative oil supplier for Poland is Saudi Arabia, with supplementary imports coming from Norway, the United Kingdom, the United States, Kazakhstan, and Nigeria.

Ending Russian energy imports was planned in Poland regardless of the outbreak of full-scale war in Ukraine, as contracts with Russian state-owned gas company Gazprom were due to expire at the end of 2022, meaning that the search for alternative supply sources has long been underway. In May 2022, the construction of an interconnector pipeline between the transmission systems of Poland and Slovakia at the Výrava point was completed.[12] The pipeline has a capacity of 5.7 billion cubic metres ($bm^3$) in the direction from Slovakia towards Poland and 4.7 $bm^3$ from Poland towards Slovakia.

On 27 April 2022, a complete suspension of natural gas supplied by Gazprom under the Yamal contract began. Gas prices increased by 20% after Gazprom decided to suspend supplies. PGNiG declared that despite Gazprom's cessation of supplies, its customers were able to receive gas in line with reported demand. This was the result of a long-standing strategy of diversifying the sources and directions of gas supplies to Poland.

7 https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20220000835

8 http://swaid.stat.gov.pl/HandelZagraniczny_dashboards/Raporty_konstruowane/RAP_SWAID_HZ_3_1.aspx

9 https://uokik.gov.pl/aktualnosci.php?news_id=19157

10 https://uokik.gov.pl/aktualnosci.php?news_id=19003

11 https://www.orlen.pl/pl/o-firmie/media/komunikaty-prasowe/2023/luty/PKN-ORLEN-zabezpiecza-dostawy-ropy-naftowej-spoza-Rosji

12 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2022/maj/26-05-2022-gaz-system-interkonektor-gazowy-polska-slowacja-jest-juz-nagazowany.html

The existing connection to the Czech Republic and Germany, the LNG terminal in ŚwinoujŚcie, which was enlarged in 2022, national resources and the high gas storage level at this time (80%) assured security. The Poland-Lithuania gas interconnector (GIPL) at Santaka Point, which began construction in 2020, was partially opened on 1 May 2022. The pipeline gives Poland access to the LNG terminal in Klaipeda and is also important for the development of the gasification network in Poland's northeast.[13]

The government has announced an acceleration of the construction of a floating storage regasification unit (FSRU) terminal in the Gulf of Gdańsk. The investment has been placed on the so-called fast-track investment path, which will allow for accelerated procedures related to necessary administrative decision-making. The project is also on the list of gas critical infrastructure under the REPowerEU plan.[14]

13 https://swi.gaz-system.pl/swi/public/#!/ksp/actualQuantity?lang=en

14 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2022/grudzien/09-12-2022-fsru-w-gdansku-z-europejskim-dofinansowaniem.html

# 3

# GOVERNMENT MITIGATION MEASURES

The Act of 5 August 2022 introduced a carbon subsidy for households (and vulnerable consumers) if the household's main source of heating uses solid fossil fuels boilers or cookers, LPG, fuel oil, and electric heating, with the provision that these sources must be registered in the Central Register of Building Emissions to receive the subsidy.[15] Support was also allocated to district heating (radiator and water heating) so that the price increase for customers reaches a maximum of 40%.

In 2023, electricity prices for household consumers up to certain consumption limits (2,000 kWh/2,600 kWh/3,000 kWh) have been frozen at the level of tariffs for trading companies from January 2022. In addition, for energy consumption above these volumes, the energy sellers have not been able to charge a price higher than PLN 0.693/kWh (approx. 15 cents). Distribution tariffs for household consumers have also been frozen to the aforementioned consumption limits.

Under the 'Law on Emergency Measures to Reduce Electricity Prices and Support Certain Consumers in 2023', local government units, public utilities, and micro-, small and medium-sized enterprises will be able to apply for an 'energy price freeze'. The solution is to introduce a maximum electricity price for eligible entities of PLN 785/MWh net (approx. €167 euro). This maximum price is in force between 1 December 2022 and 31 December 2023. The law also introduced a mechanism to encourage energy savings.

The goal of the National Fund for Environmental Protection and Water Management (NFOŚIGW) programme opened in November 2022 – 'Support for energy-intensive industries' – is to reduce emissions of energy-intensive branches of Polish industry. The budget for the implementation of the program is PLN 4 billion (approx. €0.87 billion). Under the program, micro-, small medium and large enterprises with a legal title to an energy-intensive installation can apply for financing in the form of a loan for investments aimed at improving energy efficiency, reducing the amount of raw materials used, increasing the share of RES and energy storage.

In February 2023, the NFOŚIGW launched the programme 'Aid for energy-intensive sectors related to sudden increases in natural gas and electricity prices in 2022' with a budget of PLN 5.1 billion (approx. €1.1 billion). The aim is to support energy-intensive industries such as metallurgy, ceramics, cement or fertiliser production. The aid provided ranges from several thousand to several hundred million PLN.

Heat pump sales in Poland increased by 120% in 2022, which was a significant increase from previous years, since in 2021 such increase amounted to 65%. In 2022 Poland ranked eighth among EU countries for sales of heat pumps per 1,000 households. This compares with a 40% year-on-year increase in Europe. One in three heating appliances sold in Poland was a heat pump; when including air conditioners with a heating function, the proportion was one in two.[16]

The increased interest in heat pumps was due to rising fuel prices and government subsidies for pumps via the 'Clean Air Programme' and the thermo-modernisation allowance. EU plans highlighted in the REPowerEU package as a response to Russian aggression indicated the need for planning which would allow rapid divestment from fossil fuels in buildings. The response to these announcements was evident in the interest in pumps in the Clean Air Programme: heat pumps accounted for 63% of applications for heat source replacement in December 2022, and 28% in January 2022.

15 https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20220001692/T/D20221692L.pdf

16 https://portpc.pl/port-pc-2022-rok-pomp-ciepla-w-polsce/

# 4

# CONSEQUENCES OF THE CONFLICT AND SANCTIONS TO DATE

In 2022 Poland was the only one of the seven largest electricity producers in the EU that, despite the energy crisis, was able to simultaneously reduce coal-fired power generation, cut gas consumption and dynamically develop RES.

The disruption of coal supplies from Russia to Europe have increased the price of physical supplies.[17] This has also affected the prices of Polish coal sold by Polish producers. From February 2022 to February 2023, the price index PSCMI 1 for coal for power use increased by 135% to PLN 691/tonne. The price index PSCMI 2 for coal for heating use during this period increased by 253% to PLN 1098/tonne, peaking at a historic high of PLN 1509/tonne before the heating season in September.[18] Total hard coal production and sales remained at relatively similar pre- and post-war levels, while the decline in stocks halted (see Figure 3 below).

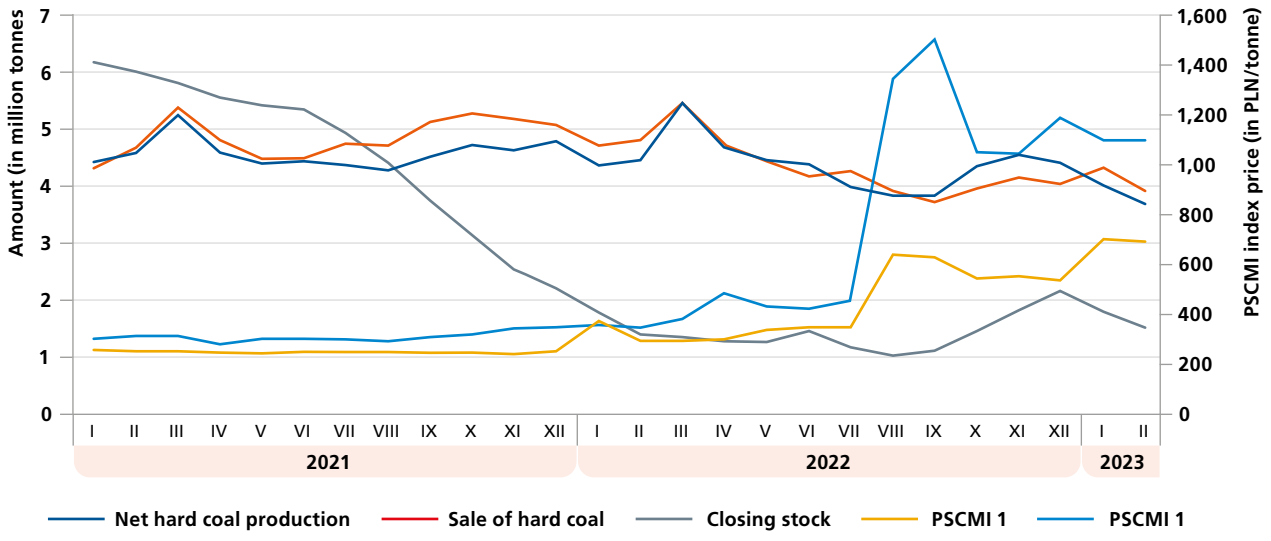
No statistics are yet available on household coal consumption during this period. However, there are surveys that suggest that in the past heating season, expenditure on coal increased by an average of 49%, amounting to more than PLN 4,400 (approx. €952).[19] One in three households spent at least PLN 5,000 (approx. €1,082). In 2022, 12% of households spent at least this amount, and 57% of households surveyed described the purchase of coal as a large or very large financial burden (based on the scale: small, moderate, large, very large). The average share of expenditure on coal was 11.1%, with a threshold of 10% representing fuel poverty. Among coal-using households, 45% exceeded this threshold, and 12% of families (more than 500,000 households) spent at least 20% of their income to purchase coal. Among those households surveyed, 70% have changed their heating consumption habits, primarily reducing their coal use at the expense of home temperatures, or by replacing coal with wood. 18% of respondents have taken steps to insulate their homes. This resulted in a significant decrease in thermal comfort, from 60% to 24%.

17 https://polskirynekwegla.pl/miedzynarodowy-rynek-wegla-w-styczniu-2022-r

18 The Polish Steam Coal Market Index (PSCMI) is a group of price indices for benchmark thermal coal produced by domestic producers and sold on the domestic market. Two PSCMIs have been created for coal in the domestic market: coal prices for power use (PSCMI 1 Index) and prices for heating use (PSCMI 2 Index).

19 http://polski-wegiel.pl/wp-content/uploads/2023/02/IGSPW_Wydatki-na-zakup-w%C4%99gla-2022-2023_raport.pdf

Figure 3
**Sales and stocks of hard coal in Poland from January 2021 to February 2023**




Source: Industrial Development Agency; https://polskirynekwegla.pl/raporty-dynamiczne

# 5

# MEDIUM AND LONG-TERM SOLUTIONS

On 29 March 2022 the Council of Ministers adopted a revision to the Energy Policy of Poland until 2040. – a strategic document setting out directions for the development of the fuel and energy sector. The new document was expected to shift the energy security approach towards greater diversification and independence. The announcement outlined expectations that half of the electricity generation will come from the renewable energy sector (RES) by 2040. In addition to the emphasis on increased wind and solar capacity, the policy called for intensified efforts to develop weather-independent RES capacity, i. e., by using water, biomass, biogas, and ground heat. The updated policy document also advocated for the establishment of energy clusters and cooperatives using RES (including hybrids), and subsidy support for energy self-sufficient households.[20] The new EPP2040 is currently being negotiated in inter-ministerial consultations within the government, as well as within the governing party coalition itself.[21]

After the outbreak of war, the Polish and Czech governments resumed talks about an abandoned Czech-Polish gas interconnector project, Stork II, with a projected capacity of up to 1 bm3. Gaz-System obtained the necessary approvals for the investment, but the decision to begin construction has not yet been made. A letter of support for the construction was signed by the ministers responsible for energy issues in Poland and the Czech Republic and the operators of the gas transmission systems in these countries.[22] Slovakia is also interested in receiving gas from the Polish LNG terminal. In March 2023, talks took place between the operators of the two countries and representatives of the governments on the use of the existing connection and access to LNG supply.[23] In the same month, Gaz-System and the Gas Transmission System Operator of Ukraine (GTSOU) signed a multi-year cooperation agreement enabling formal steps to be taken to integrate the gas markets of Poland and Ukraine. The agreement concerned the development of a market for low-carbon gases such as biomethane and hydrogen, cross-border gas trade, and the use of transmission and storage capacities.[24] In the second half of 2023, a cyclical assessment of market needs for interconnection capacity is to be carried out to decide on infrastructure expansion, potentially up to 4.5 bm3, from the FSRU.[25] Since 15 May 2023, it has also been possible to exchange electricity with Ukraine via the Rzeszów-Chmelnitskaya line.

According to the Polish Nuclear Power Programme, which was established before the full-scale Russian aggression against Ukraine, the state-owned company Polskie Elektrowni Jądrowe is to build two nuclear reactors with an approximate total capacity between 6 Gigawatts of electricity (GWe) and 9 GWe.[26] Announced in 2022 independently of the PPEJ, a third power plant is to be built in Poland in Konin/Pątnów to increase the country's energy security.[27]

In 2022, Polish oil refinery company PKN Orlen and chemical company Synthos S.A. established a joint special purpose vehicle, Orlen Synthos Green Energy S.A. (OSGE) to be responsible for the preparation and commercialisation of small modular reactors (SMRs) in Poland.[28] According to the announcement, OSGE wants to build as many as 76 reactors in 26 locations, with the first to be built in 2028/2029.[29] Polish mining corporation KGHM, one of the world's largest copper producers, also announced an investment in SMRs. Unlike OSGE, however, this is an investment to meet only its own electricity needs.[30] As announced, the first unit is expected to be operational as early as 2029. Like OSGE, KGHM applied for a technology assessment to the National Atomic

20 https://www.gov.pl/web/premier/zalozenia-do-aktualizacji-polityki-energetycznej-polski-do-2040-r-pep2040--wzmocnienie-bezpieczenstwa-i--niezaleznosci-energetycznej

21 https://www.gov.pl/web/premier/projekt-uchwaly-rady-ministrow-w-sprawie-realizacji-dzialan-strategicznych-wzmacniajacych-bezpieczenstwo-dostaw-energii-elektrycznej

22 https://www.gov.pl/web/klimat/polska-i-czechy-wspolnie-za-realizacja--projektow-stork-ii-i-fsru-gdansk

23 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2023/marzec/17-03-2023-rozmowy-na-temat-wspolpracy-regionalnej--polski-i-slowacji-w-celu-zabezpieczenia-dostaw-gazu-w-regionie.html

24 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2023/marzec/16-03-2023-gaz-system-i-gas-transmission-system-operator-of-ukraine-podpisali-porozumienie-o-wspolpracy.html

25 https://dise.org.pl/Vkongres/2019-09-24_USA%20PL%20UA_wersja%20ost.pdf

26 https://ppej.pl/o-spolce

27 https://www.poznan.uw.gov.pl/wydarzenia-biezace/pge-pak-energia--jadrowa-zajmie-sie-budowa-elektrowni-jadrowej-w-koninie

28 https://ec.europa.eu/competition/mergers/cases-1/202309/M_10933_9002315_188_5.pdf

29 https://www.wnp.pl/energetyka/obajtek-orlen-ma-bardzo-ambitne--plany-zwiazane-z-reaktorami-smr,672287.html

30 https://www.forum-ekonomiczne.pl/wyzwania-energetyki-jadrowej-w--kghm-polska-miedz/

Energy Agency in July 2022.[31] In Poland, interest in SMRs has also been expressed by other companies such as Ciech[32], UNIMOT[33] and Respect Energy.[34]

A survey commissioned by the Ministry of Climate and Environment in November 2022 suggested that more than 86% of respondents support nuclear power plants in Poland, while only 10% are against nuclear power plants. Compared to 2021, there has been an increase in supporters of nuclear power investments by as much as 12%, the highest increase in a decade.[35]

Gaz-System has submitted three hydrogen investment projects for Project of Common Interest (PCI) status:

- Nordic-Baltic Hydrogen Corridor;[36]
- Hydrogen storage facility in Damasławek; and[37]
- A national hydrogen backbone, including infrastructure connecting domestic hydrogen producers, import sources, and the hydrogen storage facility at Damasławek with end users and possibly local distribution networks.

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31 https://forsal.pl/biznes/energetyka/artykuly/8632453,male-reaktory-atomowe-dla-kghm-i-orlen-panstwowa-agencja-atomistyki-analizuje-wnioski.html

32 https://businessinsider.com.pl/firmy/atomowe-plany-spolki-sebastiana-kulczyka-ciech-oprocz-smr-analizuje-tez-magazyny/5m5jse2

33 https://www.unimot.pl/aktualnosci/nuscale-power-podpisuje-porozumienie-o-wspolpracy-mou-z-getka-i-unimot-w-celu-rozpoznania-mozliwosci-wdrozenia-technologii-smr-w-polsce

34 https://respect.energy/respect-energy-i-edf-podpisaly-porozumienie-o-rozwijaniu-projektow-energetyki-jadrowej-w-polsce/

35 https://www.gov.pl/web/klimat/rekordowe-poparcie--86-polakow-za-budowa-elektrowni-jadrowych-w-polsce#:~:text=Study%20of%20November%202022%20r,type%20investment%20a%C5%BC%20o%2012%25

36 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2022/grudzien/16-12-2022-operatorzy-z-szesciu-panstw-podpisali-umowe-o-wspolpracy-w-celu-rozwoju-nordycko-baltyckiego-korytarza-wodorowego.html

37 https://www.gaz-system.pl/pl/dla-mediow/komunikaty-prasowe/2023/marzec/03-03-2023-gaz-system-zglosil-projekty-wodorowe-do-nadania-statusu-pci.html

# 6

# FUTURE DIRECTIONS CONCERNING EU CLIMATE GOALS/TARGETS

Undoubtedly, Russia's aggression against Ukraine has directly strengthened the energy transition process in the EU. For Poland, it is important to further reduce dependence on Russia (particularly regarding oil) and to increase energy self-sufficiency. As a result, activities developing domestic energy deposits and increasing the use of technologies supporting the development of a low-carbon economy have intensified. This may be further influenced by the material supply chain problems experienced in recent years. Therefore, we can expect increased RES usage and a renaissance of nuclear power generation. Several RES and nuclear power projects are underway in Central European countries (e. g., Poland, the Czech Republic, Slovakia, and Hungary) and this process is likely to accelerate given also attitudes and actions at the EU level supporting energy transition and the use of low-carbon energy sources (e. g., hydrogen, carbon capture and storage technology, etc.). Financial incentives and capital flows to enable technological development and capital-intensive projects will be key in this regard. Yet, more attention to not only RES diversification but also the decentralisation of generation sources is desirable. The current model based on corporate and large-scale actors lacks crisis resilience. Increasing the number of prosumers who take responsibility for their energy needs means reducing the number of critical safety points in the system.

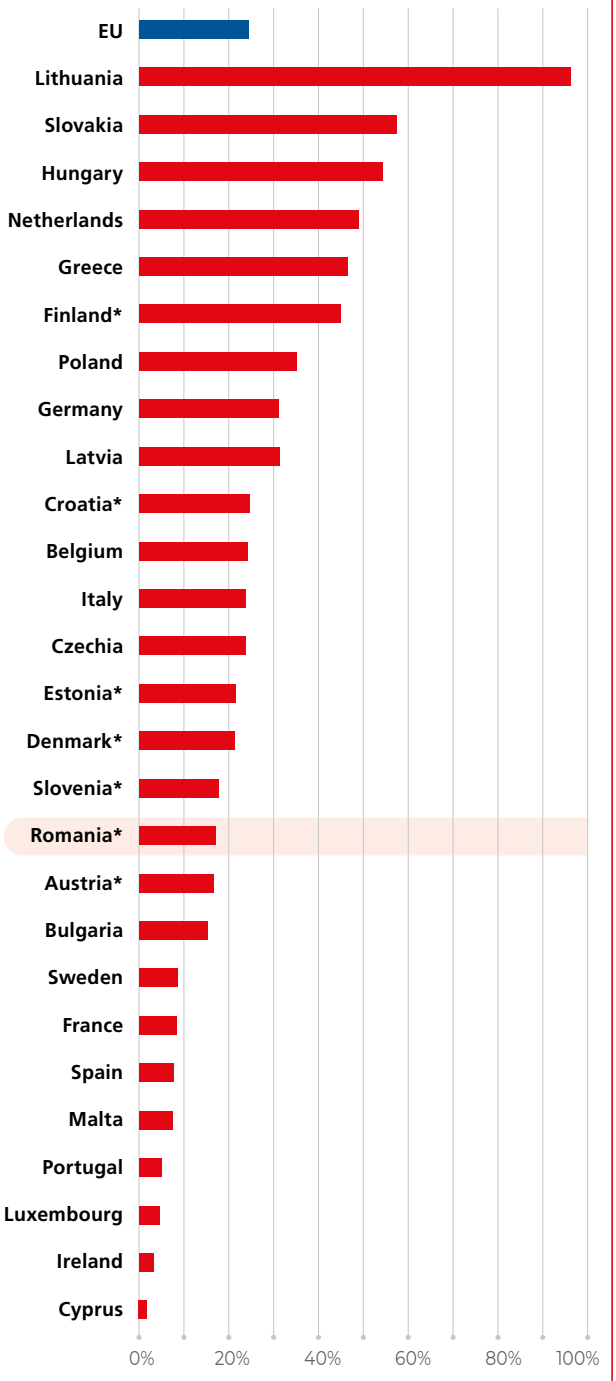
# ROMANIA

**by Corina Murafa**

# INTRODUCTION

Romania has been enjoying one of the most diversified energy mixes and low import dependencies in the European energy sector for years. While the carbon intensity of the economy has remained high, indigenous oil, gas, and coal resources have kept Russian import dependencies at relatively low levels – at 17 per cent on average. Oil dependency was slightly higher in 2020, the last year for which full data is available, at 37 per cent, while gas remained low at 15.5 per cent and coal even lower, at 11.8 per cent. While it was traditionally a net electricity exporter, in the past three years Romania turned into a net importer, yet no electricity was sourced from Russia. Consequently, the greatest consequence of the Russian invasion in Ukraine was not related to security of supply, but to price stability. While gas and electricity prices had been on the increase 3 to 6 months before the conflict, immediately in the aftermath of the invasion they rose dramatically and even quadrupled, as was the case with wholesale electricity prices. With low administrative capacity to properly target vulnerable energy consumers, the Government put in place a complex, volatile and very expensive price regulation system in all segments of the market. Supplier losses, forced to sell at end-user regulated prices (a cap) were offset by government compensations, covered through extraordinary levies raised on the windfall gains of electricity producers, irrespective of their fuel source. Despite not enacting any mandatory energy savings targets, the latest data indicate that final energy consumption decreased significantly, by up to 20 per cent in segments such as public lighting. Russian imports, particularly coal and gas, decreased dramatically, while market players also claim to have diversified oil and oil products supply sources. It is quite clear, nonetheless, that right before the embargos set in, significant oil imports from Russia were made. Renewables are advancing slower than expected, due to legislative unpredictability and low investor confidence. In international and European dialogue processes, Romania shows commitment towards renewables and hydrogen, while stressing the role of indigenous gas as a bridge fuel for transition and of nuclear energy as an important piece of the decarbonisation puzzle.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO EX ANTE

Romania has been taking great pride in its diversified energy mix and low import dependency in the energy sector. This has resulted in high energy resilience and security in the aftermath of the war in Ukraine.

In 2021 the energy mix stood as follows: oil and oil products (36 per cent), natural gas (30 per cent), coal and coal products (14 per cent), renewables (12 per cent), and nuclear (8 per cent).[1] In the same year, the electricity mix was: renewables, biofuels and biomass (48 per cent), nuclear (19 per cent), solid fossil fuels (17 per cent), and natural gas (16 per cent).[2] In precisely the month of February 2022, the electricity mix was as follows: natural gas (23.27 per cent), hydropower (21.87 per cent), nuclear (20.37 per cent), coal (16.16 per cent), wind (15.76 per cent), solar (1.32 per cent), and biomass (0.4 per cent).[3] According to the National Statistical Institute, in 2021 the energy dependency (a Sustainable Development Goal indicator in Romania) was 32.6 per cent, having increased gradually from 2016, when it stood at 21.6 per cent, to 23.9 per cent in 2017, 25.5 per cent in 2018, 25.7 per cent in 2019, and up to 30.5 per cent in 2020. Distinctly by fuel, the energy dependence in 2021 stood at 26.2 per cent for coal, 67.9 per cent for oil, and 25.4 per cent for gas. Gas had faced the sharpest increase, from merely 11.4 per cent in 2017 to 23.7 per cent in 2020 and 25.4 per cent in 2021, due to a reduction in internal natural gas production. During the same interval, while gas dependency more than doubled, gross internal natural gas consumption remained relatively steady.[4]

Traditionally a net electricity exporter, Romania has shifted in the past few years towards becoming a net electricity importer. In 2022 this switch has brought a trade deficit of over €640 million, as Romania imported approximately 1.3 TWh. Two thirds of the imported electricity originated in Bulgaria, while the most of the remaining amount came from Hungary. Small quantities were also imported from Serbia, Ukraine (about 4 per cent of the total electricity imported), and Switzerland.[5] On average, wholesale prices for imported electricity were approximately 10 per cent higher than exported electricity. 2022 was the fourth year in a row that Romania was a net electricity importer rather than an exporter, although quantities were approximately 50 per cent lower than in the previous year.

In February 2022, Romanian gas imports represented 29.18 per cent of its consumption (approx. 24 per cent from Russia and 4 per cent from other sources, namely the CEE markets, via the interconnector with Hungary), while domestic production stood at 70.82 per cent.[6]

Romania is one of the few EU countries with indigenous oil production (3,195 thousand tonnes in 2021, representing about 18 per cent of indigenous oil production in the EU27), covering approximately 30 per cent of its internal consumption. Consequently, it also has one of the lowest oil import dependency rates in the EU, of approximately 70 per cent, compared to about 92 per cent at EU level. In 2021, the latest year for which Eurostat data is available, Romania was importing 11,432 thousand tonnes of crude oil and oil products, out of which 3,745 thousand tonnes came from Russia – meaning that Russian imports totalled approximately 32 per cent of all of Romania's oil and oil products imports. Thus, from a total crude oil and oil products consumption of 20,530 ttoe in 2021, Romania had a Russian import dependency of 18 per cent. The rest of the crude oil and oil products imports were coming from mainly from Kazakhstan (slightly more than from Russia), but also Azerbaijan, Turkey and several EU countries (for oil products).

1 Source: Romania Energy Snapshot October 2022, available at https://energy.ec.europa.eu/system/files/2022-10/RO_2022_Energy_Snapshot.pdf (Last accessed 8 May 2023). Unfortunately, data on the overall energy mix is not available for the precise month of 2022 either on Eurostat or at the National Statistics Institute.

2 Source: Romania Energy Snapshot October 2022, available at https://energy.ec.europa.eu/system/files/2022-10/RO_2022_Energy_Snapshot.pdf (Last accessed 8 May 2023).

3 Source: National Energy Regulatory Authority, Monthly Electricity Market Monitoring Report (February, 2022), available at https://anre.ro/wp-content/uploads/2023/04/Monitfeb22.pdf (Last accessed 8 May 2023).

4 Source: Sustainable Development Goals indicators by National Statistical Institute, available at https://insse.ro/cms/files/Web_IDD_BD_ro/index.htm (Last accessed 8 May 2023).

5 Source: Economica.net, available at https://www.economica.net/comertul-cu-energie-electrica-ne-a-adus-un-deficit-de-640-de-milioane-de-euro-romania-este-importator-net-importam-scump-si-exportam-ieftin_648985.html (Last accessed 8 May 2023).

6 Source: Romanian Economic Monitor, available at https://econ.ubbcluj.ro/roem/ and National Energy Regulatory Authority Monthly Natural Gas Monitoring Report, February 2022, available at https://anre.ro/wp-content/uploads/2023/03/Raport-lunar-de-monitorizare-a-pietei-interne-de-gaze-naturale-pentru-luna-februarie-2022.pdf (Both last accessed on 8 May 2023).

As far as solid fuels are concerned, Romania also has a sizeable amount of its internal consumption covered from indigenous sources. In 2021, 89 per cent of the total inland consumption of 19,819 thousand tonnes was covered from indigenous production (17,733 thousand tonnes) and the remaining 11 per cent from imports. Out of the 1,611 thousand tonnes it imported, 1,024 thousand came from Russia (63 per cent). Thus, before the war, with regard to fossil fuels, Romania had an import dependency on Russia of about 5 per cent.

All in all, dependency on Russian energy imports for Romania, before the Russian invasion in Ukraine, was highest for natural gas (24 per cent in February 2022, according to data reported by ANRE), followed by crude oil and oil products (18 per cent in 2021, according to Eurostat) and solid fuels (5 per cent in 2021 according to Eurostat). Romania did not import any electricity from Russia.

According to earlier average yearly data that had comparatively assessed the Russian import dependency of EU Member States, in 2020 Romania had the following Russian import dependency rates (Figure 2).

It should be noted that these 2020 data are Eurostat estimates, due to a lack of clear statistical communication channels. They are also significantly different from the latest available data (see above) before the Russian invasion in Ukraine, either communicated to Eurostat or reported at national level. Thus, right before the invasion, Romania had a higher natural gas dependency and a lower coal dependency than in previous years, while oil dependency remained stable.

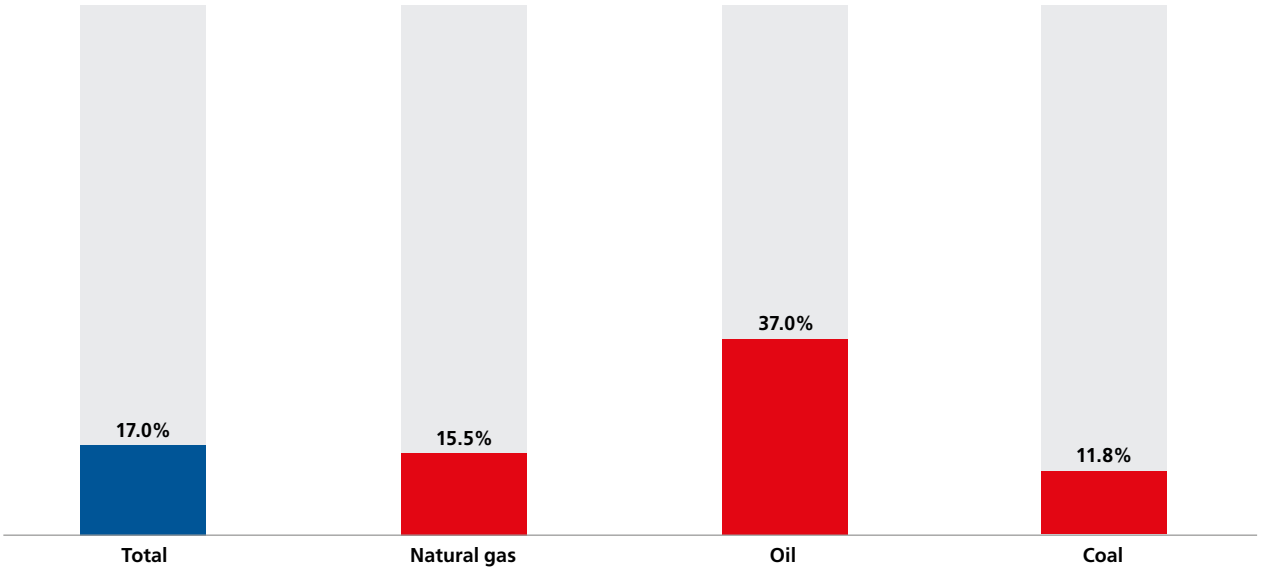
Romania's economy is definitely less based on electricity than the rest of the EU Member States. In 2021, out of the main fuel groups available for final consumption, electricity represented only 15 per cent, while oil and oil products were 35.9 per cent, natural gas 26.1 per cent, and renewables and biofuels 14.7 per cent. In the EU27, these percentages are slightly different, with electricity representing 20.8 per cent of the energy available for final consumption, oil and oil products 38.9 per cent, natural gas 21.9 per cent, and renewables and biofuels 10.7 per cent.

According to the National Statistics Institute, the primary energy production was divided between natural gas (7,425 toe), oil (3,232 toe), coal (3,006 toe) and electricity from hydropower, wind and solar (2,241 toe). While electricity from hydropower, wind and solar enjoyed a 6 per cent increase in the primary energy production from 2020, coal had an even steeper growth, at 16 per cent.

In 2021 final energy consumption increased by 7 per cent compared to the previous year. Out of 25,370 toe of final energy consumption, agriculture and forestry represented 2.2 per cent, manufacturing 26 per cent, transport 27 per cent, households 34 per cent and other branches of the economy 8.7 per cent.

Given the higher dependency on Russian imports with regard to natural gas and oil, the electricity production sector was hit least by the conflict in Ukraine; to a lesser extent, this also applies the services and manufacturing sector in general, as they are also quite reliant on electricity consumption. The same cannot be said about households, as many rely on gas for winter heating and, due to chronic underdevelopment of the railroad infrastructure, also on diesel cars and buses. However, as the Romanian electricity market is interconnected with the European one, the electricity price hikes on the European markets quickly reverberated in Romania, accentuating an increasing trend in electricity prices that had started about six months before the invasion, thus affecting households from multiple directions.

Figure 2
**Imports from Russia in gross available energy in 2020**



# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

Reducing import dependency had been a central element of national energy policy even before the Russian invasion. According to draft National Energy Strategy and public statements by Romanian officials, some of the main planned measures to reach this objective had been: the promotion of nuclear energy and further stimulating investments in new nuclear reactors, including SMRs (small modular reactors); encouraging indigenous gas production in the Black Sea; supporting the diversification of natural gas supply routes by encouraging the development of BRUA and the Southern Gas Corridor; and encouraging hydrogen development.

In summer 2023 wholesale electricity prices reached all-time highs, with prices on the local wholesale exchange being even higher than in Western Europe. Thus, in August 2022, wholesale electricity prices reached €490/MWh, then gradually dipped to €200/MWh in October 2022, only to increase again to €247/MWh in October 2022 (Source: Ember). Wholesale natural gas prices also started to increase gradually, from under €20/MWh in February 2021 to approximately €70/MWh immediately in the aftermath of the Russian invasion. Nonetheless, it should be noted that both electricity and natural gas wholesale prices had started their upward slope 3 to 6 months before the Russian invasion in Ukraine.

As mentioned in the first section, Romania enjoys significant domestic production, so the immediate concern was not related to security of supply, but to energy prices, particularly due to the price evolution which had begun to be worrisome even before the conflict. As a result, the government started a long series of subsequent legislative decrees capping prices for certain categories of consumers and compensating the suppliers through extraordinary levies on the excessive profits on the part of energy producers.

The first piece of legislation meant to address rising energy prices was issued on 18 March 2022 (EGO 27/2022). It capped end-user prices to 0.68 RON/kWh for households with an average monthly consumption below 100 KWh in the previous year, 0.8 RON/kWh for households with an average monthly consumption between 100 KWh and 300 KWh, and to a maximum of 1 RON/kWh for non-households. It also capped natural gas prices for the final consumer: to a maximum of 0.31 RON/kWh for households (irrespective of consumption levels) and to 0.37 RON/kWh for non-households with an average yearly consumption below 50,000 MWh and for heating producers delivering thermal energy to households. These price caps were supposed to last between April 2022 and March 2023. The system also entailed a fixed supply tariff and a mechanism for the compensation of suppliers for the price difference between the energy purchased on wholesale markets and the energy supplied to end-users at regulated prices. Other components of the price were also regulated. Romania took advantage of its privileged position as a natural gas producer and mandated all domestic producers to sell at a fixed price the gas quantities meant to be further sold to households (€30/MWh for direct household consumption and €50/MWh for gas meant to be processed in thermal power plants serving households). Furthermore, the Government also took advantage of its privileged position as a majority shareholder in electricity production companies to mandate by law that these companies answer to domestic suppliers' demands rather than export the electricity produced.

This mechanism was meant to be financed by an extraordinary levy of 80 per cent on power producers applied to the extra gains resulted from the extraordinary market circumstances. This extraordinary levy came on top of a levy enacted since 2013 on oil and gas producers that had benefited from market deregulation.

Soon after it was issued, ad hoc corrections started to be enacted and added to the scheme, sometimes at two-week intervals, demonstrating the low capacity of national public authorities to enact robust, data-driven policy measures and a low capacity to build public buy-in and stakeholder consensus. New categories were added to the scheme, so that they could benefit from the lowest cap (e. g., families with three children, single-parent families, clients who use medical devices, etc.). The cap got extended to all households, irrespective of consumption levels, but in a progressive fashion – i. e. the lower the consumption, the lower the cap. Nonetheless, even the highest household consumptions were capped at RON 1.3/kWh. More and more enterprises and large consumers were also added to the scheme, besides SMEs, such as public utilities operators, food industry players, public authorities, national research institutes, hospitals, churches, etc. – with most of them enjoying a cap at about RON 1/kWh (the approximate equivalent of 25 eurocents).

In December 2022 the scheme was extended until March 2025.

Ad hoc responses not related to prices, enacted from the very beginning (in EGO 27/2022 from March 2022) comprised obligations for gas suppliers to store, between 1 April 2022 and 31 October 2022, at least 30 per cent of the gas quantities estimated to be consumed by households.

Thus, by and large the main ad hoc response of the government was a re-regulation of all segments of the market, through a cap and compensation system, which included mandatory centralised electricity purchasing and which turned out to be quite costly. All in all, the system meant a public expenditure of approx. €2 billion in 2022 alone. At the same time, the government collected slightly more through the extraordinary levy paid by energy companies. The taxes that were collected fed not only suppliers' compensations, but also cash transfers not related to energy, directed at the lowest income citizens as a cushion for rising inflation.

At the end of 2022 a new tax was introduced, titled a "Solidarity Contribution", based on Council Regulation (EU) 2022/1854 of 6 October 2022 on an emergency intervention to address high energy prices. It was strongly opposed by industry, as they were claiming that the sector is already excessively taxed. Yet the government went ahead with it and changed it several times to ensure that all market players were covered. The destination of the levy is supposed to be new, low-carbon investments in the energy sector, but analysts and industry players fear it will only be used to cover the budget deficit. As a matter of fact, in spring 2023 it was amended in Parliament so that the money collected will be used for direct transfers to vulnerable consumers.

Evaluating the degree of success of the measures enacted depends on the success indicator used. Indeed, consumers were shielded from increased energy prices, but a fact-based targeting of vulnerable energy consumers was lacking. Energy demand reduction measures were also not enacted and as a matter of fact European Commission proposals in this direction were thoroughly rejected by national decision-makers, invoking national sovereignty over energy matters, the fact the energy consumption per capita is already low compared to the European average, well-being concerns for the citizens, etc.

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

Reduced dependency on Russian imports, as evidenced in section 1 above, meant that the practical impact of sanctions on the country's energy consumption and production were not drastic.

Additionally, the embargo on Russian oil and oil products came very late – the former in December 2022, the latter in February 2023. Market players had a lot of time to diversify supply sources. In the run-up to the oil embargo, Romania increased its oil imports by over 30 per cent (2022 compared to 2021), and approximately 35 per cent of the oil came from Russia. Over half of the oil imports in 2022 came from Kazakhstan and investments in oil pipes refurbishment to be able to bring in increased quantities from Kazakhstan (shipped via the Black Sea) also occurred in 2022. The 2022 ramp-up in oil imports supported players in avoiding a scarcity of oil and oil products in 2023 (as Romania still has significant local refining capacity). Oil refiners also adjusted their refining technologies to be able to process non-Russian oil. Despite the crisis, domestic production continued its decline (by 6 per cent in 2022 compared to 2021). Oil imports from non-traditional partners increased, namely from Tunisia and other North African countries, but also India as well.

Despite having low refining capacity for diesel and thus having to import diesel in significant quantities, Romanian oil and gas players diversified supply routes and sources for diesel too, and so far have been able to overcome the February 2023 embargo. Oil prices, despite remaining high, began to stabilise in the past six to eight months. What helped earlier in the year was a 20-cent rebate per litre, offered to all drivers in gas stations.

On the other hand, Romania was able to increase domestic gas production and, benefitting from a relatively warm 2022/2023 winter, managed to keep domestic consumption under control as well. A huge focus on storage throughout the warm season also helped. In November 2022 Romania had accumulated in underground storage three times more natural gas than in November 2021. Consumption also decreased under the same period analysed by 20 per cent. These cumulative factors (mild winter, focus on storage, lower consumption, etc.) helped imports reach all-time lows in January and February 2023.

While the full energy balance for 2022 has not yet been released by the National Statistical Institute (most likely the full picture for 2022 will be available in autumn 2023), the quarterly comparison between Q1/2022 and Q1/2023 is surprising.[7] While dependency on Russian imports was not negligible for coal either, good fundamentals for renewables, especially hydropower, decreased primary coal consumption by 20 per cent in the first three months of 2023, out of which the coal imports (all from Russia) decreased by almost 80 per cent. The aforementioned ramp-up in oil imports (from Russia before the embargo and from diversified sources after the embargo) became evident, as net oil consumption (including storage) increased by 18 per cent over Q1/2022, and oil imports by 28 per cent. Domestic natural gas consumption increased by 7.2 per cent, while imports decreased by over 70 per cent. Romania resumed its status as net electricity exporter, at least on a quarterly basis, with an increase in renewable and nuclear electricity production of 8 per cent. Coal and gas-fired electricity production decreased by 8 per cent, but so did wind-based electricity production (by 3 per cent) and PV (by 15 per cent). Hydropower instead skyrocketed, with a 40 per cent quarter-to-quarter increase in production. Final energy consumption decreased by almost 8 per cent, with the sharpest decreases being in public lighting (20 per cent) and in household consumption (15 per cent). While no mandatory saving measure was enacted for any market segment, not even for public institutions, local municipalities took voluntary measures; in addition, households and businesses, due to fear of high energy bills and well-orchestrated communication campaigns by private players, also managed to reduce their consumption.

All in all, despite not leading to the enforcement of any binding final energy consumption reduction targets in any market segment, consumers' behaviours shifted, and effective public policy at the level of public buildings administration led to significant energy savings. Domestic gas and coal production did not increase to make up for the lost imports from Russia, but instead renewables displaced coal; favourable weather conditions, combined with stricter storage obligations, led to a promising outlook for 2023. Wind and solar PV did not grow as expected, and the "saviour" of the national energy system turned out to be state-owned hydropower producer Transelectrica.

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7 Quarterly Q1 energy balance report for 2023 was issued by the National Statistical Institute on 15 May 2023, and is available at https://insse.ro/cms/sites/default/files/com_presa/com_pdf/energie03r23.pdf (Last accessed 15 May 2023).

Price regulation across the board kept end-user energy prices under control, but the price to pay has been significant: all gains from private players are feeding a complex and cumbersome cap and compensation system instead of being directed towards new investments in indigenous production, new technologies, and security of supply.

# 4

# MEDIUM- AND LONG-TERM ANSWER

In the medium-run, new supply sources have been identified for oil and oil products (North Africa, Kazakhstan, India) and while the not-so-secure Black Sea route is used for these imports, domestic oil pipelines and even cross-border ones (e. g. with Bulgaria) were reinforced to be able to support the diversification. While it is too early to tell, as full statistics are not public, plausible media reports are talking about high oil and oil products imports right before the embargos came into force. Still, positive structural changes did occur, such as transformations in several local refineries to be able to work with non-Russian oil. Gas supply diversification has not been so spectacular, yet notable developments did occur with the Southern Gas Corridor. With the onset of the conflict, Romania accelerated the finalisation of the domestic segment of the BRUA pipeline and also of the interconnectors with Bulgarian and Hungary. High-level diplomacy, particularly with Azerbaijan and Turkey, intensified and state-owned natural gas company Romgaz signed a Memorandum of Understanding with Azeri company SOCAR to import Azeri gas to Romania (approx. 1 billion cubic meters per year). Still, given Turkey's insatiable appetite for natural gas and the competition over Azeri gas from EU Member States much more dependent on Russian gas imports than Romania (i. e. Bulgaria), the actual import of such a vast quantity remains in question.

While there is still no officially adopted renewable energy strategy, and the National Integrated Energy and Climate Action Plan is still under revision, the Recovery and Resilience Plan (RRP) has oriented energy policy in Romania towards decarbonisation and intensification of electricity production from renewable sources. Hydrogen is favoured across the board and authorities are seeking to adopt a National Strategy for Hydrogen. At least at a discourse level, coal phase-out is still on the agenda with 2032 as end date for the closure of mines and thermal plants. Still, as 2024 is an electoral year (with local, parliamentary, presidential and European Parliament elections taking place in the same year) the most significant closure actions are planned for after 2025. What is nonetheless more worrisome is that, despite the EC-approved restructuring plans of Romania's largest coal mine and thermal power plant production complex, Complexul Energetic Oltenia, over a year ago, with coal-fired capacity scheduled to be replaced by gas-fired capacity and solar PV, no concrete steps towards the needed investments have been made to date. Romania has also announced a carbon neutrality deadline – 2050 – which means that financial incentives for renewables investments, as well as foreseen regulatory changes (e. g. contracts for difference) are planned. Nonetheless, political leaders still stress the importance of natural gas and nuclear energy as transition fuel, respectively as backbone of the electricity production system. As a matter of fact, Romania's negotiating positions at EU level comprised strong support for the inclusion of these energy sources in the EU green taxonomy. The prosumer movement was also incentivised and, despite the lack of new investments in large-scale wind and PV, over 500 MW were installed in the past two years by consumers (citizens, as well as businesses and public institutions and buildings).

According to RRP, Romania plans to install at least GW 6.9 additional capacities of electricity production based on renewable sources. By 2032, MW 4590 of coal capacity are expected to be phased out. By the end of 2023, MW 1500 based on renewable sources should be installed and another MW 2000 by 2025. Thus, Romania's target value for 2026 is to have an electricity production capacity of MW 7408 based on renewable sources. Unblocking large-scale private investments and not just CAPEX subsidies is essential for reaching such an ambitious target, yet progress is stalling. As the state continues to be a significant player in the electricity production sector, it tends to favour incumbents (the national nuclear company, the national hydropower company) including attempts at weakening and even breaching environmental legislation as to encourage these energy sources.

Encouraging prosumers through subsidies and potentially through new favourable conditions in legislation seems to be, at the moment, the main energy consumption reduction strategy in place, rather than focusing policies and incentives on demand-side response and management, building retrofitting, etc. Nonetheless, the Renovation Wave from the European level also made its way in the Romanian RRP, with €2 billion dedicated to retrofitting collective housing. At least until the NECP revision, given its mandatory savings targets, no significant savings/consumption reduction target is envisaged.

Long-term planning is not too distinct from the medium-term planning described above, with the exception being that it is now widely admitted that natural gas is only a bridge fuel. Nuclear energy is seen as the backbone of

choice and plans for building two new nuclear reactors in addition to small modular reactors are very much on the table. Natural gas supply diversification strategies comprise first and foremost exploiting indigenous natural gas in the Black Sea, followed by diversification of routes and sources, primarily around Caspian Gas (Azeri gas first and foremost). Several legislative initiatives aimed at stimulating hydrogen development are being debated and Romania is also competing in EU flagship initiatives in this area.

The Government recently published for consultation its Long-Term Strategy (LTS) for reducing carbon emissions. The document proposes a scenario of choice, according to which Romania aims at becoming climate neutral in 2050, reaching a 99 per cent net emission reduction in 2050, compared to the 1990 level. To reach this target, the interim 2030 target of 78 per cent emission reduction, relative to the 1990 level, is entering the stage. As far as the energy sector is concerned, the scenario is optimistic: "The decarbonisation of the energy sector has already started, and in 2019 69 per cent of the 2050 goal was already achieved. By 2035, 98 per cent of the goal will have been achieved." However, other fields are much more difficult to address. One case in point is transport, where emissions need to stop increasing and come down at an accelerated rate. The same scenario is valid for buildings, where emissions are poised to increase slightly by 2025, and then to start decreasing drastically. In this scenario, the RES share in the gross final energy consumption should reach 89.9 per cent in 2050 and 36.3 per cent in 2030. Even in this capacity new nuclear capacities are envisaged and all new CCGT and CHP plants are expected to be ready for green hydrogen by 2036.

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

Romania is expected to continue to advocate for hydrogen-ready natural gas infrastructure as bridge fuel and for nuclear energy as a decarbonisation tool. Depending on the number and magnitude of European allies in this positioning, it may gradually weaken its positioning, particularly if the Black Sea natural gas is not being given a green light with a final investment decision by summer 2023 or 2024. Low administrative capacity may hamper the rapid deployment of renewables but at least now, in contrast to a couple of years ago, the vision and willingness to move in this direction are present.

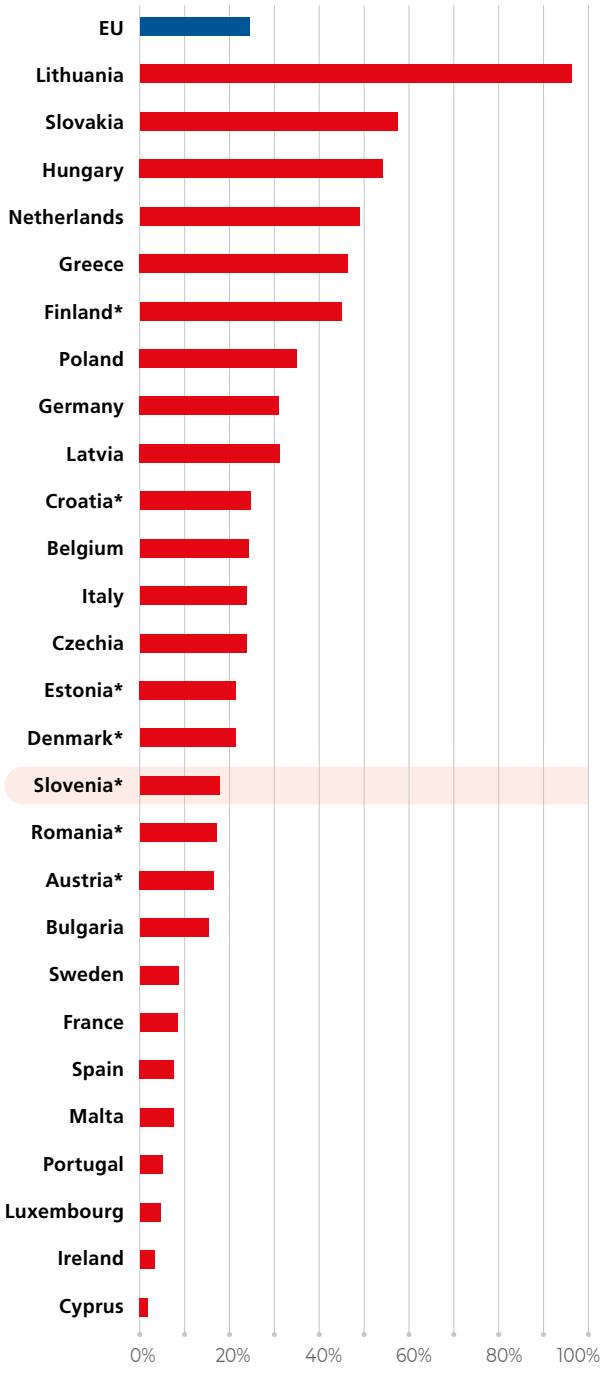
# SLOVENIA

by Tomislav Tkalec

# INTRODUCTION

As a result of the crisis in Ukraine, Slovenia experienced: high energy prices; increased risk due to its high, nearly 50 per cent energy import dependence, which reached 100 per cent dependence in the case of petroleum products and gas; and reduced energy security and reliability. Prior to the crisis, the dependence on Russia for natural gas stood at 80 per cent, while for petroleum products it was approximately 25 per cent. Numerous systemic and sectoral measures implemented by the government after the crisis have reduced this dependency, and a new strategic supply of natural gas has been secured from an African country. In recent months, the government has been focusing primarily on developmental and long-term measures in the energy sector to ensure a reduction in its vulnerability to similar risks in the future.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO ANTE (AS OF FEBRUARY 2022)

An overview of the Slovenian energy sector and energy use as of before February 2022 indicates that its energy mix, expressed as the share of fuels in gross available energy, was dominated by fossil fuels. In 2021, oil accounted for the highest share of Slovenia's gross inland energy consumption, followed by nuclear, renewables, coal, and natural gas, as seen in Figure 2 below.

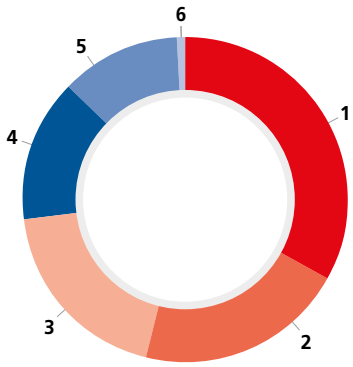
When it comes to final energy consumption, again oil and petroleum products have the highest share, followed by electricity, as seen in Figure 3.

The dominant sector in the energy consumption structure is transport, accounting for a share of 38 per cent. It is followed by the industry sector at 27 per cent, households at 23 per cent, and other use (agriculture, service sector, and other) with a combined share of 11 per cent (IJS CEU and other 2023). In 2021 Slovenia's energy supply per capita was 3.11 toe/capita, and final energy consumption per capita was 2.29 toe/capita (SURS 2023).

Slovenia's electricity generation still relies on coal, representing 25 per cent of the electricity mix in 2021. However, re-

Figure 2
**Share of fuels in gross available energy in Slovenia, for 2021, in %**

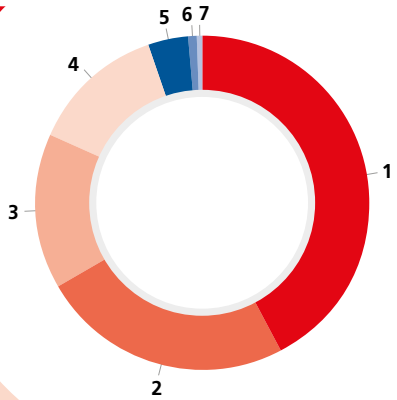
| | Fuel type | Share |
|---|---|---|
| 1 | Oil and petroleum products | 33.3% |
| 2 | Nuclear heat | 20.6% |
| 3 | Renewables and biofuels | 19.2% |
| 4 | Solid fossil fuels | 14.3% |
| 5 | Natural gas | 11.8% |
| 6 | Non-renewable waste | 0.8% |




Source: Eurostat, 2023

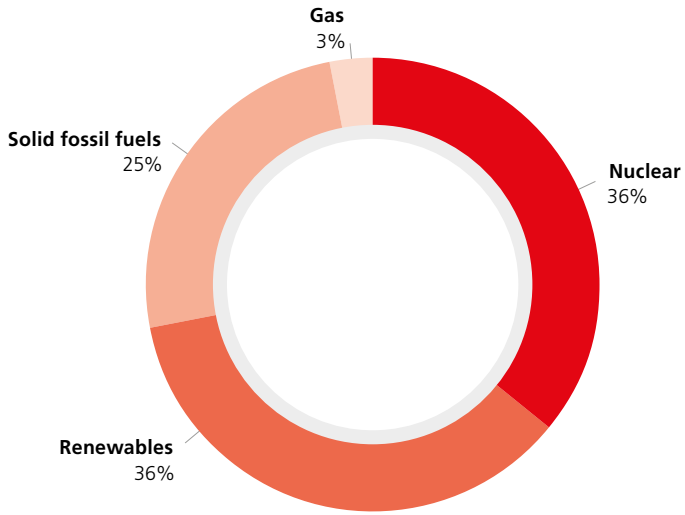
Figure 3
**Share of fuels in final energy consumption in Slovenia, for 2021, in %**

| | Fuel type | Share |
|---|---|---|
| 1 | Oil and petroleum products | 42.4% |
| 2 | Electricity | 24.3% |
| 3 | Renewables and biofuels | 15.1% |
| 4 | Natural gas | 12.9% |
| 5 | Heat | 3.9% |
| 6 | Non-renewable waste | 0.9% |
| 7 | Solid fossil fuels | 0.4% |



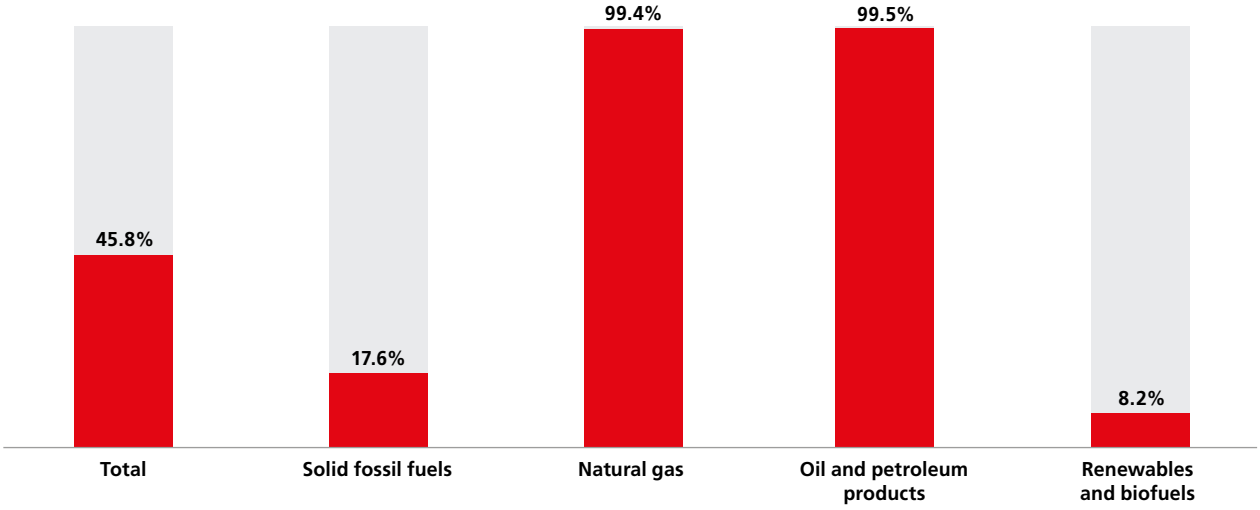

Source: Eurostat, 2023

Figure 4
**Share of fuels in electricity generation mix in Slovenia, for 2021, in %**



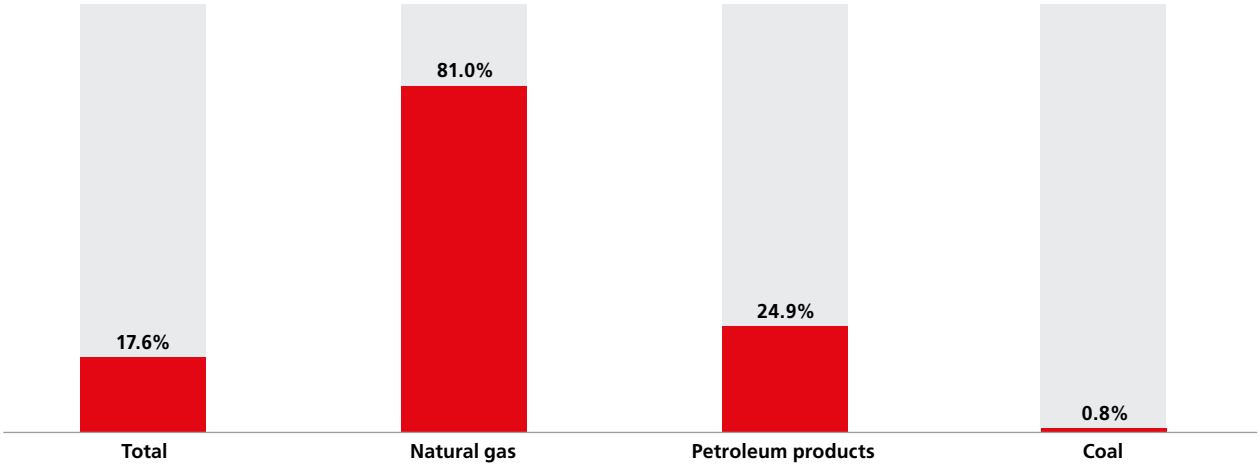

Source: Eurostat in European Commision 2023

Figure 5
**Share of net imports in the gross available energy in Slovenia, for 2020, in %**




Source: Eurostat 2023

Figure 6
**Imports from Russia in gross available energy in Slovenia, for 2020, in %** (including Eurostat estimates)




Source: Eurostat 2022

newable energy sources constituted 36 per cent of the electricity mix, with hydro power alone contributing 31 per cent. The remaining 36 per cent was generated by the Krško nuclear power plant (Figure 4).

In 2020, Slovenia satisfied 54 per cent of its energy needs with domestic energy sources. The remaining required quantity was supplied through imports, with the supply of petroleum products and natural gas entirely dependent on imports. Figure 5 shows Slovenia's import dependency in 2020.

Before Russia's invasion of Ukraine, Slovenia depended heavily on Russia as its main supplier of natural gas, either directly (14 per cent) or through Austria (85 per cent) (European Commission 2023). While there are no clear data on Slovenia's import of fuels from Russia, on the basis of the Eurostat assumptions that approximately 80 per cent of imports from Austria are assumed to be from Russia, this would mean that in 2020 more than 80 per cent of natural gas and approximately 25 per cent of petroleum products were imported from Russia, as shown in Figure 6. This data shows how important imports from Russia were in the country's overall energy mix.

In Slovenia gas is used mainly in the industry sector, which in 2021 accounted for 62.3 per cent of overall gas consumption, followed by the energy sector (19.7 per cent), while households' share of gas consumption was only 14.5 per cent, services and public sector 2.9 per cent, and the transport sector only 0.6 per cent (Eurostat in European Commission 2023).

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

Since the beginning of the crisis in Ukraine, the government has implemented certain systemic and sectoral measures in the field of energy due to the increase in electricity prices and high import dependency in certain key energy sectors. To mitigate the consequences of high energy prices and limit the damage to consumers and the economy, newly adopted "crisis" laws introduced temporary measures to reduce import dependency in energy supply, increase energy production from renewable sources with additional assistance aid, and implement price controls for energy and fuels. Two additional laws were adopted to provide assistance to the economy. The state was providing financial support to companies by co-financing their costs of electricity and natural gas in 2022. The assistance to the economy for 2023 includes subsidising the high prices of electricity, natural gas, and process steam, subsidising two measures to preserve jobs, and implementing measures to ensure the liquidity of companies (Ministry of the Environment, Climate and Energy 2023a).

A Guarantee Law for energy companies was adopted in order to ensure uninterrupted gas supply. The main purpose was to ensure reliable access for eligible energy companies to short-term liquidity working capital needed to cover short-term extreme liquidity pressures. Three companies were eligible for state guarantees, with a total cap of €1.2 billion (Ministry of the Environment, Climate and Energy 2023b).

For end users, especially households, several other measures were put in place. Amendments of the Gas Supply Act in September 2022 ensured the right to basic gas supply for all households and provided mandatory and alternative gas supply to all protected consumers. By adopting the Law on an Urgent Measure in the Field of Value Added Tax to Mitigate the Increase in Energy Prices, the standard VAT rate for all electricity consumers, natural gas consumers, district heating users, and purchasers of firewood was reduced from 22 per cent to 9.5 per cent for the period from 1 September 2022 to 31 May 2023. Additionally, for natural gas and electricity, the excise duty was temporarily reduced by half, and for electricity, the contribution for RES was further reduced by half (Ministry of the Environment, Climate and Energy 2023a).

Estimates indicate that, due to the implemented measures, households and other small end users achieved savings of approximately 15–30 per cent on electricity costs (Ministry of the Environment, Climate and Energy 2023c) and between 10–37 per cent on natural gas costs (Ministry of the Environment, Climate and Energy 2023d).

Since 21 June 2022, a regime of regulated margins for traders of petroleum products outside highways has been introduced in Slovenia, while a liberalised regime for setting prices of gasoline and diesel fuel on highways is still in place. The key objective of this measure was to eliminate uncertainty for the economy and consumers. The state has also temporarily waived the environmental tax ($CO_2$ levy) on diesel fuel, gasoline, heating oil, and natural gas until 9 May 2023. The contribution for renewable sources is exempted from the price of diesel fuel and gasoline outside highways and for diesel fuel at highway fuel stations (Ministry of the Environment, Climate and Energy 2023e).

Due to the increasing social hardship faced by the population, the Act on Temporary Measures for Mitigating the Consequences of Energy Costs for the Most Vulnerable Population Groups was adopted. The law provided payment of an energy supplement to recipients of monetary social assistance and protective supplement. The amount of the one-time energy supplement was €200 for single individuals and disabled persons, and €314 for families, with an additional €118 for each child in the family (Ministry of the Environment, Climate and Energy 2023f).

Also note that the government has for the first time adopted measures and recommendations for efficient energy use in buildings within the public sector, as well as recommendations for energy conservation in households.

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

Historically, Slovenia has relied almost entirely on Russian natural gas imports, both directly and indirectly. However, in 2022, Slovenia managed to secure alternative supplies from Algeria via Italy, which were adequate to meet approximately one-third of the country's annual consumption. These alternative supplies amounted to 0.3 billion cubic meters (bcm) or roughly one-third of Slovenia's total natural gas supply, which reached 0.92 bcm in 2021 (European Commission 2023).

Between August 2022 and March 2023, Slovenia achieved a 13.8 per cent reduction in gas consumption compared to the previous five-year average. These gas demand reductions were made possible through the implementation of measures that encouraged consumers, particularly large consumers, to voluntarily limit their gas consumption and transition to alternative fuels.

The decision of the European Union to ban the import of Russian oil starting from December 2022, and subsequently, the import of petroleum products starting 5 February 2023, has triggered a significant redirection of oil flows. Slovenia does not import crude oil as it does not have its own refinery. However, statistics show that before the sanctions on petroleum products came into effect, there was a substantial increase in their import from Russia. Calculations based on data on the import of petroleum products by Slovenian companies, published by the Statistical Office of the Republic of Slovenia, indicate that the share of Russian oil was 6 per cent in 2021, and by October 2022 it had increased to 13 per cent. In addition to the traditional flows from the Mediterranean region (via Greece and Italy), the import of oil from Saudi Arabia also significantly increased last year. This could potentially replace the Russian shortfall in the long term (Lončar 2023).

Slovenia imports half of its primary energy from abroad, making developments in external energy markets crucial for energy supply competitiveness in Slovenia. Given that Slovenia imports 100 per cent of its liquid fuels and natural gas, it is fully dependent on the uncertainties of oil and gas prices in global markets.

Due to established measures to reduce dependency on Russian energy resources and Russia's decision to reduce gas flow to the EU, the price of natural gas has increased, leading to the most significant energy crisis in decades (IJS CEU et al. 2023). Higher gas prices continue to have a significant impact on gas-intensive manufacturing sectors, including basic metals, chemicals, paper, and paper products. Therefore, it remains a priority to take further actions to ensure supply security by continuing efforts to diversify away from Russian fossil fuels and reduce overall dependence on fossil fuels (European Commission 2023).

The Slovenian electricity market is at the intersection of three major European markets: the German-Austrian, Italian, and Southeast European markets, which also have the greatest influence on electricity prices in Slovenia. In the first half of 2022, electricity prices in the EU were 30 per cent higher compared to the previous year, mainly due to the increased price of natural gas. Considering recent events, future electricity prices are even more unpredictable, particularly due to efforts to reduce dependence on imported natural gas (IJS CEU et al. 2023).

An additional complicating factor was the constrained supply of domestically produced coal from the Velenje coal mine, which resulted in the temporary shutdown of the Šoštanj thermal power plant in late 2022. This situation coincided with the scheduled maintenance of the Krško nuclear power plant. Consequently, there was a substantial decrease in domestic electricity generation, necessitating increased reliance on electricity imports for Slovenia.

# 4

# MEDIUM- AND LONG-TERM ANSWERS

Slovenia is currently preparing an update to the National Energy and Climate Plan (NECP), which outlines the direction of energy policy development, the long-term energy scenarios and the set of energy and climate targets for GHG emission reduction, RES share, and energy savings for the year 2030. As this plan is in preparation after the start of the Ukrainian crisis, it incorporates and enhances core principles that resulted from this situation and are focusing on secure, reliable, and competitive energy supply.

The draft update of the NECP indicates that Slovenia sets its goals within the framework of contributing to achieving the EU's net-zero greenhouse gas emissions by 2050, which serves as a basis for planning objectives, policies, and necessary measures until 2030. The phase-out of coal is planned by no later than 2033.

The further development of the energy sector in Slovenia will require coordinated actions in the technological, legislative, economic, and social domains with the aim of reducing energy needs, decreasing import dependency, increasing diversification (of sources, technologies, production locations, supply routes, etc.), and energy storage, as well as managing risks and emergency situations in energy markets (IJS CEU and other 2023).

## FUTURE ENERGY MIX

In the draft update of the NECP, under the scenario that includes additional measures, which follows two different paths after the year 2030 (100 per cent RES and RES + nuclear), the following energy supply is projected for the year 2030, as seen in Table 1 for gross available energy and in Table 2 for final energy consumption. Oil and petroleum products will remain their highest shares, although slightly lower than in the year 2021, while the share of renewables will slightly increase. Also, hydrogen and synthetic fuels will be added to the fuel types used in 2023 in comparison to 2021.

## ENERGY SUPPLY AND DIVERSIFICATION STRATEGIES

Energy security, primarily due to the energy crisis, is now at the forefront of the NECP (National Energy and Climate Plan) renovation. Ensuring a reliable and competitive energy supply is set as one of the key objectives. In the case of electricity, these objectives translate into ensuring an adequate level of supply reliability, which means at least 85 per cent of electricity supply from domestic generation by 2030 and 100 per cent by 2040, as well as continuing the utilisation of

Table 1
**Share of fuels in gross available energy in Slovenia, for 2030**
(in %, as planned in the scenario that includes additional measures in the draft update of the Slovenian NECP)

| Fuel type | Share |
|---|---|
| **Oil and petroleum products** | 26.42% |
| **Nuclear heat** | 23.76% |
| **Renewables and waste** | 27.34% |
| **Solid fossil fuels** | 10.82% |
| **Gas** | 13.31% |
| **Hydrogen** | 0.56% |
| **Synthetic fuels** | 0.85% |
| **Electricity import** | –2.18% |

Source: IJS CEU and other 2023

Table 2
**Share of fuels in final energy consumption in Slovenia, for 2030**
(in %, as planned in the scenario with additional measures in the draft update of the Slovenian NECP)

| Fuel type | Share |
|---|---|
| **Oil and petroleum products** | 35.32% |
| **Electricity** | 29.31% |
| **Renewables and waste** | 18.46% |
| **Gas** | 12.49% |
| **Heat** | 3.58% |
| **Hydrogen** | 0.75% |
| **Solid fossil fuels** | 0.09% |

Source: IJS CEU and other 2023

nuclear power and making a transparent decision on the construction of a new nuclear power plant no later than 2027 (IJS CEU and other 2023).

Regarding gas, the plan includes further development of the natural gas pipeline system in line with changing gas flows, including new gas sources from RES and waste, also domestically produced. Given the altered geopolitical conditions in the eastern supply corridors since February 2022 and the EU's measures to reduce exposure to eastern supply sources, a priority is given to increasing transmission capacity at the border point with the Italian transmission system. Only about 30 per cent of natural gas is delivered to end consumers through the distribution network, which exists in 83 out of 212 local communities. The future development of existing and new gas distribution networks depends primarily on the ability to ensure supply of renewable replacement gases (IJS CEU and other 2023).

The NECP foresees the preparation of the system for the introduction of hydrogen in line with gas flows and system capabilities, as well as the introduction of hydrogen. In the long term, the focus will be primarily on hydrogen production through electrolysis of water, utilising surplus electricity from RES (sector coupling) (IJS CEU and other 2023).

## RENEWABLES

Slovenia lags behind in terms of deploying renewables. Slovenia reached its 2021 renewable energy sources target by using the EU mechanism of cross-border cooperation in line with Directive 2018/2001/EU (statistical transfers). The draft update of NECP sets a target value of at least 30–35 per cent share of RES in final energy consumption by 2030 (IJS CEU et al. 2023).

The country needs to significantly increase efforts in deploying renewable energy installations, streamline the procedures for obtaining permits, and putting more investments in the distribution grid and energy storage infrastructure for the uptake of renewables (European Commission 2023). There is a particular emphasis on solar energy, with advancements in wind energy utilisation also expected by 2030. Geothermal energy utilisation and biomass use are envisioned primarily for heating purposes.

## ENERGY EFFICIENCY AND DEMAND REDUCTION

The NECP foresees the accelerated improvement of energy and material efficiency in all sectors as a key factor for successfully overcoming the energy crisis and achieving effective implementation of the green agenda based on the principle of "energy efficiency first". This is a prerequisite for a successful and competitive transition to a climate-neutral society (IJS CEU et al. 2023).

As a consequence of soaring gas prices, it is crucial to tackle the industry sector's high energy and carbon intensity through the implementation of energy efficiency policies and investment measures. Although energy prices have declined, uncertainties persist for the upcoming winter, emphasising the need for ongoing endeavours to structurally reduce gas demand.

## NUCLEAR ENERGY

In recent months the government, primarily with the energy crisis in mind, has announced a serious consideration of the construction of a second unit at the Krško nuclear power plant and expressed support for the long-term use of nuclear energy. However, it still insists on holding a referendum, which will take place when sufficient data and information about the project are available for an informed decision-making process. It is anticipated that the updated NECP will clearly and decisively outline the long-term use of nuclear energy (UMAR 2023).

# 5

# CONCLUSION

Slovenia responded to the energy crisis by implementing an extensive set of mitigating measures that have addressed the issues fairly successfully but with a significant impact on the state budget. The past 15 months have placed the trilemma of energy security, reliability, and competitiveness at the forefront of energy policies. As a result, in addition to RES and energy efficiency, nuclear energy has come to the forefront in Slovenia in recent months, with increasing support. While the government is shifting towards more development-oriented and long-term measures in energy policies, Slovenia still needs to address short-term challenges and barriers to adequately develop its RES potential and strive to achieve the target of increasing the share of RES in final energy consumption by 2030. These challenges primarily include spatial planning issues, lengthy procedures, and the upgrade of the power grid.

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**Ministry of the Environment, Climate and Energy,** (2023b). Vlada določila predlog poroštvenega zakona za obveznosti družb GEN energijo, HSE in Geoplin (The government has proposed the Guarantees Act for the obligations of GEN energija, HSE, and Geoplin companies). https://www.energetika-portal.si/nc/novica/n/vlada-dolocila-predlog-porostvenega-zakona-za-obveznosti-druzb-gen-energija-hse-in-geoplin/

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# SLOVAKIA

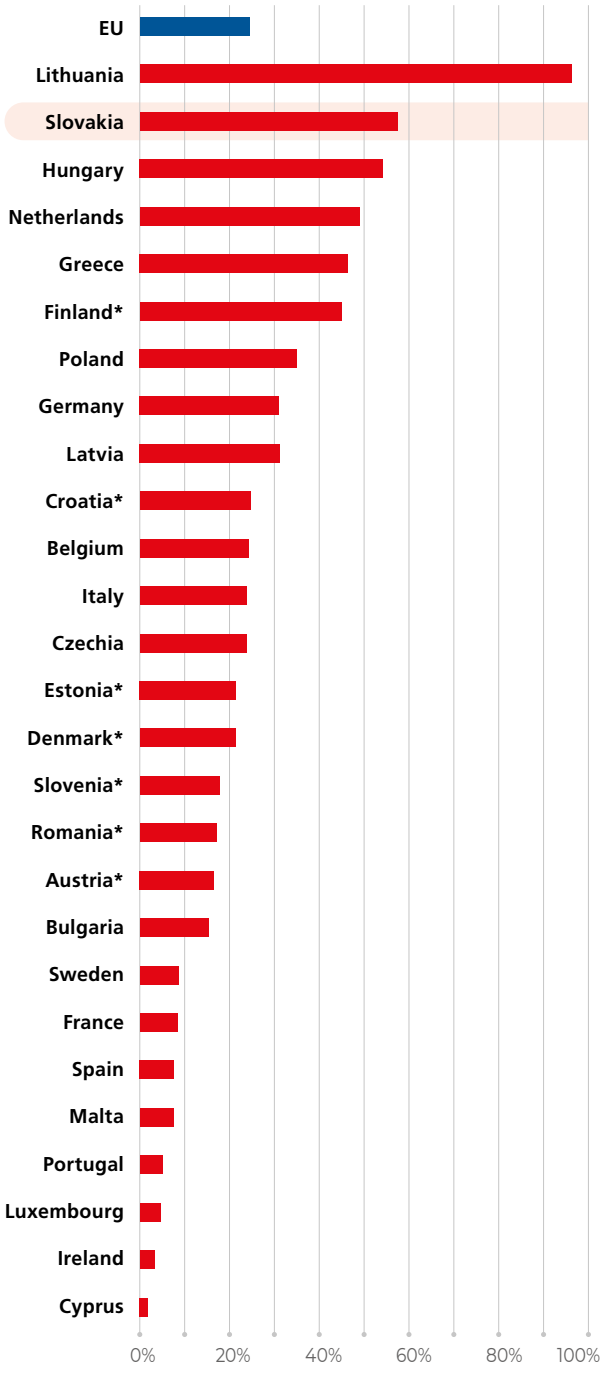
by Veronika Oravcová

# INTRODUCTION

Before the outbreak of Russian invasion in Ukraine in February 2022 Slovakia was fully dependent on Russian energy imports. Slovakia was almost 100% dependent on Russian imports of natural gas, oil, and nuclear fuel. The country also imported Russian coal, accounting for around one third of solid fuels imports. After the invasion Slovakia began to diversify its natural gas suppliers, and so far it has succeeded in substituting around one third of Russian gas. In February 2022 Slovakia contracted the first LNG import. Diversification efforts have continued, and the country has concluded several new contracts with different suppliers. Coal is important, especially for Slovak industry (US Steel), which already ended Russian coal supplies in April 2022.

In the case of oil and nuclear fuel, the country was less successful. Slovakia still processes Russian oil at the Slovnaft refinery and imports nuclear fuel from the Russian company TVEL. However, both sectors have been adjusting their use to other than Russian sources. Slovnaft is trying to decrease its dependence on Russian oil by up to 60% in 2023 and has been adjusting its technologies for processing different types of oil. The substitution of Russian nuclear fuel is more complicated due to certification processes; however, by the end of the year the company Slovenské elektrárne, which operates nuclear power plants, will have launched a tender for new suppliers.

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# SLOVAKIA'S ENERGY SYSTEM BEFORE FEBRUARY 2022

The energy sector in Slovakia relies especially on natural gas, oil, and nuclear power (see Table 1). Domestic production of oil and natural gas are negligible and the country imports these sources through the Druzhba and Brotherhood pipelines. The main domestic sources of energy are renewables (dominated mainly by biomass and hydro production) and brown coal. As for the degree of dependence on third countries, Slovakia is highly dependent on all the main energy sources, with Russia being the main supplier: before the outbreak of full-scale war, Slovakia imported nuclear fuel, natural gas, and oil from Russia.

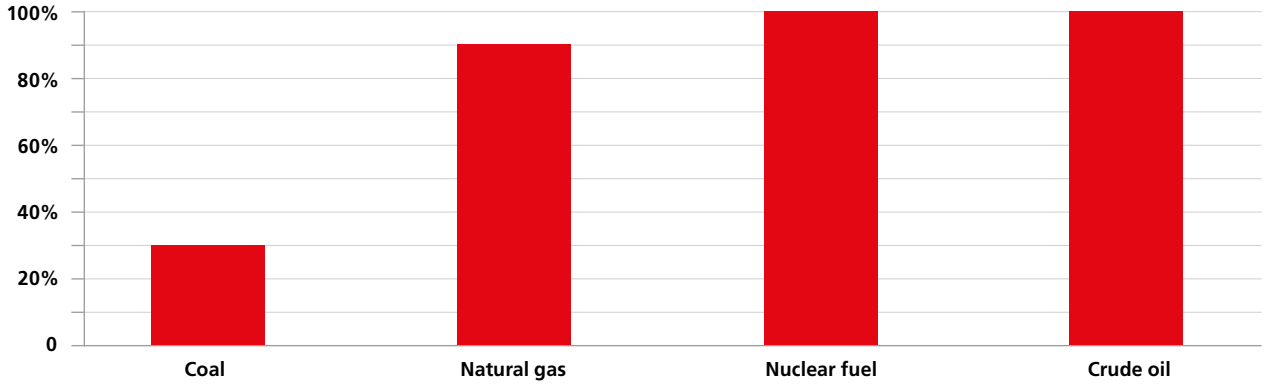
Coal is used especially in industry (steel production), but also electricity generation and the heating sector. The country is heading towards a coal phase-out, as in 2023 state subsidies for the production of electricity from domestic coal will end, which basically also means the end of coal mining in Slovakia.

Oil is crucial not only for the transport sector, but also for industry (see Figure 3).

Oil deliveries are provided by Russia.[1] Slovakia has one refinery – Slovnaft – located in the capital city, Bratislava, producing a range of products, mainly motor fuels, for domestic consumption and for export to neighbouring countries (es-

1 Integrated National Energy and Climate Plan for 2021 to 2030 (2019). European Commission: https://energy.ec.europa.eu/system/files/2020-03/sk_final_necp_main_en_0.pdf

Figure 2
**Imports from Russia in energy supply before the war (2021)**



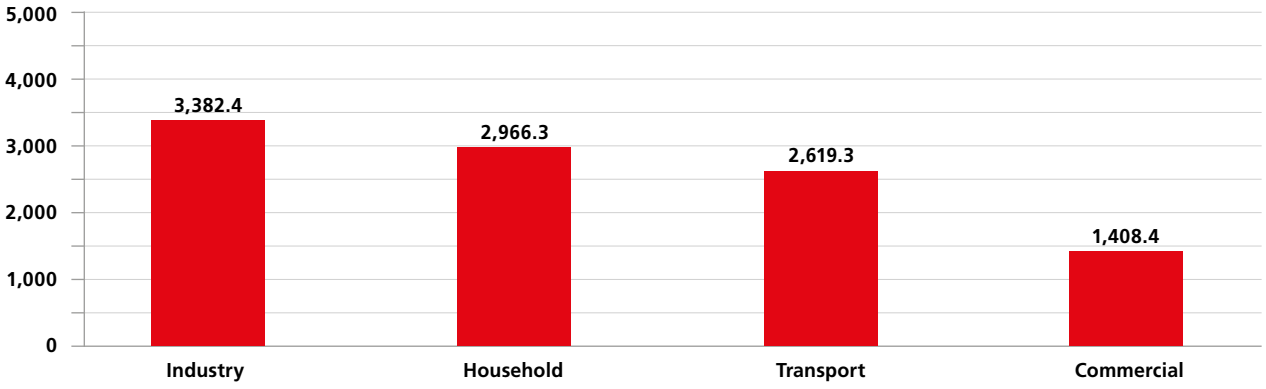

Source: Statistical Office of the Slovak Republic, Eurostat

Table 1
**Total energy supply by product (2021; in ktoe)**

| | | |
|---|---|---|
| **Natural gas** | 4,551.1 | 26% |
| **Nuclear** | 4,051.1 | 23% |
| **Oil and petroleum products** | 3,714.4 | 21% |
| **Solid fossil fuels** | 2,823.3 | 16% |
| **Renewables and biofuels** | 2,325.1 | 13% |
| **Non-renewable waste** | 273 | 1% |

Source: Eurostat

Figure 3
**Final energy consumption by sector (2021; in ktoe)**




Source: Eurostat

pecially Czechia). Slovnaft has been part of the Hungarian MOL Group since 2004. Slovakia is also dependent on natural gas imports and has very limited domestic production that covers around 1% of overall consumption. Domestic production has been gradually falling. The bulk of gas consumption is mostly used for heating and electricity generation in the steel and iron industries, and also as a feedstock in the chemical and petrochemical industries. Currently, around three quarters of Slovak municipalities are connected to the gas infrastructure, which accounts for more than 94% of all inhabitants of Slovakia. Gas is the predominant heating source in more than 1.48 million apartments, which accounts for 66.2% of all apartments, while over 68% of houses are connected to the gas infrastructure.[2]

Nuclear is the most important source in electricity generation (see Figure 4). Nuclear power plants are located at two sites, in Mochovce and Jaslovské Bohunice. Two blocks of the Mochovce power plant were put into operation in 1998 and 1999 with an anticipated lifetime of 50–60 years. Blocks of the Bohunice V2 power plant were put into operation in 1985 and 1986 and should be operational by 2045. The Bohunice power plant also supplies heat to nearby towns. In 2023, block 3 of the Mochovce power plant was completed and put in operation[3] and currently block 4 is planned to be commissioned. After putting block 4 into operation Slovakia will have six nuclear blocks with a total installed capacity of 2,880 MW.

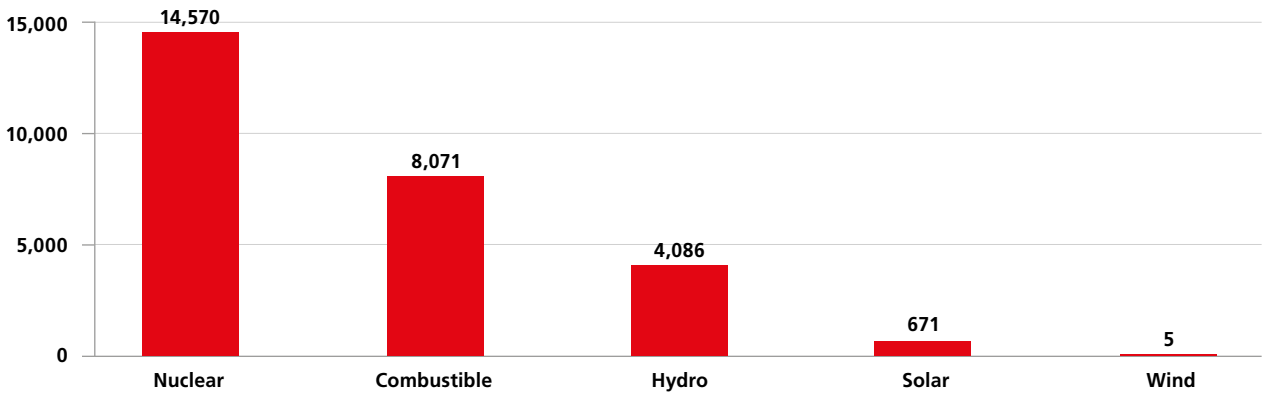
For nuclear fuel, Slovakia is dependent on Russia. In 2018, Slovenské elektrárne company (which operates nuclear power plants) signed a contract for the supply of nuclear fuel with Russian company TVEL. The contract is valid for the 2022–2026 period, with the option of extension to 2030, and allows programmes for the introduction of nuclear fuel from alternative suppliers. American Westinghouse was also part of the tender, but it offered a higher price and therefore the TVEL company was chosen. Price was the main criterion of the tender and aspects of energy security have not been considered and addressed properly.[4]

2 Plyn ako prevažujúci zdroj na vykurovanie využíva 66,2 percenta bytov (2022). Trend: https://www.trend.sk/spravy/plyn-ako-prevazujuci-zdroj-vykurovanie-vyuziva-66-2-percenta-bytov

3 Tretí blok Mochoviec zvýšil výkon na 35 % (2023). Slovenské elektrárne: https://www.seas.sk/tlacove-spravy/treti-blok-mochoviec-zvysil-vykon-na-35/

4 M. Hudec, Expert na jadrové elektrárne: Pri dodávateľovi paliva by sme sa nemali dívať len na cenu (2022). Euractiv: https://euractiv.sk/section/energetika/news/expert-na-jadrove-elektrarne-pri-dodavatelovi-paliva-by-sme-sa-nemali-divat-len-na-cenu/

Figure 4
**Net electricity production (2021; in GWh)**




Source: Eurostat

The role of coal in the overall energy mix has been gradually decreasing. Domestic production in the Upper Nitra region does not cover coal demand, domestic coal is uncompetitive, and the sector is highly dependent on state subsidies, which are to end in 2023. As for coal-fired power plants, the Nováky power plant (Upper Nitra region) and the Vojany power plant (Eastern Slovakia) are currently in operation. The Upper Nitra region is a mining region that has been included among the 14 pilot regions across the EU that are to undergo transition towards a post-coal economy and has also become part of the Just Transformation Mechanism. Support for electricity generation from coal and lignite will be abolished in accordance with the Action Plan for the Transformation of the Upper Nitra Coal Region approved by the Slovak Government in 2019. The Nováky power plant, after its transformation from solid fossil fuels, will remain the primary heat source for the region. In the case of the Vojany power plant, its transformation towards using solid secondary fuel is being considered, along with support for the circular economy in the region. Since 2009 biomass in form of wood chips has also been added to the fuel supply.[5]

Renewables are dominated by biomass that is crucial in the heating sector, and hydro, which is a key renewable energy source in electricity generation. The country is lagging behind in the development of wind energy (having only five turbines), solar, and geothermal as well (see the final section below for a more detailed discussion). According to Eurostat data, the share of energy from renewable energy sources stood at 17 % in 2021.

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5 Vojany power plants (2022). Slovenské elektrárne: https://www.seas.sk/elektraren/elektrarne-vojany/

# 2

# AD HOC RESPONSES AFTER FEBRUARY 2022

Russia's invasion of Ukraine in February 2022 revealed the vulnerability of the Central European region in the energy sector, while two problems have been fully exposed: first, dependence on third countries in energy (which was the case of Slovakia) and second, a more intense use of domestic fossil fuels undermining the EU climate goals (for instance Poland). The immediate reaction of the EU and its member states was unprecedented diversification, especially in the gas and oil sectors. Currently, there is a strong need to further diversify existing energy routes and suppliers, but it is important to focus on decarbonisation and energy efficiency measures. The Russian invasion of Ukraine highlights the need to decouple not only from Russian energy sources, but from fossil fuels in general, which is challenging at both the political and technological levels.

## NATURAL GAS

In 2022 Slovakia began to decrease its dependence on Russia by diversification of energy suppliers, especially in the natural gas sector. However, it must be noted that these debates on diversification in the country are not entirely new. These discussions were already on the table in 2009 during the gas crisis. Slovakia has been among the countries that were hit the hardest by the cutting off of supplies through Ukraine. Since the country was completely unprepared for this situation, in terms of physical infrastructure several diversification projects have been introduced since then under the umbrella of the EU initiative projects of Common Interest.[6] Slovakia has now been connected to all its neighbours including interconnection projects with Hungary, and reverse-flow projects from the Czech Republic, Ukraine, and Austria. The country has also developed underground gas storage sites. The last project was the Polish-Slovak gas interconnector that was put in operation in November 2022, gaining access to the Polish LNG terminal in ŚwinoujŚcie. However, despite all of the building up of infrastructure, the main supplier has remained the same: Russia. Therefore, since 2022 the main measures in the natural gas sector have been dedicated to the diversification of energy suppliers.

SPP (Slovakia's largest gas supplier) has concluded contracts on Norwegian gas and also LNG for the first time and considered taking a share in LNG terminals in the countries of the Baltic Sea. Despite initial estimates by the Ministry of Economy that Slovakia could cover two thirds of its natural gas imports with non-Russian sources,[7] by the end of the year around 60% of natural gas was still coming from Russia.[8] There have also been several negotiations at the ministerial level to gain access to LNG from Qatar, Asia, Africa, and the United States.[9] Diversification efforts have continued, and SPP signed a Memorandum of Understanding with Italian companies ENI, Snam, and Enel[10] and German RWE[11] on commercial cooperation in the gas and LNG sector. The Italian Memorandum was also discussed during the visit of Italian President Sergio Matarella in Slovakia with his counterpart President Zuzana Čaputová.

Diversification efforts have been more successful than emergency supplies and measures to economise. Slovakia has been failing to address proper energy efficiency measures and despite there having been a risk of gas shortages in Europe before the heating season (2002/2023, with the next two winters also being critical), Slovakia was not able to conclude solidarity agreements with its neighbouring countries that would provide emergency gas supplies. The EU countries agreed to reduce gas consumption by at least 15 per cent between August 1, 2022, and March 31, 2023, as part of the REPowerEU agreement in Council Regulation (EU) 2022/1369 on coordinated gas demand-reduction measures within the Save Gas for a Safe Winter initiative. Several countries have managed to get opt-outs, including

6 Projects of Common Interest (2013). European Commission: https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest_en

7 Sulík: SPP podpísal nový kontrakt na plyn, ktorý pokryje 65% spotreby (2022). TASR: https://www.teraz.sk/slovensko/spp-podpisal-zmluvu-na--dodavku-norske/636585-clanok.html

8 D. Funtíková and T. Grečko, Zmluva s Gazpromom platí do roku 2034, dovtedy musíme za ruský plyn platiť, hovorí šéf SPP (2023). Denník N: https://e.dennikn.sk/3210323/zmluva-s-gazpromom-plati-do-roku--2034-dovtedy-musime-za-rusky-plyn-platit-hovori-sef-spp/?ref=inm&_ga=2.147535031.1253148166.1682318304-1258735783.1661247989

9 Korčok rokoval v Katare aj o dodávkach skvapalneného plynu (2022). Trend: https://www.trend.sk/spravy/mzvez-korcok-rokoval-katare-aj-do-davkach-skvapalneneho-plynu

10 SPP podpísal memorandá s kľúčovými spoločnosťami talianskej energetiky (2023). TASR: https://www.teraz.sk/ekonomika/spp-podpisal-memoranda-s-klucovymi/709091-clanok.html

11 SPP podpísal s nemeckou spoločnosťou RWE memorandum o porozumení (2023). SPP: https://www.spp.sk/spp-podpisal-s-nemeckou-spolocnostou-rwe-memorandum-o-porozumeni/

Slovakia because of the size of its industrial sector and sufficient gas storage levels.[12] However, in April 2023 Eurostat released a document showing that natural gas consumption had dropped by 17.7 per cent from August 2022 to March 2023 in the EU. All the countries were able to save gas with the exception of Ireland (–0.2%), Slovakia (–1.0%), Spain (–10.8%), Poland (–12.5%), Slovenia (–13.8%), Belgium (–14.5%), and Malta, which actually saw a 12.7% increase.[13] Several state institutions launched their own information energy saving campaigns, for example the Slovak Innovation and Energy Agency together with the Ministry of Economy and a government office which provided tips on how to reduce household and office energy bills. The Ministry of Environment came up with the own initiative, setting a savings target of 15 per cent and issuing energy saving guidelines for public buildings,[14] but despite the monthly reporting commitment, there is no data monitoring and the amount of savings are not being tracked.

## OIL SECTOR

Similar to the natural gas sector, the 2009 gas crisis also brought several lessons with regard to the oil sector. The main project was the connection of the Druzhba pipeline (from Russia through Belarus and Ukraine to Slovakia) to the Adria pipeline, thus also connecting Slovakia to Croatia and gaining access to the Omišalj terminal. Although the project was completed in 2015 and the Slovnaft refinery began to test non-Russian oil back in 2016,[15] the refinery has still not substituted Russian oil. Therefore the Druzhba pipeline was not included in the sixth package of the EU sanctions towards Russia, which gained time for Slovakia to address the refinery technological problems with oil processing.[16] (See the next section for detailed discussion on oil sanctions.) However, Slovnaft has announced that it has started to process oil from Arab countries and the Caspian Sea and expects to process around 30–40% of non-Russian oil in 2023.

## NUCLEAR FUEL

For years, nuclear has been considered a domestic energy source in Central and Eastern European countries, although the fuel is imported from third countries.[17] The fuel for both of Slovakia's nuclear power plants – Jaslovské Bohunice and Mochovce – is supplied by the Russian company TVEL. The need for fuel diversification only began to be debated properly in 2022, following the arrival in March of Russian planes carrying fuel for the nuclear power plants despite the EU's and the government's decision to close the airspace. Until then the price of the nuclear fuel had been the deciding factor, without considering safety and supplier reliability. For example, American Westinghouse has been testing nuclear fuel designed for VVER 440 reactors (found in Slovakia and other EU countries – Bulgaria, Hungary, Finland and the Czech Republic). Fuel diversification has become a priority for the Ministry of Economy, and in 2022 Slovenské elektrárne initiated a tender for a nuclear fuel supplier;[18] however, the process of certification of new nuclear fuel will take several years.

12 Council Regulation (EU) 2022/1369 of 5 August 2022 on coordinated demand-reduction measures for gas (2022). Official Journal of the European Union https://eur-lex.europa.eu/eli/reg/2022/1369/oj

13 https://ec.europa.eu/eurostat/web/products-eurostat-news/w/DDN-20230419-1

14 Verejná správa ide príkladom (2022). Ministry of Environment of the Slovak Republic: https://www.minzp.sk/files/aktuality/verejna-sprava-ide-prikladom.pdf

15 Slovnaft sa chystá testovať inú než ruskú ropu (2022). SITA: https://www.energia.sk/slovnaft-sa-chysta-testovat-inu-nez-rusku-ropu/

16 O. Világi, Ako je to s kapacitou (2022). HN Online: https://hnonline.sk/komentare/komentare/96017670-ako-je-to-s-kapacitou

17 J. Osička and F. Černoch, Anatomy of a black sheep: The roots of the Czech Republic's pro-nuclear energy policy, Energy Research & Social Science, 2017, 27, pp. 9–13.

18 Vymenia slovenské atómky ruského dodávateľa jadrového paliva? Signálov pribúda, tak skoro to však nebude (2023). Zoznam: https://openiazoch.zoznam.sk/energetika/vymenia-slovenske-atomky-ruskeho-dodavatela-jadroveho-paliva-signalov-pribuda-tak-skoro-to-vsak-nebude/

# 3

# MAIN CONSEQUENCES OF THE CONFLICT AND SANCTIONS SO FAR

The full-scale war in Ukraine revealed the vulnerability of the energy sector, as demonstrated especially by the hesitant approach on the part of the EU countries (especially those of Central Europe) to introduce economic sanctions towards Russia. While the agreement of the EU leaders to ban Russian coal, which came with the fifth package of EU sanctions,[19] was relatively unproblematic, much more intense debates occurred regarding natural gas (that have not yet materialised in the form of sanctions) and oil sanctions (coming up in the sixth round of sanctions with several opt-outs for Central European countries including Slovakia[20]). In addition, for the first time debates on nuclear fuel and the need for its diversification appeared in the broader discourse in Slovakia.

Debates on energy sanctions have been very intense in Slovakia since the outbreak of full-scale war. Generally, there were two views adopted: one arguing that we should cut off Russian fossil fuels, especially natural gas, as soon as possible[21] and the second arguing that cutting them off would have severe consequences, especially for industry.[22] The second view was presented in particular by the former Minister of Economy Richard Sulík. Although there were fears that Europe would not have enough gas for the 2022/2023 heating period, these concerns proved to be unfounded due to the mild winter. Slovakia was able to fill its underground gas storage capacities in a few months, reaching up to 90% of the storage capacities before the heating season.[23] However, around two thirds of gas consumption in the country in 2022 still came from Russia.[24]

At the same time, high gas prices were of an important concern in Slovakia. Rising energy prices have been challenging not only for households (where there is a risk of increased energy poverty), but also for industry (due to risk of suspension of production or of higher costs) and municipalities. While financial compensations of high energy bills could be among short-term solutions (financial compensations for industry, households, and municipalities were agreed by the government by the end of 2022[25]), it is unsustainable from the point of view of long-term public finances. Well-targeted measures and policies to protect vulnerable consumers on the one hand and decreased energy demand on the other should be among the key solutions. In December 2022 the government had debated the materials drafted by the Regulatory Office for Network Industries, which proposed a definition of energy poverty,[26] pointing out that nearly one out of four Slovak households live in energy poverty and presented several financial, legislative, and supportive measures for tackling the issue. The material has been met with positive feedback from the expert community and it is the first step towards more targeted financial compensations.

With regard to oil sanctions, it was important to make some exception for the oil sector in Slovakia. Therefore the sixth package on sanctions contains a complete import ban on all Russian seaborne crude oil and petroleum products covering around 90% of the oil imports from Russia.[27] Although seaborne oil imports were subject to sanctions, Slovakia, Hungary, and the Czech Republic were awarded an exemption and could continue buying Russian crude oil supplied via the Druzhba pipeline until the end of 2023. The main argument for the sanctions opt-out came from the Slovnaft refinery, which stated it would need more time to adapt the technology to process a different type of oil.[28]

19 Ukraine: EU agrees fifth package of restrictive measures against Russia (2022). European Commission: https://ec.europa.eu/commission/presscorner/detail/en/IP_22_2332

20 Russia's war on Ukraine: EU adopts sixth package of sanctions against Russia (2022). European Commission: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2802

21 M. Hojsík, Koniec Putinovho plynu (2022). Denník N: https://dennikn.sk/2759023/koniec-putinovho-plynu/?ref=inm

22 Sulík: Žasnem nad detinskou úvahou o odpojení ruského plynu. Tým si iba zlikvidujeme priemysel (2022). Trend: https://www.trend.sk/ekonomika/sulik-zasnem-detinskou-uvahou-odpojeni-ruskeho-plynu-tym-iba-zlikvidujeme-priemysel

23 The storage level in proportion to the overall gas consumption in Slovakia is almost 67%. Slovakia has also an underground storage facility in the Czech Republic, in Dolní Bojanovice, connected only to the Slovak infrastructure.

24 D. Funtíková and T. Grečko, Zmluva s Gazpromom platí do roku 2034, dovtedy musíme za ruský plyn platiť, hovorí šéf SPP (2023). Denník N: https://e.dennikn.sk/3210323/zmluva-s-gazpromom-plati-do-roku-2034-dovtedy-musime-za-rusky-plyn-platit-hovori-sef-spp/?ref=inm&_ga=2.147535031.1253148166.1682318304-1258735783.1661247989

25 Dotácie na energie (2022). Ministry of Economy of the Slovak Republic: https://energodotacie.mhsr.sk/

26 ÚRSO otvára verejné pripomienkovanie návrhu koncepcie ochrany odberateľov pred energetickou chudobou (2022). Regulatory Office for Network Industries: https://www.urso.gov.sk/urso-otvara-verejne-pripomienkovanie-navrhu-koncepcie-ochrany-odberatelov-pred-energetickou-chudobou/

27 Russia's war on Ukraine: EU adopts sixth package of sanctions against Russia (2022). European Commission: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2802

28 M. Hudec, Business as usual for Slovakia as EU oil embargo comes into effect (2022). Euractiv: https://www.euractiv.com/section/politics/news/business-as-usual-for-slovakia-after-eu-oil-embargo-comes-into-effect/

According to Prime Minister Eduard Heger, the outcome of the negotiations provided good news for Slovakia, as the country negotiated sanctions on Russian oil and Slovakia's demands were accepted, which means that the country will be able to use Russian oil until it has a full-fledged alternative.[29] The Ministry of Economy argued that a complete ban on Russian oil would have a direct impact not only on Slovakia, but also on the region in which the Slovnaft refinery operates.[30] Thus Slovakia would suffer extremely by hastily cutting off the supply of Russian oil.[31] It therefore asked for a three-year transition period during which it will be required to strengthen the oil pipeline, modifying storage tanks with estimated costs of approximately €160 million, strengthening the Adria pipeline, and preparing Slovnaft for the change in the quality of imported oil. These measures are also expected to cause a smaller share of diesel production at this refinery, leading to further price increases. Thus the effects of sanctions on Russian oil are questionable in Slovakia so far, as they have not yet materialised. A price spike in fuel prices occurred in mid-2022, but since then the price has been decreasing.

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29 Heger: Dohoda EÚ na ropnom embargu pre Rusko je pre Slovensko dobrá (2022). Government Office of the Slovak Republic: https://www.vlada.gov.sk/heger-dohoda-eu-na-ropnom-embargu-pre-rusko-je-pre-slovensko-dobra/?csrt=9015442639516943591

30 Schválené embargo výrazne zníži príjmy Ruska, v rámci solidarity by sme mali mať osobitný prístup k zdrojom z REPowerEU (2022). Ministry of Economy of the Slovak Republic: https://www.mhsr.sk/top/schvalene-embargo-vyrazne-znizi-prijmy-ruska-v-ramci-solidarity-by-sme-mali-mat-osobitny-pristup-k-zdrojom-z-repowereu?csrt=6573360287388248777

31 Slovensko podporuje ďalšie sankcie proti Rusku, požaduje iba prechodné obdobie pri rope (2022). Ministry of Economy of the Slovak Republic: https://www.mhsr.sk/top/slovensko-podporuje-dalsie-sankcie-proti-rusku-pozaduje-iba-prechodne-obdobie-pri-rope?csrt=6573360287388248777

# 4

# MEDIUM- AND LONG-TERM ANSWERS

## MEDIUM-TERM ANSWERS

In terms of physical infrastructure, Slovakia has good gas connections with all of its neighbouring countries, as it engaged in a diversification programme supported by Projects of Common Interest (PCI) launched by the European Commission in 2013. Slovakia installed reverse flows with neighbouring countries (the Czech Republic, Austria, and Ukraine), completed new interconnectors with Ukraine (in 2014), Hungary (in 2015) and then Poland in October 2022, providing access to the LNG terminal in ŚwinoujŚcie, with the first tender in mid-November.[32] Another large diversification project was the Eastring pipeline to connect the Slovak transition system with Bulgaria via Hungary and Romania. Although the project was withdrawn from the PCI list, gas stakeholders began discussing its possible revival, arguing that Russian gas had to be replaced.[33] Similarly, there has been discussion about expanding domestic gas extraction, which currently covers approximately one per cent of consumption, but it could reach approximately 10%. Further expansion of underground gas storage facilities (operated by the Nafta company) and also discussion on building an LNG terminal in Bratislava port (close to the city centre) have been revived.[34] However, all the discussed measures in the gas sector have been met with strong opposition, calling for focusing on gas savings instead and the gradual ending of fossil fuels. So the future of other gas infrastructure projects is rather questionable. Regarding biogas, the estimations are that it could cover approximately 10% of gas consumption.

Since the war broke out, energy policy strategy has not changed remarkably. Slovakia has completed the third block of the Mochovce power plant and has been working on putting block 4 into operation, and continues to phase out coal from electricity generation. With regard to oil, the Slovnaft refinery must invest in technologies and processes that enable a shift from Russian oil. When it comes to energy savings strategies, there are several small initiatives, but a long-term vision of energy consumption decrease has been lacking. For instance, households will receive a substantial share of Slovakia's Recovery and Resilience Plan, about €528 million for upgrading buildings under the Home Renovation programme, which includes home renovation grants by 2026. The grant is conditional on achieving at least a 30 per cent saving in primary energy, including home insulation, replacement of windows, replacement of heating source, green roofs, installation of shading technology, and asbestos removal.[35]

32 "Booked capacity (2023). Eustream: https://tis.eustream.sk/TisWeb/#/?nav=bd.cap

33 P.Jurkovič, J. Klepáč: Z hľadiska energetickej bezpečnosti SR netreba nahrádzať zemný plyn v energetickom mixe, ale jeho zdroj, Rusko (2022). Slovgas: https://www.slovgas.sk/aktuality/j-klepac-z-hladiska-energetickej-bezpecnosti-sr-netreba-nahradzat-zemny-plyn-v-energetickom-mixe-ale-jeho-zdroj-rusko/

34 T. Bakoš, V Bratislave chcú postaviť nový LNG terminál. V blízkosti nových mestských štvrtí (2023). Pravda: https://ekonomika.pravda.sk/energetika/clanok/662965-v-bratislave-chcu-postavit-novy-lng-terminal-v-blizkosti-novych-mestskych-stvrti/

35 Opatrenia, na ktoré môžete získať príspevok (2022). Slovak Environment: https://obnovdom.sk/opatrenia.php#A

Table 2
**Energy consumption per capita (2020; in kgoe/cap)**

| | EU | Slovakia |
|---|---|---|
| **EU 27** | 3,266 | 3,123 |
| **Slovakia** | 2,996 | 3,013 |

Source: European Commission

When it comes to renewables, the largest industry players are already responding by shifting basic electricity production to renewable sources. For instance, Železiarne Podbrezová (ironworks and metalworks) are to invest €3 million into a new rooftop solar power plant, which will be the largest solar installation in the country. Duslo Šaľa (fertilisers producer and the largest industrial gas consumer in the country) are to become the first industrial factory to use large scale wind energy (37 to 43 MW) with a planned €60 million investment. SPP also presented a project on wind development in the Western part of the country; however, so far it has is not met with positive feedback from the citizens living in the areas where large-scale wind energy development is being considered.[36] By the end of April 2023 the first geothermal power plant received its permit from the Ministry of Environment.[37]

## LONG-TERM ANSWERS

### NUCLEAR ENERGY

Slovakia plans to maintain a high share of nuclear energy in its electricity mix, arguing that if the construction of the new nuclear power plant is not implemented, Slovakia may face a real danger of lack of electricity power sources to cover its own consumption by around the year 2035.[38] Although nuclear is a long-established industry for Slovakia and the country could offer its long-term expertise in this sector (for example cooperating with Poland, which plans to develop nuclear facilities), Slovakia is still dependent on Russian nuclear fuel and must work on diversification. Moreover, there have been discussions about further expansion of nuclear facilities: for example, state company JESS (Nuclear Energy Company of Slovakia) has applied for a permit to build a new nuclear power plant by 2039.[39] However, there has been no public discussion on spent nuclear fuel management and a permanent repository.

### DECARBONISATION

Decarbonisation brings with it opportunities to not only shift away from Russian fossil fuels, but away from fossil fuels in general. Within renewables the government plans to focus on geothermal development, but also to electrification in the transport sector and the modernisation of electricity networks. However, coherent strategies on low-carbon development have been lacking. In the coming years the heating sector and, in particular, district heating, will be important for the transformation of the energy sector. The high degree of centralisation of heat supply creates good technical preconditions for the use of biomass, biomethane, and geothermal energy.[40]

### HYDROGEN

Hydrogen is a challenging technology due to its uncertainty, but also an opportunity for decarbonisation, especially in industry, research and development, and business. When drafting hydrogen strategy of Slovakia the former Minister of Economy Richard Sulík even stated that the prospects for electromobility are limited and that the future lies in hydrogen cars instead.[41] Hydrogen was also of great focus during EXPO 2022 in Dubai and there are several smaller initiatives and projects in transport and industry, but the coherent national strategy has not been updated.

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36 I. Haluza, Veľký veterný park chystá už aj prvá štátna energofirma. Plynári z SPP naň chcú vynaložiť 63 miliónov eur (2023). Denník N: https://e.dennikn.sk/3264667/velky-veterny-park-chysta-uz-aj-prva-statna-energofirma-plynari-z-spp-nan-chcu-vynalozit-63-milionov-eur/

37 I. Haluza, Prvá geotermálna elektráreň u nás získala súhlas envirorezortu. Energiu vyrobí pre najmenej 20-tisíc domácností (2023). Denník N: https://e.dennikn.sk/3345924/prva-geotermalna-elektraren-u-nas-ziskala-suhlas-enviro-rezortu-energiu-vyrobi-pre-najmenej-20-tisic-domacnosti/?ref=list&_ga=2.72038419.1253148166.1682318304-1258735783.1661247989

38 Why a new nuclear power plant (2023). JESS: http://www.jess.sk/en/home/why-a-new-nuclear-power-plant

39 Projekt novej atómky v Jaslovských Bohuniciach je o krok ďalej, firma JESS podala žiadosť o vydanie povolenia (2022). SITA: https://sita.sk/venergetike/projekt-novej-atomky-v-jaslovskych-bohuniciach-je-o-krok-dalej-firma-jess-podala-ziadost-o-vydanie-povolenia/

40 Integrated National Energy and Climate Plan for 2021 to 2030 (2019). European Commission: https://energy.ec.europa.eu/system/files/2020-03/sk_final_necp_main_en_0.pdf

41 I. Jenčová, Vláda nevidí po kríze budúcnosť dopravy v elektromobilite, staviť chce na vodík (2020). Euractiv: https://euractiv.sk/section/energetika/news/vlada-nevidi-po-krize-buducnost-dopravy-v-elektromobilite-stavit-chce-na-vodik/

# 5

# FORESEEABLE CONSEQUENCES WITH REGARD TO EU CLIMATE GOALS/TARGETS?

The main focus of RePowerEU strategy is on energy efficiency and renewables deployment in order to decrease dependence on Russian fossil fuels. Although both areas are crucial for increasing energy security and decreasing fossil fuels dependence, they have been problematic for Slovakia for many reasons. For example, for years the country has been struggling to implement more renewables into its energy mix. As can be deduced from Table 3, Slovakia was committed to achieving a renewables share of 14% in 2020. For years it seemed that there was no way Slovakia could meet this goal, as its renewables share was around 12%;[42] however, the situation changed once the figures on biomass use were corrected and by the end of the year Slovakia reached 17.3 %. The correction reflected the change in the methodology used to calculate biomass use to include households and small companies, which had not previously been part of the official statistics and Eurostat reporting.[43]

Even the 2030 target on renewables share has been challenging for Slovakia from the beginning. Slovakia's National Energy and Climate Plan (NECP) is far from ambitious regarding renewables deployment and was not even able to meet the 2030 renewables target calculated using the formula in Annex II of Regulation (EU) 2018/1999 (Governance Regulation), as the proposed 19.2 % in its final National Energy and Climate Plan (NECP) is below the Commission's recommended 24 %. Moreover, the EU target within the REPowerEU initiative has been increased substantially in 2023, to at least 42.5 %, which is requiring much effort.

The untapped potential lies in geothermal and wind energy. Although there has been an increasing interest in individual deployment of renewables (in households and industry) in 2022 due to rising energy prices, there are also several obstacles, which include a lack of financial motivation for prosumers, high initial costs that prevent low-income households from entering the renewables market, frequent legislative changes resulting in legal uncertainty of the market, a limit on distribution system capacity, and a lack of information.[44]

By the end of April 2023 the government decided to add a new RePowerEU chapter with €403 million in its Recovery Plan, dedicated to the simplification of environmental permit processes, support of sustainable energy, the creation of two pilot zones for the development of wind energy in Slo-

42 Share of renewable energy in the EU up to 18.0% (2020). Eurostat: https://ec.europa.eu/eurostat/documents/2995521/10335438/8-23012020-AP-EN.pdf/292cf2e5-8870-4525-7ad7-188864ba0c29

43 I. Jenčová, Analytička SHMÚ: Čísla o spotrebe biomasy nesedeli už roky, nikoho to nezaujímalo (2021). Euractiv: https://euractiv.sk/section/energetika/interview/analyticka-shmu-cisla-o-spotrebe-biomasy-nesedeli-uz-roky-nikoho-to-nezaujimalo/

44 P. Čakovská, Slováci si chcú vyrábať energiu sami. Bráni im v tom byrokracia a slabá podpora štátu (2022). Euractiv: https://euractiv.sk/section/budovy/opinion/slovaci-si-chcu-vyrabat-energiu-sami-brani-im-v-tom-byrokracia-a-slaba-podpora-statu/

Table 3
**2020 and 2030 renewables targets**

| | 2020 | | 2030 targets | | | |
|---|---|---|---|---|---|---|
| | targets | values | NECP drafts | EC - NECP evaluation | NECP final | Fit for 55 |
| **Slovakia** | 14 | 17.3 | 18 | 24 | 19.2 | 32 |
| **EU total** | 20 | 22 | 30.4–31.9 | 32 | 33.1–33.7 | 40–42.5 |

Source: European Commission

vakia, a better use of geothermal energy and bio-waste processing, and modernisation of transmission lines and investments in regional distribution systems.[45]

Similarly, there is a lack of a systematic approach in energy efficiency measures that would lead to a decrease in dependence on natural gas. Although Slovakia claims that energy efficiency is the priority, there is a lack of information on how the measures will be applied in practice. For example, there is no long-term renovation strategy for buildings, which should be included among the key measures. According to the 2022 report of the Supreme Audit Office of the Slovak Republic, around 75 % of public buildings require deep renovation; however, there are several barriers to that, including a fragmentation of the funding system and subsidies among several ministries and institutions, a lack of professional capacities, the lack of a national database, and lack of involvement of owners and managers of public buildings.[46] All these problems must be addressed in order to succeed in meeting energy efficiency goals.

While Slovakia is on track to phase out coal from electricity generation, successful decarbonisation in Slovakia also requires the decarbonisation of the transport sector and industry. That would also lead to a decrease in dependence on natural gas and oil. In industry there are several sectors that require special attention: iron and steel, cement, and chemicals production. Significant investments are required, especially in the steel sector, in order to meet the EU-wide target, which is a 55 % decrease of greenhouse gases in 2030 compared to 1990.[47] Transport is an especially risky sector not only in the EU, but also in Slovakia with regard to reaching climate neutrality due to increasing emissions and a preference of cars over public transit. There has been a growing number of new car registrations, a relatively high average age of the car fleet in Slovakia, an underdeveloped charging infrastructure for electric cars, and a low proportion of electric cars. In Slovakia, a significant increase in the uptake of electric vehicles will be needed alongside the measures of redirecting transport to public transit solutions.

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**45** Slovensko pridáva do plánu obnovy nové zelené opatrenia v hodnote 403 miliónov eur (2023). Government Office of the Slovak Republic: https://www.planobnovy.sk/aktuality/slovensko-pridava-do-planu-obnovy-nove-zelene-opatrenia-v-hodnote-403-milionov-eur/

**46** Správa o výsledku kontroly 2022: Obnova verejných budov (2022). Supreme Audit Office of teh Slovak Republic: https://www.nku.gov.sk/documents/10157/18210a5a-740a-4470-b910-45a813c6bc70

**47** Decarbonization of the Slovak economy by 2030 (2022). Value for Money Department: https://www.mfsr.sk/files/archiv/35/Decarbonization-of-the-Slovak-economy-by-2030_study-062022.pdf

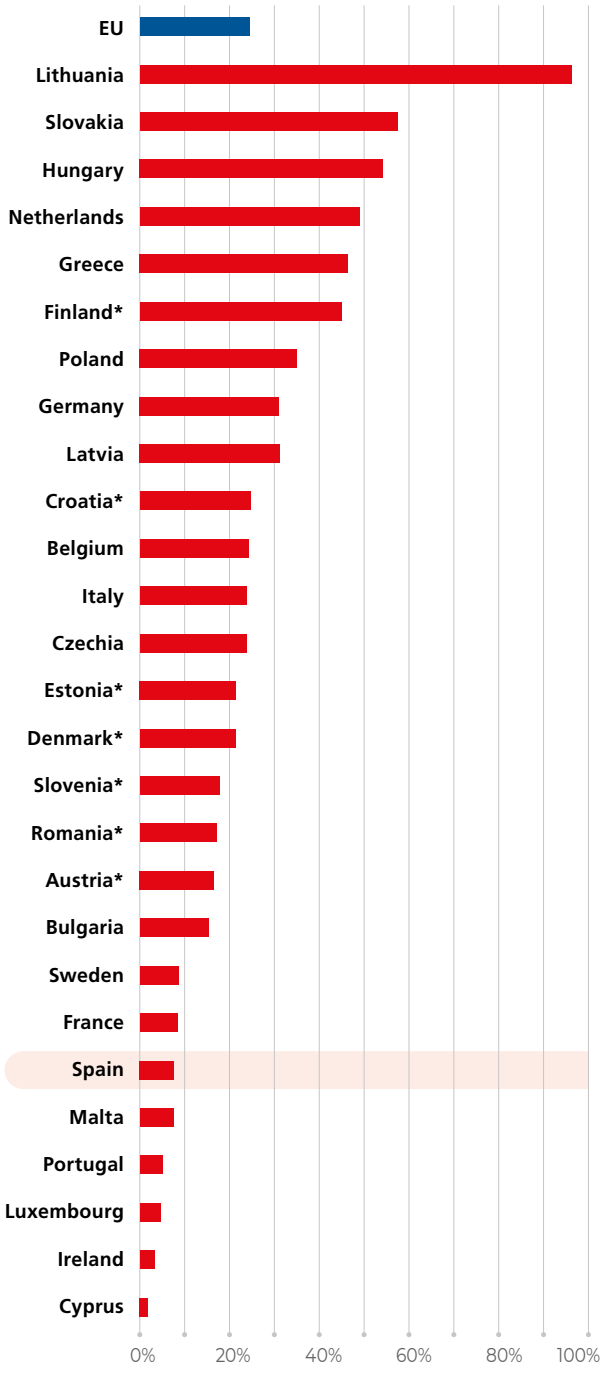
# SPAIN

**by David Ribó Pérez**

# INTRODUCTION

The year 2022 shook the European energy system. The Russian invasion of Ukraine disrupted energy flows, particularly the supply of Russian gas to Europe. Pipelines that carried the majority of European gas imports were closed, causing prices to soar to historic highs. European countries were forced to adapt to the new situation in a matter of months. Countries like Germany, which relied heavily on pipeline gas transport, were forced to build new infrastructure, such as regasification stations, in under a year's time. Other European countries shifted away from Russian imports to alternative sources such as Qatar and the United States. In response, the EU launched a coordinated European initiative called REPowerEU, aimed at transitioning away from gas, accelerating the shift to renewables, and increasing energy security (EC, 2022).

Figure 1
**Imports from Russia in gross available energy, EU, 2020**




Source: Eurostat, Including estimates for non-reported data for countries with*

# 1

# STATUS QUO UP UNTIL THE WAR

Spain, however, was in a different situation. Located in the southwestern corner of Europe, its insular location made the Iberian peninsula an energy island with large energy infrastructure facilities and low ties with the Russian supplies. Spain was not as dependent on Russia for its energy supply, and the energy crisis affected the country mainly in economic terms; there was never a fear of energy shortages. However, the Spanish infrastructure and the lack of European sanctions on Russian gas ended up generating a larger amount of Russian gas imports that were afterwards mostly exported to other EU countries.

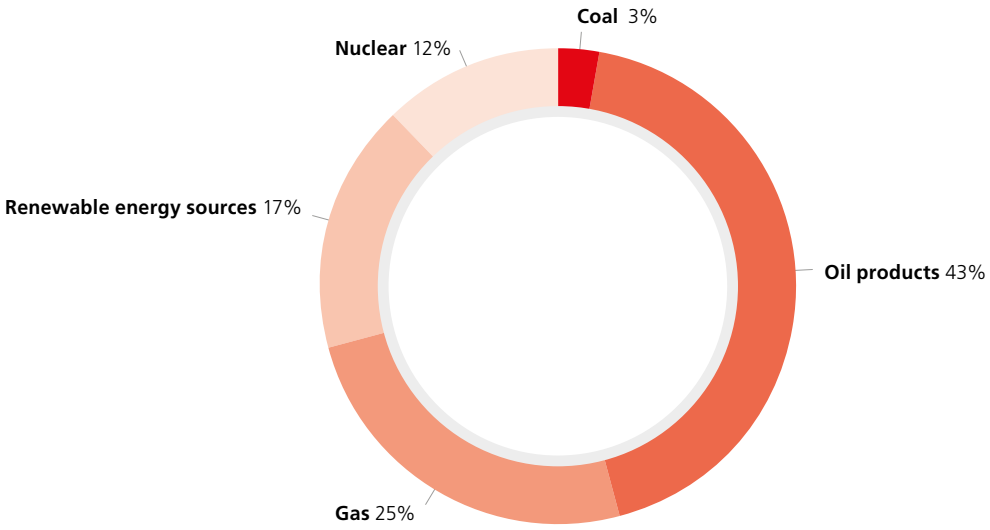
According to Eurostat, the overall energy imports from Russia accounted in 2020 for 7.5 per cent compared to an EU average of 24.4 per cent, more than 3 times higher. Gas imports in particular accounted for 10.5 per cent of gas compared with 41.1 per cent in the EU countries overall. While oil and coal accounted by 8.8 per cent and 43.2 per cent respectively, coal accounts for only a residual share in the energy mix (Eurostat, 2023).

The definition of the Iberian peninsula, and therefore Spain, is that of an energy island related to an energy transport infrastructure that only exists between France and Spain, with connections accounting for just 3 per cent of electricity and two gas pipelines. These connections have not met the expected objectives set for 2020 (10 per cent) and are far from the 15 per cent goal set for 2030. For this reason, Spain had a lower dependency on Russian fuels and the largest regasification capacity in Europe. In addition, it shares a gas market, Mercado Ibérico del Gas (MIBGAS), which is a trading hub with Portugal. Furthermore, Spain has two pipelines that directly connect to the Algerian gas hub in Hassi R'Mel – one directly from Algeria and another that connects via Morocco. Spain also has a milder climate compared to northern European countries, with household demand for heating representing 40 per cent of the total household demand, while the European Union (EU) average is 62 per cent (Eurostat, 2021).

This combination of diversified infrastructure and low dependence on Russian gas meant that Spain was never at risk of a gas shortage. However, the stress on the gas market brought several consequences, particularly the sudden rise in electricity prices, which led to increasing inflation.

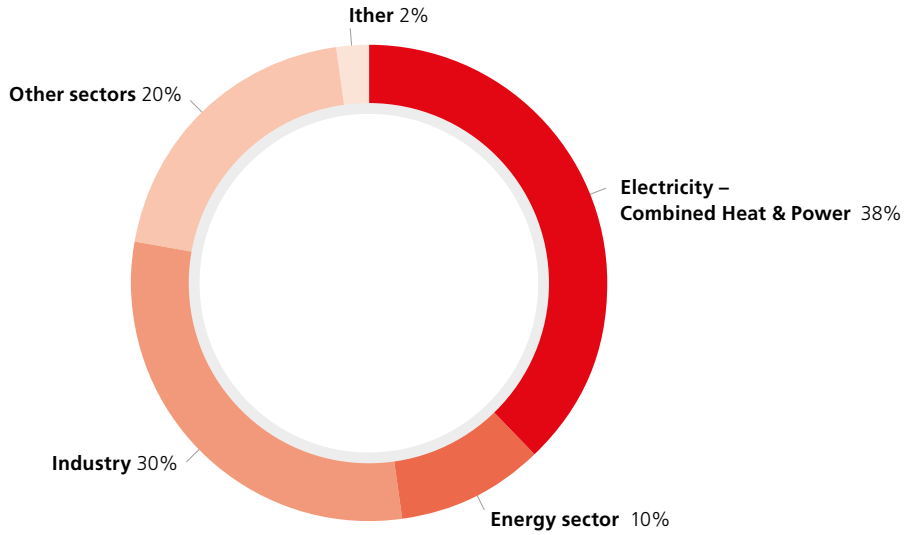
Spain's energy mix heavily relies on fossil fuels, with oil products and natural gas accounting for 43 per cent and 25 per cent, respectively, of the country's total primary energy consumption of 1366.82 TWh in 2021. The majority of

Figure 2
**Share of the total primary energy consumption by source**




Source: MITECO (2022)

Figure 3
**Share of the gas consumption by sector (MITECO, 2022)**




Source: MITECO (2022)

these fuels are imported, making Spain heavily dependent on foreign energy sources. In fact, the country imports 70.1 per cent of its total primary energy (MITECO, 2022). However, Spain's dependence on fossil fuels has been declining due to the increasing production of renewable energy, which accounted for 16.5 per cent of the energy mix in 2021. Wind and biomass were the two largest sources of renewable energy, while solar PV saw the largest annual growth. In 2021, final energy consumption in Spain was divided between the transport sector (38 per cent), industry (36 per cent), and other sectors (26 per cent), including households, services, and agriculture, showing a total energy consumption per capita of 111.23 GJ (MITECO, 2022).

Gas is primarily used for electricity production, industry, and other sectors, such as households and services. While it represents an important part of the electricity mix and industry, gas has almost no presence in the transport sector (Table 2). Therefore, the energy shock of 2022 heavily impacted the electricity and industry sectors.

Spain imported 415,569 GWh of gas in 2021, with Algeria being the predominant supplier, accounting for 42.8 per cent of total imports. Spanish companies, especially Naturgy, have long-term contracts with the state-run Algerian company Sonatrach. The rest of the imports came in the form of Liquefied Natural Gas (LNG) through various regasification stations in Spanish ports. LNG imports mainly came from Nigeria (11.5 per cent), the US (14.4 per cent), Russia (8.9 per cent), and Qatar (6.3 per cent). Russian imports represented a low percentage compared to the European Union due to the absence of pipeline connections (CORES, 2022b).

In 2021, Spain's oil supply mix was more diverse, with Nigeria (18.3 per cent), Mexico (13.6 per cent), and Libya (11.2 per cent) being the most important countries of origin. Meanwhile, imports from Russia only accounted for 4.6 per cent, making it the seventh largest country of origin for Spanish oil imports (CORES, 2022a).

However, at the end of the year, a major shift occurred in Spain's energy relation with Algeria due to ongoing geopolitical tensions between Algeria and Morocco and Spain's international position. Spain changed its official stance related to the situation in Western Sahara and accepted a solution based on the autonomy of Western Sahara inside Morocco under United Nations principles. This changed its relationship with Algeria, which had been one of the main defenders of an independent Western Sahara. As a result, Algeria decided not to renew a 25-year contract that ended on 1 November, which meant the closure of the pipeline connecting Algeria with Spain through Morocco and stopping all gas exports to Morocco. Despite the change in Spain's relationship with Algeria, the contracted gas supply is still being sent through LNG thanks to the regasification infrastructure existing in Spain and the directly connected pipeline.

Spain developed its gas infrastructure based on a low connection capacity through pipelines with the rest of Europe during the late 1980s and 1990s. There are two supply pipelines connecting to the Algerian gas hub in Hassi R'Mel. The first is the Magreb Europe pipeline, which connects Morocco and Spain through the Gibraltar Strait and the second is the Medgaz pipeline, which connects the northwestern coast of Algeria with southern Spain. The Magreb Europe pipeline is currently not in use, but it has a total yearly capacity of 12 bcm/year. The Medgaz pipeline has a total capacity of 10.5 bcm/year (GECF, 2021).

Spain has developed the largest regasification capacity in Europe, amounting to 61.9 bcm/year, with an additional terminal of 7 bcm/year that is currently not operational (King & Spalding, 2018). These facilities are situated along the Spanish coastline in Barcelona (Catalonia), Sagunto (Comunitat Valenciana), Cartagena (Murcia), Huelva (Andalucía), Mugardos (Galicia), El Musel (Asturias), and Bilbao (Basque Country). Despite being one of the largest gas consumers in Europe, Spain's regasification plants have historically operated at a low capacity due to their combined large capacity and the availability of cheaper gas through pipelines.

The Spanish gas system is integrated with Portugal's, and both countries have their own gas trading hub, MIBGAS, which is distinct from the Dutch Title Transfer Facility (TTF) gas market. Connections to the rest of Europe are currently limited to two pipelines that link Spain to France near the Atlantic coast. These connections, located in Irun and Larrau, have a capacity of 5 and 5.3 bcm, respectively. A proposed third connection, Midcat, with a capacity of 9 bcm, was considered by the French, Portuguese, and Spanish governments; however, the project was ultimately not constructed due to French opposition arguing that it would be against the EU policy of reducing fossil fuels and would involve a long construction period. Other parts of the energy infrastructure with France, such as electricity interconnections, have also encountered difficulties in their development.

The electricity sector is the largest consumer of gas in Spain. However, the power system has made significant progress in decarbonisation, with 69.5 per cent of the total generation being fossil-free and 48.4 per cent coming from renewable energy sources in 2021 (REE, 2022). The objective, drawn in the Integrated National Energy and Climate Plan (PNIEC) of the Ministry of Ecological Transition (MITECO) is to reach a level of 74 per cent of electricity generated to come from renewable energy sources in 2030 (Auguadra et al., 2023; MITECO, 2020b). The average emissions factor for electricity in Spain is 0.14 $tCO_2$/MWh. Nonetheless, 27.51 per cent of the total generation comes from gas sources, including Combined Cycle Gas Turbines and Combined Heat and Power (REE, 2022). Spain and Portugal have a unified electricity system with minimal connection constraints and a shared electricity market Mercado Ibérico de Electricidad (MIBEL). Historically, Spain has been a net importer of electricity, with most of its imports coming from the French system and its large nuclear fleet. Similar to gas consumption, electricity consumption in Spain is concentrated in the industrial, residential, and service sectors.

# 2

# SHORT-TERM IMPACTS AND RESPONSE TO THE ENERGY CRISIS

The energy shock resulting from the Ukraine invasion by Russia, followed by sanctions and European plans, had a significant impact on the Spanish energy mix and economy. Gas prices started to rise in the summer of 2021 and reached all-time records in 2022, causing a heavy impact on the Spanish economy. The increase in gas prices led to an increase in Spanish inflation, particularly through the electricity retail tariffs. The implementation of the Iberian gas cap in mid-June reduced electricity prices and consequently inflation levels.

In 2022, Spain became an exporting energy hub due to its gas infrastructure, the French nuclear crisis, and the rapid penetration of renewables in the power system. However, the year also showed a structural change in gas imports. Although the total imports decreased only by 0.5 per cent, the closure of one of the two pipelines led to a 50.6 per cent reduction in pipeline imports and a 40.2 per cent increase in LNG imports. Despite the overall drop in gas consumption in Spain, exports to neighbouring countries such as France, Italy, and the Netherlands increased by 160 per cent, 634 per cent, and 215.9 per cent, respectively. Exports to France occurred through the two existing pipelines, while exports to Italy and the Netherlands occurred through LNG.

The change in gas imports by country was significant, with the US replacing Algeria as the top gas importer. Imports from the US increased its exports to Spain by 112.6 per cent, while Algerian imports decreased by 40.2 per cent. On a yearly average, the US accounted for 28.9 per cent and Algeria for 23.9 per cent of the imports. Surprisingly, Russian gas imports increased during 2022 by 54.8 per cent, reaching a total share of imports of 12.6 per cent. The absence of sanctions on Russian gas and the regasification capacity of Spain allowed the Bilbao regasification station (the closest to the Baltic sea) to operate almost at full capacity, importing almost 30 per cent of Spanish gas in 2022. The increase in gas imports was ccaused by the absence of sanctions, the lower cost of gas in comparison with other LNG imports, the reduction of Algerian pipeline gas imports, the large regasification capacity of Spain, and the new role played by Spain as an intermediate point of other European countries' imports as France and Italy. In sum, the increased Russian imports had a commercial (lower cost) and European (increase exports to EU countries) aspect. In contrast, in terms of oil, Russian imports decreased from 4.6 per cent to 1.1 per cent due to the European sanctions on Russian oil (CORES, 2023a, 2023b).

The invasion of Ukraine resulted in a significant shock to gas prices, which in turn had an impact on electricity prices due to the pay-as-cleared wholesale electricity market design. The increased cost of natural gas led to reduced consumption, particularly in gas-intensive industries such as the tile, paper, and glass sectors. To support these industries, the Spanish government implemented financial assistance programmes. Overall, gas consumption decreased by 10.8 per cent in 2022 (Eurostat, 2023), but with the exclusion of gas consumption for electricity exports, the gas consumption reduction amounts to 21 per cent (MITECO, 2023).

The gas shock had a significant impact on the electricity sector, particularly on the prices seen by households. In Spain, regulated electricity tariffs are designed to incentivise flexible consumption by translating the hourly wholesale price to small consumers. Therefore, the increases in wholesale electricity prices immediately affected households, and not only large consumers as in other European countries. This had a significant impact on inflation, which rose to 10.8 per cent in July 2022, mainly due to electricity and food prices (INE, 2022). To address this issue, Spain and Portugal negotiated the Iberian Mechanism at the European level. This mechanism artificially capped gas prices in the electricity wholesale market (and afterwards compensated for them) (Hidalgo-Pérez et al., 2022)es decir, sobre el precio de venta del pequeño consumidor (PVPC. The mechanism effectively reduced wholesale MIBEL market prices, which in turn benefitted both large and small consumers.

In terms of electricity production in 2022, Spain's ongoing drought had a significant impact on hydroelectric production, resulting in a marked decrease. Despite maximum wind and solar production, the combination of increased generation for export and low hydro production resulted in an increased reliance on gas generation. Exports reached a historical high, with a 71.4 per cent increase compared to 2021, and France shifted from being a net exporter to a net importer from Spain. Two main factors drove exports to France: corrosion problems in the French nuclear fleet, and the price differential between Iberian and French electricity prices due to the Iberian Mechanism (REE, 2023a).

In addition to the Iberian Mechanism, the Spanish government implemented several measures to reduce taxes and tariffs, including a reduction in the electricity VAT, electricity tax, and electricity policy support tariff, which amounted to 80 per cent of the initial taxes and 55 per cent of the tariffs (Gobierno España, 2022). The government also reduced gas taxes, implemented a price cap on the gas tariff, and decreased the price of gasoline and diesel by 20 cts€/L. To support vulnerable consumers, the government implemented additional reductions and increased the number of potential beneficiaries for both electricity and gas. The government provided €625 million in aid to electro-intensive and gas-intensive industries. Finally, the government encouraged the deployment of renewable energy sources with a new legislative package (RD 20-2022), which opened the door for a quicker environmental evaluation procedure if certain conditions were met by the project pursuant to European agreements. While most projects will still go through the common process, opening the door to reduced environmental evaluations gained the approval of the opposition of environmental NGOs and Civil platforms. Overall, these measures had a positive impact, and inflation levels at the beginning of 2023 were among the lowest in the European Union (Eurostat, 2023).

# 3

# LONG-TERM ACTIONS AND CONSEQUENCES

After the crisis, the Spanish government approved an Energy Security Plan aimed at reducing energy dependence and accelerating the transition to renewable energy sources. The plan has six main pillars: energy savings and efficiency, acceleration of the ecological transition, protection for vulnerable consumers, fiscal measures, energy autonomy, and solidarity with other EU countries (Gobierno España, 2022). The plan is in line with several long-term actions that were already in place.

Saving actions concentrate on the industrial, commercial, residential and public sectors. In order to reduce the final energy consumption, electrification processes are also seen as key. In this sense, both the electrification of heat and mobility are fostered in these sectors. However, Spain is still lagging behind in heat pump installation, buildings refurbishment, and electric vehicles penetration compared to other European countries. In terms of heat pumps, Spain still has a low penetration of these technologies in households compared to other European countries. Moreover, during 2022 and the energy crisis, Europe saw a surge in heat pump installations of 38 per cent compared to 2021, but this increase was only 24 per cent in Spain (Carbon Brief, 2023). Regarding private transport, only 3.8 per cent of the cars bought in Spain in 2022 were electric, a percentage far lower than in other countries of the EU such as the Netherlands (23.5 per cent) or Denmark (20.8 per cent) or neighbouring countries as France (13.3 per cent) or Portugal (11.4 per cent) (ACEA, 2023).

The increase in energy autonomy is in line with some of the European recovery funds after the Covid-19 crisis. These funds have strategic lines named PERTEs and two of them in particular are related to the development of Electric Vehicles Industry (VEC) and the PERTE ERHA (Renewable Energy and Hydrogen industry). These public funding efforts aim to develop new industrial facilities relating to car and battery manufacturing, renewable energy value chains, and green hydrogen production. The ERHA aims to mobilise almost €7 billion of public investment and €9.5 billion of private investment (Gobierno España, 2021). A special effort is foreseen in the fabrication of Solar Panels and Hydrogen. And in addition, specific roadmaps have been established for offshore wind with 1 to 3 GW planned for 2030 (MITECO, 2021b) (not as developed as in other countries due to a more difficult marine orography) and the energy storage roadmap (MITECO, 2021a).

In energy production terms, the acceleration of the ecological transition focuses on an upgrade of the Energy Plan for 2030 with increased renewable ambitions during the first semester of 2023. Over the last years there has been a boost in investment in renewables and a renewed interest after a decade of low investments. Due to its geographical situation and the solar resource, Solar PV investments are more competitive in Spain, and Spain is installing more Solar PVs than foreseen in the PNIEC. Nowadays, Spain is the county in the world with the highest Solar PV penetration in the system (IEA, 2023), ahead of countries such as Chile. This seems to be a trend that will intensify in the following years, with many projects already approved and in the construction pipeline. In contrast, wind capacity is lagging behind in respect to the objectives. The phase-out of nuclear remains as it was prior to the energy crisis with a foreseen objective of reducing by half the nuclear fleet by 2030 and closing all the reactors by 2035.

The renewables deployment objectives will also require an increase in the transmission and distribution capacities of the electricity grid that will require special efforts and a more flexible and ambitious planning of the grid. It is expected that the penetration of renewables will decrease the energy dependency, which will be in line with an increase in energy autonomy and strategical renewable industrial policies. As a matter of solidarity, Spain plans to increase its interconnection capacity with France in both terms of electricity and hydrogen.

Green hydrogen is a major debate in the Spanish context and has recently gathered much attention after the crisis. The Spanish government also published a roadmap for this renewable gas in 2020 with an objective of achieving 10 per cent of the European capacity in 2030, 4 GW of electrolysers (MITECO, 2020a). The idea is to produce hydrogen to decarbonise the current difficult-to-decarbonise industries such as the chemical, steel, and ceramic industries, and to use it as energy for heavy transport and export part of the production to Europe. In this sense, Enagas (gas TSO) has planned the backbone of a hydrogen system, which includes a hydrogen pipeline that connects Barcelona with Marseille and is expected to have a capacity of 2 MTones of $H_2$ per year. The pipeline known as H2Med is supported by the European Commission but it is still under debate between the Spanish and French governments. The first envisions a pipeline only for green hydrogen (produced with re-

newable energy sources) and the second provides for the possibility of also transporting pink hydrogen (produced with nuclear electricity).

In general, Spain has a hydrogen strategy and has planned a future infrastructure that aims to cover the main industrial clusters existing in Spain. The infrastructure plan covers the two clusters in the north of Spain, a hydrogen pipeline following the Ebro river and two parallel north-south pipelines, one on the Mediterranean coast and a second one connecting the western part of Andalucía with the north of Spain.

# 4

# CONCLUSIONS

Spain has never been heavily reliant on Russian fuel imports, and its geographically diversified gas infrastructure has allowed it to avoid any supply disruptions and the fear of this occurring. Despite this, Spain increased its LNG imports from Russia in 2022 due to its regasification capacity, the lower price of Russian LNG, and the absence of European sanctions to gas and gas exports surging, particularly to France and Italy. However, the increase in gas prices had a significant impact on the Spanish economy, particularly in terms of electricity prices, which resulted in higher inflation. In response, the Spanish government implemented various measures – including the Iberian Mechanism – to control electricity prices and inflation. While these measures did reduce gas usage, the reduction was not as significant as in other European countries.

The Russian invasion of Ukraine has had a significant impact on Spain's energy system and accelerated its transition. While the invasion did not fundamentally alter Spain's overall strategy, it did reinforce the country's existing objectives. One notable change has been a decrease in the use of natural gas as a transitional fuel. There has also been a shift in public opinion, with a growing acceptance of renewable energy's volatility compared to fossil fuels. The use of hydrogen is becoming an increasingly popular topic, but efforts to electrify energy demand – particularly in heat and transportation – have been slower. This could lead to issues in the near future, as an oversupply of renewable electricity may result in very low electricity prices during certain periods of the year, potentially causing a decline in investment in renewable energy infrastructure.

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Responsible for content and editing:
Ernst Hillebrand, Head, European Economies of the East
ernst.hillebrand@fes.de

Orders/Contact: fesbp@fesbp.hu

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