Report

WAR AND ENERGY SECURITY
LESSONS FOR THE FUTURE

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List of Abbreviations and Units of Measurement

AFU	Armed Forces of Ukraine
bcm	billion cubic meters
CESA	Continental European Synchronous Area
CESEC	Central and South East European Connectivity Initiative
CEO	chief executive officer
CERT-UA	Computer Emergency Response Team of Ukraine
CIA	Central Intelligence Agency
CHP	combined heat and power
CO2	carbon dioxide
COP26	UN Climate Change Conference of the Parties
COVID-19	Coronavirus disease 2019
DC	District of Columbia
DSO	distribution system operator
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortisation
EE	Estonia
ETS	Emissions Trading System
EU	European Union
EUR	euro
FI	Finland
FSRU	floating storage regasification unit
GDP	gross domestic product
GHG	greenhouse gas
GIPL	Gas Interconnection Poland-Lithuania
GTS	gas transmission system
GW	gigawatt
HPP	hydro power plant
IAE	International Energy Agency
ICS	industrial control system
IPCC	United Nations Intergovernmental Panel on Climate Change
IPCEI	Important Projects of Common European Interest
IPS/UPS	Integrated Power System/United Power System
IT	Internet technology
KHNP	*Korea Hydro & Nuclear Power Co*.
LNG	liquified natural gas
LT	Lithuania
Ltd.	limited
LV	Latvia
MLRS	multiple-launch rocket systems
mcm	million cubic metres
mm	millimetres
MW	megawatt
MWh	megawatt per hour
NATO	North Atlantic Treaty Organisation
NPP	nuclear power plant
NS1	Nord Stream 1
NS2	Nord Stream 2
OPEC	Organisation of the Arab Petroleum Exporting Countries
PEESA	Protecting Europe's Energy Security Act
PGE	*Polska Grupa Energetyczna*

PPA	power purchase agreements
P-TECC	Partnership for Transatlantic Energy and Climate Cooperation
PV	photovoltaics
RF	Russian Federation
SBU	Security Service of Ukraine
SE	Sweden
SMR	small modular reactor
SOC	Security Operational Centre
TFEU	Treaty on the Functioning of the European Union
TPP	thermal power plant
TSO	transmission system operator
TTF	Title Transfer Facility
TWh	Terawatt-hour
UGS	underground gas storage
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USSR	Union of Soviet Socialist Republics
UZ	*Ukrainska Zaliznytsia*, Ukrainian Railways Company
ZE PAK	*Zespół Elektrowni Pątnów-Adamów-Konin*

Executive Summary

The multifaceted and far-reaching impact of the war by Russia against Ukraine offers an opportunity for a deeper reflection on the lessons learned for energy security at the national, regional, and EU levels. It allows for an assessment of the responses to the energy crisis triggered by the war and energy security prospects in the geopolitical landscape where Russia is comprehensively isolated; new energy and technology players grow in importance; a new global energy order emerges; and the effects of the climate crisis become more severe and evident. It is also a rare opportunity to assess how complex energy systems retain their resilience or degrade under the conditions of a high-intensity conventional war, which has collective defence implications to the ability of the frontline states, such as Estonia, to fulfil NATO's baseline requirements for national resilience and thus Article 3 of the North Atlantic Treaty. The report provides analysis concerning these aspects of the war's short-, medium-, and long-term impact on energy security in Europe and the Baltic region.

In Chapter 1, Veli-Pekka Tynkkynen examines how fossil fuels empowered Russia's regime and created Europe's vulnerability. It highlights that increasing energy security, ending dependence on Russia, climate protection, promoting the energy transition, and defending democracy are all intertwined. In Chapter 2, Andrian Prokip considers the historical roots of the European overdependence on Russian energy and the US policy to counter it. He underlines the US' role in Europe's energy security and the importance of transatlantic energy and energy technology relations in the future. Christian Egenhofer and Edoardo Righetti analyse, in Chapter 3, what impact the war has or may potentially have on the EU's energy, climate, and industrial policies in the long run, while bringing to the fore the importance of common policies and solidarity.

This broader analysis is followed by a regional perspective. In Chapter 4, Arūnas Molis examines, from the Lithuanian perspective, how the Baltic region responded to the energy crisis triggered by the war and how this response was shaped by the EU's actions, technological opportunities, societal pressures, and innovation policy. In Chapter 5, Priit Mändmaa elaborates on how Estonia coped with the energy crisis and what lessons it learned from it towards move forward towards energy security and security of supply in the future.

Finally, the report includes wartime resilience perspective that captures Ukraine's experience. In Chapter 6, Tony Lawrence reviews lessons from Russia's war for critical energy infrastructure that the EU and NATO members should incorporate into their planning and preparedness. In Chapter 7, Oleksandr Sukhodolia delves deeper into Ukraine's resilience to Russia's efforts to destroy its energy system. He emphasises pre-war preparedness, wartime coordination and adaptation, and international assistance as key elements of this resilience.

Conclusions of the report stress the importance of regulatory, policy, and technological flexibility, as well as innovation, in responding to various forms of strategic coercion through the energy sector – especially when such coercion is applied against targets under the duress of a major war, in which economic disruption, market uncertainty, geopolitical turmoil, and societal anxieties are abundant. The conclusions caution that the appetite for resilience-enhancing investments and transformative solutions might diminish in the cost-conscious economic environment of the future or that the EU and US will start a vicious cycle of protectionist measures in green energy development, which will undercut transatlantic cooperation in energy security.

There is no energy crisis,
only a crisis of ignorance.

Richard Buckminster Fuller
(1895-1983)
American scientist,
inventor and futurist

Introduction

Tomas Jermalavičius

Russia's war against Ukraine has produced multiple shifts in the geopolitical landscape of Europe. Various EU member states and EU institutions broke through entire decades of dogmatic principles and established practices in security and defence policies to respond to Russia's aggression and protect the continent. The energy domain is at the forefront of this confrontation, as Russia used its dominant market position in European energy supply in the run-up to – as well as during – the war to weaken Europe's responses, divide the EU, and deter it from increasing its support to Ukraine.

On the one hand, the EU has increasingly sought to use its collective 'buyer's power' to compel Russia to stop its military aggression by including energy into successive packages of sanctions. On the other hand, many individual EU member states, including Estonia, have scrambled to cast away the last vestiges, in some sectors, of their energy dependence on Russia as soon as possible, within the overarching framework of the EU's RePowerEU plan and through a raft of individual initiatives. They have often been encountering multiple domestic political, economic, technological, and societal challenges.

The United States, in the meantime, has risen to the occasion. To support energy security on the continent, it leverages its diplomatic power in relation to key producers, besides Russia, and increases its own role as a supplier in the European energy markets. While under attack, Ukraine has been both maintaining the functioning of its energy system and simultaneously working to carve for itself a future role in the EU's energy sector as a candidate country – a double act of resilience hardly ever witnessed before.

The geopolitical crisis is also unfolding in the context of the accelerating climate emergency. According to the latest report by the United Nations Intergovernmental Panel on Climate Change (IPCC), we have only a narrow – and rapidly closing – window of opportunity to prevent a catastrophic outcome.[1] The war will not only confirm the importance of some key tenets of a global response to the climate change (such as the importance of renewables) but will also put pressure on the fragile societal consensus. It highlights the costs of transition at a time when geopolitical turbulence already produces high inflation, as well as creates new and equally pressing vulnerabilities.

The multifaceted and far-reaching impact of the war offers an opportunity for a deeper reflection on the lessons learned for energy security at the national, regional, and EU levels. It allows for an assessment of the prospects in the geopolitical landscape where Russia is comprehensively isolated; new energy and technology players grow in importance; a new global energy order emerges; and the effects of the climate crisis become more severe and evident. It is also a rare opportunity to assess how complex energy systems retain their resilience or degrade under the conditions of a high-intensity conventional war, which has collective defence implications to the ability of the frontline states, such as Estonia, to fulfil NATO's baseline requirements for national resilience and thus Article 3 of the North Atlantic Treaty.[2] The report seeks to provide analysis concerning these aspects of the war's

[1] Intergovernmental Panel on Climate Change, *Climate Change 2022: Mitigation of Climate Change* (Cambridge, UK and New York, NY: Cambridge University Press, 2022).

[2] "Resilience, civil preparedness and Article 3," North Atlantic Treaty Organisation (NATO), last modified on 20 September 2022.

short-, medium-, and long-term impact on energy security in Europe, the Baltic region, and Estonia. It is structured as follows:

- Chapter 1 examines how fossil fuels empowered Russia's regime and created Europe's vulnerability. It highlights that increasing energy security, ending dependence on Russia, climate protection, promoting the energy transition, and defending democracy are all intertwined.

- Chapter 2 considers the historical roots of the European overdependence on Russian energy and the US policy to counter it. It underlines the US' role in Europe's energy security and the importance of transatlantic energy and energy technology relations in the future.

- Chapter 3 analyses what impact the war has or may potentially have on the EU's energy, climate, and industrial policies in the long run, while bringing to the fore the importance of common policies and solidarity.

- Chapter 4 examines, from the Lithuanian perspective, how the Baltic region responded to the energy crisis triggered by the war and how this response was shaped by the EU's actions, technological opportunities, societal pressures, and innovation policy.

- Chapter 5 elaborates on how Estonia coped with the energy crisis and what lessons it learned from it to move forward to energy security and security of supply in the future.

- Chapter 6 reviews lessons from Russia's war for critical energy infrastructure that the EU and NATO members should incorporate into their planning and preparedness.

- Chapter 7 delves deeper into Ukraine's resilience to Russia's efforts to destroy its energy system. It emphasises pre-war preparedness, wartime adaptation, and international assistance as key elements of this resilience.

The report closes with the conclusions that stress the importance of regulatory, policy, and technological flexibility and innovation in responding to various forms of strategic coercion through the energy sector. They caution that the appetite for resilience-enhancing investments and transformative solutions might diminish in the cost-conscious economic environment of the future. Europe must remain razor-focused on fulfilling the goals of the European Green Deal and RePowerEU, using this crisis as a great accelerator, and incorporate candidate countries, such as Ukraine, as well as constructively engage with key strategic partners such as the US in this effort.

1. Violent Russia Powered by Fossil Fuels

Veli-Pekka Tynkkynen

President Vladimir Putin – perhaps together with only four insiders from the Russian political elite – decided to launch a massive invasion of Ukraine on 24 February 2022.[3] How can a handful of people have so much power? And why was the West so powerless to meet this challenge? Key factors that help answer these questions are the centralisation of power that extends to the fossil energy sector of Russia's economy and the foreign policy leverage that Moscow exerts via the flows of natural gas and oil to Europe.

This chapter explains both Russian and European perspectives on energy leverage and (inter)dependence by reflecting upon recent developments. Furthermore, it outlines how Europe should engage with Russia in the future.

1.1. Fossil Energy as the Source of Political Power

Not only Putin and his close circle but also the Russian people see themselves as an empire. This mindset dictates that their country – be it modern-day Russia, the Soviet Union, or Tsarist-era Russia – should subjugate such states as Ukraine. Whereas Ukraine's development into a democracy governed by the rule of law is perceived as a challenge to the authoritarian model of Russia under Putin. The escalating violence against Ukraine is an indication that the Putin regime sees democratic Ukraine – and Belarus – as an existential threat. They represent an 'anti-Russian' model of society that shall not become an alternative in the eyes of the Russian people.[4]

Not only Putin and his close circle but also the Russian people see themselves as an empire

Putin's regime believes that Ukrainians are *malorossy* (small Russians) who do not have a right to independence. This idea is shared by many Russians. For more than twenty years, Russians have been exposed to this propaganda, at the centre of which is the ultra-nationalist, imperial Russia. This worldview has developed into an openly fascist ideology that glorifies the rule of the few. The root cause of the war in Ukraine, therefore, is the colonialist spirit shared by many Russians; its foundations have not been dismantled after the fall of the Soviet Union.[5] In this paradigm, culture, language, and territory of both Ukraine and Belarus cannot be separated from Russia; as states, they cannot exist because they do not fit into how Russians see and understand the world around them.

Already by the 2010s, Putin and his inner circle had taken over the media and started shaping the image of Russia as an imperial superpower. They have been emphasising Russia's military might, especially nuclear weapons, and promoting the country's messianic mission – a state that has a central role in global history. Russia is thus presented as the leader of the conservative and authoritarian world and protector of genuine Christian values.[6]

Fossil energy revenues increased significantly during Putin's presidency and enabled Russia to invest in its military while centralising its political power. At some point, oil and gas exports accounted for up to half of the Russian federal budget. And although minerals, metals, and services played a role, it is the oil money has been the key to Putin's centralisation of power.[7] Under Putin, political elites formed by welding security agencies together with the oil and gas industry

[3] This chapter is partly based on Veli-Pekka Tynkkynen, "Öljykulttuurin rohkaisema väkivaltainen Venäjä [Violent Russia encouraged by oil culture]," in *Epävarmuuksien aika. Kuinka Venäjän hyökkäyssota muuttaa maailmaa?* [A time of uncertainty. How will the Russian war of aggression change the world?], ed. Sanni Tengvall (Helsinki: Gaudeamus, 2023).

[4] Timothy Snyder, *On Tyranny: Twenty Lessons from the Twentieth Century* (New York: Tim Duggan Books, 2017).

[5] Lynne Hartnett, "The long history of Russian imperialism shaping Putin's war," *The Washington Post,* 2 March 2022.

[6] Maria Engström, "Contemporary Russian Messianism and New Russian Foreign Policy," *Contemporary Security Policy* vol. 35, issue 3 (2014): 356-379.

[7] Veli-Pekka Tynkkynen, *The Energy of Russia: Hydrocarbon Culture and Climate Change* (Cheltenham, UK & Northampton, MA: Edward Elgar Publishing, 2019).

and all the power concentrated in the hands of a few. Among industrialised nations, Russia is the one whose wealth is distributed most unfairly: 1% of the population owns 58% of the wealth.[8]

Vladimir Putin and his inner circle's control over the hydrocarbon industry has also made it possible to channel the 'oil money' into solidifying power instead of developing society and diversifying the economy. A third of government spending is invested in the machinery of violence: the defence industry, the armed forces, the security forces, and the police. In addition, some 'oil money' has been spent on supporting conservative forces in the US and Europe, as well as carrying out terrorist and cyber operations in the West.[9]

The ease of managing cash flows is related to the social contract of Russia as a petrostate. The energy sector employs only about 2% of the workforce, whose silence is easily bought so that they are not a challenger to the political system. The public, on the other hand, has been kept content until recently, with the funds trickling down from the elite to the middle class by the oil-driven economic growth. The Russian social contract says that, in exchange for handing over the political rights to the regime, the Russian people can enjoy growing incomes and low costs of living.[10] The effects of a large-scale war on both the economy and people's private lives are now obvious, so the foundation of this social contract has begun to shake.

To balance the grossly unfair income distribution with the social contract, Russia has tried to create a special oil culture with the help of propaganda

To balance the grossly unfair income distribution with the social contract, Russia has tried to create a special oil culture with the help of propaganda. The state media convinced Russians that oil and gas are the main tools to restore the glory of the Great Power. A citizen of the oil culture must respect patriotic hydrocarbons because they enable the growth of Russia's military power. Citizen of the oil culture has thus been led to believe that climate change does not threaten Russia; that Europe's dependence on Russian energy makes it an all-powerful actor; and that Russia can dominate others while being economically independent itself. Since the early 2000s, the Russian media – as well as academia – have written about a "Finlandised" Europe that is on the ropes, with some calling Putin a "gas emperor."[11]

Russian war is an attack not only on democracy but also against the environment

Fossil energy is the main weapon in the Russian toolbox. Like the geopolitical thinking of Putin's Russia, which draws on nationalism, the country's means of production – i.e., oil and gas – are based on innovations from the early 20th century. Putin's Russia wages war against democracy and political reforms and, at the same time, desperately tries to slow down technological modernisation that can help protect against climate change. Russian war is an attack not only on democracy but also against the environment.[12] Putin's dictatorship fights for a fossilised, environmentally destructive world, while the West fights against it.

However, the idea of a self-sufficient *Russkiy mir* (Russian World), built with increasingly fervent nationalist propaganda, is based on self-deception. Russians have been led to believe that the import substitution programme to boost domestic production would free Russia from its dependence on the global economy.[13] Russia is often described as an energy superpower on which others depend – after all, Russia produces 20% of the world's gas and 10% of its oil. This has fuelled the idea that "Fortress Russia" can survive on its own, while Europe is unable to break away from Russian energy.

[8] Anthony Shorrocks, James Davies, and Rodrigo Lluberas, *Global Wealth Report 2022* (Zurich: Credit Suisse Research Institute, 2022).

[9] Shelby Butt and Daniel Byman, "Right-wing Extremism: The Russian Connection," *Global Politics and Strategy* vol. 62, issue 2 (2020): 137-152.

[10] Natalia Mamonova, "Understanding the silent majority in authoritarian populism: what can we learn from popular support for Putin in rural Russia?," *The Journal of Peasant Studies* vol. 46, issue 3 (2019): 561-585.

[11] Veli-Pekka Tynkkynen, *The Energy of Russia.*

[12] Bruno Latour, "Is Europe's soil changing beneath our feet?," *War Ecology: A New Paradigm* issue 2 (September 2022).

[13] Anna Nadibaidze, "Understanding Russia's Efforts at Technological Sovereignty," *Foreign Policy Research Institute*, 8 September 2022.

Financially, Russia prepared for the war. The shrinking energy export revenues in Europe were thought to be buffered with contingency funds. Leading up to the February 2022 invasion, Russia had more than 600 billion euros hoarded. Some of these funds have now been frozen by the West.[14] Yet, thanks to the funds that are still usable and the energy trade that is still ongoing (some with Europe and some redirected to Asia), Russia can finance its war in Ukraine.[15] Self-sufficiency is, however, another self-deception: Russia is not able to replace the income it will lose in Europe on the Asian energy market. Most importantly, Putin underestimated the ability of Western sanctions to erode Russia's energy and natural resource production capacity. The technology needed by the oil and gas industry – especially the offshore drilling know-how – as well as by the mining and metal industry, is developed and produced mainly by the West. Hence, the production of fossil energy and raw materials in Russia will probably decrease in the next few years.[16]

1.2. Failure of *Wandel durch Handel*

For decades, Europe used to trade energy with the Soviet Union and Russia hoping that such business cooperation would guarantee peaceful relations between the parties. The idea dwelled on the new eastern policy initiated by West Germany in the late 1960s: *Ostpolitik* assumed that trade would benefit both sides, 'tame' the Soviet Union, and promote democracy.[17] However, *Wandel durch Handel* (change through trade) relied on the Western economic thinking, to which all other political objectives were also believed to be subordinate in Russia. The collapse of the Soviet Union in 1991 was interpreted as a success stemming directly from this policy. Yet, the Soviet Union was brought down by the collapsing economy (resulting from low oil prices in the 1980s) rather than a democracy 'imported' via Western trade.

In post-Cold War Europe, people believed in interdependence via energy trade. Politicians, energy industry representatives, and scholars of Russia still believed in this fallacy in the weeks leading to the Russian invasion of 2022. However, the first signs signalling the inefficiency of such peace-building interdependence were already clear in 2008, in connection with the war in Georgia, or at the latest when Russia started the war in Ukraine in 2014. The truth is that while cheap Russian fossil energy has increased Europe's economic prosperity, in Putin's Russia, the oil money – and the centralising power of fossil energy – have fuelled more aggression.

While cheap Russian fossil energy has increased Europe's economic prosperity, in Putin's Russia, the oil money – and the centralising power of fossil energy – have fuelled more aggression

Interdependence develops when there is a balance of power between the parties. Many believed the European Union to have parity with Russia in energy policy. In reality, the EU, as an institution, had no power to influence Russia, which became visible when the EU failed to impose effective sanctions on Russia after 2014.[18] The EU itself has not bought a single barrel of oil, a cubic meter of gas, or a ton of coal from Russia. Trading only took place between Russia's giant state-owned companies and Europe's mostly privately owned energy

[14] "Allies freeze $330 bn of Russian assets since Ukraine invasion: task force," *AFP / France24*, 29 June 2022.

[15] During the first six months of Russia's invasion the largest fossil fuel importers were the EU (85.1 billion euros), China (34.9 billion euros), Turkey (10.7 billion euros), India (6.6 billion euros), Japan (2.5 billion euros), Egypt (2.3 billion euros), and South Korea (2 billion euros). See: Lauri Myllyvirta, Hubert Thieriot, Jan Lietava, Erika Uusivuori, Ronja Borgmästars, Vera Tattari, Lyder Ulvan, Oleksii Mykhailenko, and Andrei Ilas, "Financing Putin's war: Fossil fuel exports from Russia in the first six months of the invasion of Ukraine," *Centre for Research on Energy and Clean Air (CREA)*, accessed on 17 March 2023.

[16] Julian Ringhof, "Give and tech: How technology sanctions can help counter the threat from Russia," Commentary, European Council on Foreign Relations (ECFR), 4 March 2022.

[17] Felix K. Chang, "Legacy of Ostpolitik: Germany's Russia Policy and Energy Security," *Foreign Policy Research Institute*, 8 May 2014.

[18] Peter A.G. van Bergeijk, "Sanctions against the Russian war on Ukraine could be made to work," *VoxEU, Centre for Economic Policy Research*, 28 March 2022.

companies. Although they may have significant influence and lobbying power within the individual EU member states, they are not so big and powerful that their economic muscles would be felt in Moscow.

In terms of energy security (and therefore comprehensive security), Europe has lived in an institutional delusion that has prevented us from seeing the (geo)political power of energy to its full extent. This delusion opened a window of opportunity for Putin's Russia and allowed it to wage its expensive colonial war, which Europe practically financed. It has also proven difficult for Europe to punish Russia and stop supporting Putin's war machine because a third of all oil imported to the EU countries and almost half of the natural gas have flowed from Russia. Energy trade has been fading painfully slowly and – more importantly – at Russia's pace and terms.[19] The price caps introduced by the West on Russian energy are an attempt to reverse this pattern.

The EU's market-driven energy policy has granted the energy companies the possibility to define what constitutes European energy security

Trade interdependence that presumably guarantees peace – a utopian idea that persists even despite Russia's violence and brutality in Ukraine – rendered the West unable to exhaust Putin's war machine. The situation is such because the EU's market-driven energy policy has granted the energy companies the possibility to define what constitutes European energy security. On the EU level, countries never saw a stress test that would play out a scenario in which all gas flows from Russia were to stop.[20] Neither the energy industry nor the political establishment could ever imagine this scenario to be possible. And thus, it was the philosophy that guided Europe's energy policy. Europe saw Russia as a normal country and believed that Russia accepted the Western economic logic, even though some observers warned that Russia had not been abiding by it since the early 2000s.[21] Neither the fixation of Putin's criminal clan on the Great Russian imperialism and colonialism nor the overwhelming support for this worldview among the Russian people was considered to be a factor in the risk calculations by the European energy companies and their political allies. The path of violence was perceived to be an economically absurd option.

Therefore, the energy industry shall not decide the European energy policy. Political institutions shall be the 'master,' while industry shall be a 'servant' – not vice versa, as has been the case. Hopefully, in the future, the decision-making power – when it directly impacts the energy sector and energy security in the whole of Europe – will not be handed over to private actors. An uninterrupted flow of energy is vital to modern society as it guarantees the operational reliability of critical infrastructure and industrial production.

Energy is a 'master resource,' which is why the interdependencies among energy trading partners cannot be compared to those of other sectors. Russia has been able to utilise the European energy sector as its tool of influence. On the one hand, Russia has long enjoyed a central market position. On the other hand, sudden changes to the energy infrastructure are always difficult because of the domino effect they create. Thus, it is impossible to cut off the energy trade overnight – otherwise, Europe's critical infrastructure would shut down. That is why the EU's strategic autonomy – or self-controlled geopolitical freedom of action – needs energy and resource sovereignty alongside military power.[22]

[19] Anniki Mikelsaar, "Between *Ostpolitik* and *Zeitenwende*—Germany's Dual Dependence on China and Russia," *The International Centre for Defence and Security (ICDS)*, December 2022.

[20] European Commission, *Communication from the Commission to the European Parliament and the Council on the short term resilience of the European gas system: Preparedness for a possible disruption of supplies from the East during the fall and winter of 2014/2015*, COM/2014/0654 final/2 (Brussels: European Commission, 2 March 2015).

[21] Laura Solanko and Pekka Sutelo, "Too Much or Too Little Russian Gas to Europe?," *Eurasian Geography and Economics* vol. 50, issue 1 (2009): 58-74; "Russia after the Crisis - Challenges of Modernization," Finnish Institute of International Affairs (FIIA), 16 November 2010.

[22] European Union External Action Service, *A Strategic Compass for Security and Defence* (Brussels: EU External Action Service, 2022); Mario Damen, *EU strategic autonomy 2013-2023: From concept to capacity* (Brussels: EU Strategic Autonomy Monitor Briefing, European Parliamentary Research Service, Strategic Foresight and Capabilities Unit, July 2022).

1.3. It's The Economy, Stupid and Other *Maskirovka*

The economic bias and interdependency delusion explained above are the reasons why Europe failed to see the three fundamental steps Russia had taken in the realm of economy and energy in order to prepare itself to launch the full-scale invasion, especially in 2020 and 2021. The 'buffer funds' accumulated over the years with oil and gas money, the developments in the European gas market, and Russia's climate strategy are examples that show how Europe misunderstood Russia, while Russia used them to prepare for the invasion of Ukraine – as well as for its colonial war against the rule of law, human rights, democracy, and responsible climate policy.

First, western economists argued for years that piling large 'buffer funds,' while paying off most of Russia's foreign debt, was a wise austerity policy for an oil-producing country, as it helped to buffer against the negative effects of the fluctuating oil prices on the economy.[23] Hardly, did we hear any analyses (until late 2021) that Russia had instituted this fiscal policy primarily to position itself for the war of aggression and the consequent western sanctions. The same can be said about the lenses through which some Western scholars viewed Russia's import-substitution programme – as a modernisation effort, not a policy to build up Russia's resilience in wartime.[24]

Second, Russia started to apply pressure on the European energy market as early as June 2021 by not selling gas on the spot market as it had done previously. As a result, both gas and electricity prices skyrocketed, and Europe failed to fill its gas storages to the level of normal winter capacity. Thus, Europe found itself in a rather vulnerable position in 2022, when the invasion began. In 2021, Russia veiled the decreasing volumes as a market reaction to countries switching from long-term contracts to spot sales. Some analysts were quick to vouch for the economic and market reasons behind Gazprom's decisions. Yet, it was a Russian '*maskirovka*' – i.e., a disguise.[25] More importantly, several European energy companies – such as the Finnish *Fortum* and its German subsidiary *Uniper* – benefited from higher prices (and sales on the spot market declining), so they went along with the Russian narrative and even amplified it. Hence, the European energy industry severely undermined not only Europe's energy security but also its ability to confront Russian aggression in 2022.

Third, after China and the US had come out with a zero-emission climate pledge in early 2021, Russia might have felt weaker, compared to other powers, due to its free-rider stance in terms of the global climate policy. It could no longer rely on the climate-denialist 'hydrocarbon axis' between Russia and the US, as did during the Trump administration. In the spring of 2021, Russia announced that it was drafting a climate strategy that would aim for carbon neutrality by 2060 and promised to deliver this strategy at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow. However, at the Glasgow summit in the autumn of 2021, Russia moved its own deadline by six months. Instead of a full-fledged climate strategy, Russia delivered a full-fledged war. Despite the fact that Anatoly Chubais, the head of Russia's climate policy authority, and his colleagues probably worked genuinely on the climate plan, Putin and his entourage had already decided to invade Ukraine by the time their work began. Chubais fled Russia right after the invasion, thereby effectively halting Russia's already weak climate policy.[26] Thus, Putin exploited Russia's climate strategy promise as a perfect *maskirovka* to deceive the West into thinking that Russia was solidly in the interdependency frame and gave Russia more room to manoeuvre.

Instead of a full-fledged climate strategy, Russia delivered a full-fledged war

[23] Theo Smid, "Russia's Fortress strategy is not for free," Atradius, 14 September 2021.

[24] Vladislav Inozemtsev, "Russia's Economic Modernization: The Causes of a Failure," *Russia/NEI Center, Ifri*, September 2016.

[25] Jack Sharples, "A Series of Unfortunate Events: Supply-side factors in the European gas price rally in 2021 and outlook for the rest of winter," *The Oxford Institute for Energy Studies*, December 2021.

[26] Lisa McIntosh Sundstrom and Laura Henry, "Cloudy Forecast for the Climate: Russia's Climate Policy in a Time of War," *Policy Memo* no. 785 (PONARS Eurasia, 14 July 2022).

1.4. Russia Mine Inc. is Not Omnipotent

The Russian war machine will only stop when confronted with a mightier military force. To reinforce this restraint, the West must isolate Russia from the global economy as much as possible. As Putin's regime seeks to maintain its power by resorting to escalating violence, it will need additional financial and technological resources to succeed. In the near future, the EU will do its best to replace Russian oil and gas and stop financing Russia's war. It has already committed to massive investments in energy saving, renewable energy, and liquefied natural gas imports.[27] Replacing Russian oil and gas, however, is more difficult, and energy scarcity can, therefore, be expected throughout Europe. Yet, high prices also encourage innovation – a silver lining around the dark Russian cloud.

Russia's industry has many weak spots: from oil drilling to fertiliser extraction and metal smelters. It is high time we exploited them so that Russia suffers as much economic damage as possible

It is in the West's best interest to suppress the fossil energy flows that fatten Russia's war chest, while China and India want to maintain them. Exports to Asia have already replaced some of the markets that Russia lost in Europe. Surely, Russia is unable to fully substitute those losses, as Asian customers have successfully bargained for lower prices. Sanctions already imposed on exports and technology transfer will soon start chipping away at Russia's ability to extract oil and gas, as well as other minerals.[28] For example, Western companies enjoy a near-complete monopoly over underground mining drilling equipment. Restricting access to such equipment (that also wears out quickly and requires constant maintenance) will significantly reduce the Russian mining capacity and hamper production within one year. Putin is the CEO of "Russia Mine Inc.," with fossil energy and minerals comprising over 70% of the export volume. Russia's industry has many weak spots: from oil drilling to fertiliser extraction and metal smelters. It is high time we exploited them so that Russia suffers as much economic damage as possible.

Russia is still able to continue to sell these commodities but at a much lower price. A trade embargo must also apply to China and other third countries – Western military, energy, and mineral-production technology must not be allowed to enter Russia through them. Europe should make its fossil energy sanctions permanent – Russia that lives on oil is more likely to be violent than Russia relies on renewable energy.[29] We must always remember that it was oil and gas that enabled the regime to centralise power and funnel the money into Putin's machine of violence in the first place.

1.5. EU's New Russia Strategy

Until February 2022, Europe had been hopeful about Russia and, therefore, naive in the face of Russia's growing appetite for violence. However, *Wandel durch Handel* or 'hustling Russia into peace' through trade is not an inherently bad idea – one just must have both hard and soft power to achieve geopolitical goals. Europe's old *Ostpolitik* relied on the 'invisible hand' and was schizophrenic in content. On the one hand, it trusted the geopolitical power of the economy. On the other hand, it never elaborated on the details of that power, which could have hedged against over-dependence. The concrete foreign and security policy dimensions of energy trade – as well as the risks of dependence – were swept away as social taboos, as if the oil and gas pipelines or the nuclear power plants were exclusively environmental or economic issues.

Hustling Russia into peace' through trade is not an inherently bad idea – one just must have both hard and soft power to achieve geopolitical goals

[27] European Commission, *REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition* (Brussels: European Commission, 18 May 2022).

[28] Iryna Bogdanova, "The Role of Technology Sanctions in Crippling Russia's War Machine," *The International Institute for Sustainable Policy Development (IISD)*, 6 September 2022.

[29] Veli-Pekka Tynkkynen, *The Energy of Russia.*

Behind it was the fear of Russia and its reactions, which Putin skilfully exploited (just as he exploited Germany's sense of guilt for the horrors of the Second World War). This led to the "Finlandisation" of Europe under Germany's leadership: Europe dared not to demand anything from Russia. Whenever Russia escalated (as it did in 2014), Europe's response was to offer Russia a bigger carrot – i.e., to expand the energy trade and thus deepen Europe's dependence.[30] Europe's inability to learn its lessons only spurred Putin further towards the path of violence and colonialism.

Europe's inability to learn its lessons only spurred Putin further towards the path of violence and colonialism

Russia of the old *Ostpolitik* was akin to Lord Voldemort from the Harry Potter series – he-who-must-not-be-named. The new Russia Strategy must call things by their proper names, and taboos must be broken. The new policy may recycle some 'soft parts' from the old approach but also acknowledge the mistakes of this one-sided, appeasing strategy in order to foster a more united and cohesive Europe. Unanimity and defence of democracy are needed when the new Russia Strategy is being drawn up. Europe and the democratic world should establish the criteria that promote transparency, as well as environmental and social sustainability, to the top of their trade policy.[31] The work must begin immediately and serve as an invitation to cooperation for Russia that wants to leave the path of violence. The Russian business elite should be persuaded to choose this road – this carrot is needed right now. However, it cannot be an off-ramp for the Putin regime – but a helping hand lent only to a democratic Russia.

Alongside the carrot of the new Russia strategy, Europe and the West should carry a powerful stick

One should not be overly optimistic about Russia: a significant portion of the people supports the war, even now. The Russian imperialist and colonialist worldview will not disappear overnight.[32] Therefore, alongside the carrot of the new Russia strategy, Europe and the West should carry a powerful stick. In practice, it should boost military capability in Europe and include nuclear deterrence. Europe – one of the world's strongest economic regions with a population of half a billion – shall never again be afraid of a country with a relatively small economy and a population of 140 million.

The cornerstone of the Russia Strategy should be actions that curb climate change and support the energy transition. Russia has significant reserves of strategic metals, and these raw materials are needed in a renewable energy system.[33] The EU's new Russia Strategy could direct the structure of Russian industry so that investments in fossil energy sources shrink while investments in strategic materials increase. Russia does trade them on the global market when it can generate significant income. The current embargo should be strengthened and remain in place as long as the war in Ukraine continues. Yet, after Russia has withdrawn its troops from Ukraine and agreed on war reparations, the export of strategic metals shall be allowed, but only if Russia implements democratic reforms.

In addition to the economic challenges, for many Europeans, it is politically – and mentally – challenging to end the energy trade. Although the vast majority of European politicians have already emphasised that we need to get rid of Russian energy and isolate Russia, there are some voices who claim that economic ties (with energy at their core) should be maintained. For those who subscribed to Germany's *Ostpolitik,* it is now difficult to make the decision to finally give up Russian energy.[34] Thus, as long the energy crisis is raging in Europe, there will likely be many

[30] Patrick Wintour, "'We were all wrong': how Germany got hooked on Russian energy," *The Guardian,* 2 June 2022.

[31] Anne Applebaum, "America Needs a Better Plan to Fight Autocracy," *The Atlantic,* 15 March 2022.

[32] Kristi Raik and Martin Hurt, "Building European Security Against Russia – A View From Estonia," *The International Center for Defence and Security (ICDS)*, November 2022.

[33] Veli-Pekka Tynkkynen, *The Energy of Russia.*

[34] Anniki Mikelsaar, "Between *Ostpolitik* and *Zeitenwende*."

parties who would try to 'relieve geopolitical inflammation' with energy or raw materials.

Whatever the economic consequences, it is, nevertheless, necessary to pursue policies that promote not only Europe's social resilience but also economic competitiveness, while growing its geopolitical power. Disengagement from Russian energy will have a high price regardless, and the costs must not be disproportionately shouldered by the most vulnerable. Were this to happen, it would fuel extremist ideologies and crack the European community, which has always been the goal of Putin's Russia. Viktor Orbán's fossil populism in Hungary – i.e., the right-wing populist policies feasible only with the help of cheap Russian oil and gas – is a warning example that Russia hopes to replicate throughout the EU. Europe must, therefore, clearly communicate how energy security, dependence on Russia, climate protection, energy transition, and democracy are all intertwined.

Whatever the economic consequences, it is necessary to pursue policies that promote not only Europe's social resilience but also economic competitiveness, while growing its geopolitical power

2. Transatlantic Energy Relations: Historical Legacy, Current Support, and Future Prospects

Andrian Prokip

For decades, the US has tried to play a role in Europe's energy security to prevent Europe from closer cooperation with the USSR and later Russia and thus reduce its energy dependency. Now, Russia's military aggression and the extraordinary energy crisis may bring transatlantic relations to a new level: the EU wants to give up on Russia itself, and the US aspires to become the key energy supplier to Europe. The prospective cooperation may go further than the fossils trade and extend into the climate agenda and energy transition, making transatlantic partnership even more fruitful and mutually beneficial.

2.1. The Historical Context

2.1.1. The Cold War: The Birth of European Dependency and The US Opposition

Since the beginning of the Cold War, the US has been among the key partners of Western Europe. As a part of the rally for global leadership, the US was interested in containing the USSR, while European countries were interested in having a potent partner to strengthen security. The energy factor – e.g., energy supplies by the USSR to Europe – later complicated these relations and fostered some contradictory dynamics.

Naturally, European states were interested in buying Soviet oil and gas. On the one hand, there was a legitimate fear for their own security threatened by the USSR. On the one hand, there was a desire to have a reliable flow of relatively cheap energy. Later, they produced a new narrative: strong economic ties as a means to normalise relations between Europe and the Soviet Union, supposedly leading to lower security threats.

The US was concerned that Western money and technology would enable the Soviets to undermine the US influence and power across the world. The US National Petroleum Council's reports of 1962 noted:

> Soviet Bloc trade is being used to extend communist influence, destroy operations of private companies that pose a threat to the spread of their ideology of state control, create unrest in key foreign areas, and to obtain vital strategic materials and technical know-how from the Free World.[35]

The US was concerned that Western money and technology would enable the Soviets to undermine the US influence and power across the world

The US was troubled by the fact that the USSR was using its export revenues and import of goods and equipment from the West to produce military equipment. Besides, the Soviet oil export growth would have affected the export capabilities of countries allied with the US, in particular Venezuela and the Gulf states.[36]

The above-mentioned developments help to explain the US attempts to prevent energy integration between the European nations and the USSR. After the Oil Shock of 1973-74, Europe began eyeing the Soviet energy supplies.[37] Amplified by the embargo by the Organisation of the Arab Petroleum Exporting Countries (OPEC) following the Yom Kippur War, it was perceived as a serious threat to the Western power. In 1976, M D Taylor, a US diplomat and military general, was probably the first public official to use 'energy weapon' as a term:

> For the USSR, the aggressive use of the oil weapon by the producer countries is a priceless asset, providing a peaceful and seemingly innocent means of undermining NATO and indeed entire Western capitalist system without direct Soviet involvement. For the Kremlin, this must appear a thoroughly enjoyable economic war by proxy.[38]

In 1978, the Soviet Union proposed a new Urengoy-Pomary-Uzhhorod pipeline from Siberia to Western Europe. As the US intelligence said at that time, Western European gas producers were neither willing nor able to grow their production in the 1980s, whereas non-European suppliers – such as Algeria, Nigeria, Qatar, Indonesia, or Canada – appeared too unreliable and too expensive. According to a CIA report, "The West Europeans further believe that the Soviet gas deal is relatively advantageous in terms of security, flexibility, and price."[39]

Therefore, leading Western European countries endorsed the new pipeline, which later necessitated loans and equipment transfers to the USSR to make the project happen. Naturally, the US reaction was negative. In 1981, Ronald Reagan's administration imposed new sanctions against the USSR to ban sales of equipment for energy exploration and production. European countries – already dependent on Soviet energy but still not paying much attention to risks associated with it – demanded cheaper energy and deemed sanctions to be illegal. In the end, some European companies violated those restrictions. The US ultimately lifted the ban in 1982, and the pipeline was commissioned in 1984.[40]

2.1.2. From 1990 to 2014: The Dashed Hopes of Liberalisation

The collapse of the USSR removed the fears of communist expansion – military or hybrid alike. This was the reason to reboot Europe's relations with Moscow in the hopes to build a new partnership without the shadow of history. Europe expected Russia to become a free economy and the market principle to become a basis for energy cooperation.

[35] National Petroleum Council, *Impact of Oil Exports from the Soviet Bloc* (Volume I) (Washington, DC: National Petroleum Council, 1962).

[36] National Petroleum Council, *Impact of Oil Exports from the Soviet Bloc.*

[37] Marco Siddi, "EU-Russia Energy Relations," in *Handbook of Energy Governance in Europe*, eds. Michèle Knodt and Jörg Kemmerzell (Cham: Springer, 2020), 1-25.

[38] Maxwell D. Taylor, "The Legitimate Claims of National Security," *Foreign Affairs,* April 1974.

[39] Director of Central Intelligence, *The Soviet Gas Pipeline in Perspective* (Special National Intelligence Estimate) (Washington, DC: Central Intelligence Agency, 1982).

[40] Richard Nephew, *Transatlantic Sanctions Policy: From the 1982 Soviet Gas Pipeline Episode to Today* (New York: Center on Global Energy Policy, School of International and Public Affairs, Columbia University, March 2019).

Western European energy companies were deepening their partnership with the Russian *Gazprom* in the 1990s and 2000s.[41] Even countries with traditional concerns regarding the Kremlin – for instance, Poland – were open to cooperation in energy. In 1993, Poland and Russia signed an agreement to build a new pipeline connecting the two countries.[42] The Yamal-Europe pipeline was put into operation in 1997, and a deal on gas supplies and transit was signed.

In early August 2009, when Russia and Turkey signed an agreement on the construction of the Turkish part of the South Stream – a pipeline bypassing Ukraine under the Black Sea – Russia informed about its final decision not to join the European Energy Charter Treaty. This step freed Russia from an obligation to allow gas transit across its territory, specifically from the gas-rich Central Asia countries. Russia itself would buy gas from them and trade it, thus restricting their access to the free market (including the European market).[43] Besides, Russia saw the Charter as an obstacle to wresting control over the domestic energy markets in Europe.

In the late 2000s and early 2010s, Russian energy abuse was more than evident

In the late 2000s and early 2010s, Russian energy abuse was more than evident. For instance, in 2005 and 2009, Moscow lodged gas claims against Kyiv, which resulted in gas transit suspension to Europe and halted supplies to the continent. Russia accused Ukraine of stealing the gas intended for European consumers. It tried to persuade the European establishments that Kyiv was an unreliable transit partner and, therefore, argued for building new gas pipelines to bypass Ukraine. In 2010, the Kremlin again exploited its gas leverage and successfully pressured a weak, short-sighted, and corrupt pro-Russian government led by Viktor Yanukovych to extend the lease on the Russian Black Sea fleet in Ukraine's Crimea in exchange for an illusory natural gas discount. Hence, by 2010, it had already become clear that Russian energy policy was politically driven and far from market-oriented. At the same time, Russia's war against Georgia in 2008 showed that the Kremlin had never abandoned military aggression as a foreign policy tool. Just as during the Cold War, the US was again uneasy about the Kremlin's ability to use energy revenues to finance its aggressive policy. This, however, did not affect the energy policy in many European states.

The US took steps to strengthen the EU's energy security which proved prescient but only partially successful

The US took steps to strengthen the EU's energy security which proved prescient but only partially successful. Washington supported the idea of the Nabucco pipeline that had to connect gas fields in Iran, and later Turkmenistan, Uzbekistan, and Azerbaijan with the EU. When the project had failed, the US administration continued to pursue unlocking Azerbaijan's gas export potential. Those efforts led to the construction of the Trans-Anatolian pipeline that became a part of the so-called Southern Gas Corridor.[44] Russia opposed both the Nabucco project and the idea of the Trans-Caspian pipeline that would connect Kazakhstan and Azerbaijan and hurried with the South Stream deal.

[41] Marci Siddi, "The European Green Deal: Assessing Its Current State and Future Implementation," *FIIA Working Paper* 114 (May 2020).

[42] "Porozumienie między Rządem Rzeczypospolitej Polskiej a Rządem Federacji Rosyjskiej o budowie systemu gazociągów dla tranzytu gazu rosyjskiego przez terytorium Rzeczypospolitej Polskiej i dostawach gazu rosyjskiego do Rzeczypospolitej Polskiej, sporządzone w Warszawie dnia 25 sierpnia 1993 r [Agreement between the Government of the Republic of Poland and the Government of the Russian Federation on the construction of a gas pipeline system for the transit of Russian gas through the territory of the Republic of Poland and the supply of Russian gas to the Republic of Poland, signed in Warsaw on 25 August 1993]," *Monitor Polski* no. 46, 512 (2011).

[43] Philip Roche, Steve Abraham and Sherina Petit, "Russia's withdrawal from the Energy Charter Treaty," Norton Rose Fullbright via Lexology, 26 August 2009.

[44] "U.S. eyes smaller pipeline for Azeri gas as option," *Reuters*, 15 November 2015.

2.2. Contemporary Setting

2.2.1. Europe Hits a Snooze Button

In 2014, Russia annexed the Crimean Peninsula and unleashed the war in Donbas, yet the preparations to approve the South Stream persisted. The very idea of that pipeline contradicted a new European energy regulation – i.e., the Third Energy Package. Regardless of the Russian aggression and clash with the EU law, some European energy giants, nevertheless, signed contracts to construct the pipeline and publicly promoted the project.

The pipeline emerged as a political issue in mid-April 2014 when the European Parliament issued a non-binding – yet harsh – resolution calling for the project to be halted and citing the developments in Ukraine and, in particular, the annexation of Crimea. US President Barack Obama urged the EU leaders to decrease reliance on Russia and diversify energy supplies.[45] In June 2014, Bulgaria – referring to the EU's concerns – suspended all works related to the Russian-led South Stream pipeline. The announcement was made by the then-Prime Minister Plamen Oresharski and came after he met with three US senators – John McCain, Christopher Murphy, and Ron Johnson – who had arrived in Sofia one day prior, presumably lobbying for the project to be blocked.

In February 2015, the European Commission published the Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy that called for making the EU stronger in terms of energy security.[46] Russia was mentioned in the document only once.

> The EU will consider reframing the energy relationship with Russia based on a level playing field in terms of market opening, fair competition, environmental protection, and safety, for the mutual benefit of both sides.

As an alternative, the strategy planned to expand the EU's energy partnership with other countries such as Azerbaijan through the South Gas Corridor. But this reaction was not long-lasting: some EU member states were still interested in 'business as usual' with Russia. In 2015, *Gazprom* and several European companies signed an agreement on the Nord Stream 2 construction; one year later, a deal on the TurkStream – a reincarnation of the South Stream pipeline with half of the previous capacity – was finalised. Both projects came under US criticism amidst Russia's disruptive energy policy and its military aggression against Ukraine, as well as the EU's energy dependency, and resulted in new American sanctions.

Nord Stream 2 was the most controversial. There was a considerable concern that once Russia has secured enough capacity to bypass Ukraine in delivering gas to the EU, Russia might feel more emboldened to launch a new act of aggression against Ukraine. That is why Kyiv took diplomatic steps to rally US support in challenging the project. In mid-2017, fearing that President Donald Trump might greenlight Nord Stream 2 to help Russia, the US Senate imposed more sanctions with some additional restrictions to follow.[47] One of those bills was appropriately titled Protecting Europe's Energy Security Act (PEESA). The issue became central to the relations between the US and some European states, aggravating other transatlantic cracks that occurred during Donald Trump's presidency.

Some European countries did learn the lesson that Kremlin's energy policy had not changed for the better since the Soviet era and, therefore, sought to reduce their dependence on energy supplies from Russia. For instance, Lithuania commissioned a floating regasification unit, thus ending *Gazprom's* monopoly. Even though it continued importing some LNG from Russia's *Novotek,* it did so at competitive market prices, without paying a monopoly rent.[48] Poland built an LNG

[45] Dave Keating, "Obama urges EU to diversify its energy sources to end dependency on Russia," *Politico,* 26 March 2014.

[46] European Commission, *Energy Union Package: A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*, COM(2015) 80 final (Brussels: European Commission, 25 February 2015).

[47] Georgi Gotev, "New US sanctions threaten EU firms involved in Nord Stream 2," *Euractiv,* 16 June 2017; Katie McDougall and Stefan H. Reisinger, "Update on US sanctions in respect of Nord Stream 2 and TurkStream pipelines," *Norton Rose Fulbright*, 6 November 2020.

[48] "LNG terminal in Klaipėda to remain the main leverage over gas prices after 2024," Ministry of Energy of Lithuania, 11 April 2018.

terminal – with further plans to expand it – and signed a 20-year contract for the US gas imports in 2018.[49]

However, not everyone in Europe followed suit. Germany and Austria, among others, continued to lobby for the Nord Stream 2 project and tried to persuade the US to lift its sanctions. Despite all the controversy, including his warm spot for Russia and its president, it was hard to disagree with Donald Trump's arguments that the US President presented ahead of the NATO summit in 2018: while Germany was not spending enough on defence, it was going to pay more money to Russia – the country from which it expected the US to protect Europe.[50] Although the US rhetoric was, to a large extent, driven by the desire to enhance its LNG exports to Europe, it did negate the argument about the contradictory nature of the European approach.

Although the US rhetoric was, to a large extent, driven by the desire to enhance its LNG exports to Europe, it did negate the argument about the contradictory nature of the European approach

Following the meeting between the presidents of the European Commission and the United States in mid-2018 – where the parties had agreed to strengthen energy cooperation – volumes of LNG imports from the US increased significantly.[51] The same year, Chancellor Angela Merkel stated her intention to import LNG in order to reduce reliance on Russia and build an LNG terminal in Germany.[52] These promises, however, were made to soften the US position regarding the controversial pipeline, rather than out of a genuine concern about the growing dependency on the Russian gas. Thus, as of early 2022, when the Russian invasion of Ukraine and the ensuing energy crisis shook Europe, Germany – the biggest natural gas consumer in the EU – was still lacking an LNG terminal to help the nation cope with the crisis.

2.2.2. 2021-22: Dependency Comes Back to Bite, the US Rides to the Rescue

After taking office in 2021, US President Joseph Biden pledged to improve both transatlantic and US-German relations. As a result, under his leadership, the US administration waived the sanctions imposed on Nord Stream 2, and *Gazprom* finalised the construction of the pipeline in late 2021. Nonetheless, these sanctions delayed the project's completion and helped Ukraine to secure a new gas transit contract with Russia before the previous one would have expired at the end of 2019.

At the same time, Washington remained concerned about the Russian military threat to Ukraine. In a so-called Washington memorandum of mid-2021 that capped the efforts of the Biden administration to reset energy relations with Berlin, the US and Germany agreed on joint actions (including sanctions) that would limit Russian energy exports to Europe were the Kremlin to use energy as a weapon or commit further acts of aggression against Ukraine.[53]

The US officials had been anticipating energy tension in the case of Russia's invasion

The US officials had been anticipating energy tension in the case of Russia's invasion. In early 2022, they started looking for options to substitute Russian supplies to counter the Kremlin's blackmailing and negotiated with energy-importing countries in Asia to share the already booked deliveries with Europe.[54]

[49] Damian Słomski, "Paliwo przyszłości dostępne już dziś. Spółka PGNiG podpisała ważną umowę [The fuel of the future, available today. PGNiG has signed an important agreement]," *money.pl,* 17 October 2018.

[50] Georgi Gotev, "Trump begins NATO summit with Nord Stream 2 attack," *Euractiv,* 11 July 2018.

[51] European Commission, *Joint U.S.-EU Statement following President Juncker's visit to the White House* (Brussels: European Commission, 25 July 2018); European Commission, *EU-US LNG Trade: US liquified natural gas (LNG) has the potential to match EU gas needs* (Brussels: European Commission, February 2022).

[52] "Germany warms to liquefied gas terminal plan," *Deutche Welle,* 25 October 2018.

[53] U.S. Department of State, *Joint Statement of the United States and Germany on Support for Ukraine, European Energy Security, and our Climate Goals* (Washington, D.C.: U.S. Department of State, Office of the Spokesperson, 21 July 2021).

[54] Dmitry Zhdannikov, Ron Bousso, Simon Lewis, and Timothy Gardner, "Exclusive: U.S. talks to energy firms on EU gas supply in case of Russia-Ukraine conflict," *Reuters,* 15 January 2022; Jennifer Jacobs and Annmarie Hordern, "Biden Scours Globe to Send Europe Gas If Russia Hits Ukraine," *Bloomberg,* 2 February 2022.

At the same time, many European states were sceptical about the probability of a full-scale war, while their infrastructure ran into bottlenecks to import enough energy – especially gas – from sources other than Russia.

Moreover, energy-exporting countries were not able to offer such huge volumes of energy – particularly natural gas – on such a short notice. However, upon the US's request, Australia – the biggest LNG exporter and America's strategic ally in the Indo-Pacific – agreed to send additional volumes to Europe. The US itself, being the third biggest LNG exporter in 2021, promised to supply Europe with 15 bcm more gas than initially planned; eventually, the US supplies to Europe even exceeded those of Russia.[55] In some instances, European countries managed to buy American LNG cheaper than they would otherwise pay for the Russian pipeline gas, as it was with Bulgaria.[56] In the first half of 2022, the US had become the top LNG exporter in the world, with 71% of its supplies going to Europe.[57]

With regards to substituting Russian oil, some progress was made to ease the US sanctions, allowing for an increase in oil production in Venezuela (still in progress as of late 2022) and enabling its exports to Europe.[58] The US banned Russian energy imports shortly after the invasion and actively promoted an embargo.[59] Washington negotiated with other countries to release oil from reserves into the global market to soften the financial impact resulting from the Kremlin's weaponisation of energy resources, thus securing 60 million barrels from 30 countries.[60]

The US role in mitigating the energy crisis in Europe was solidified when the US administration and the European Commission established a taskforce to reduce Europe's dependency on Russian fossil fuels.[61] They agreed to join forces to withstand Russian energy blackmail during its war in Ukraine.

In the meantime, the US faced some domestic energy problems that complicated its efforts to ease the EU's energy crisis. High energy prices – which President Biden blamed on Russia – fuelled inflation that broke the 1981 record.[62] This put significant pressure on the economy and, subsequently, on the administration, with President Biden's approval ratings plummeting.[63] Despite its previous geopolitical clout in oil-rich regions such as the Gulf, Washington failed to persuade the OPEC+ to restrain from cutting production quotas in October 2022 and was forced to continue releasing oil from Strategic Petroleum Reserve that soon reached its lowest level since 1984.[64]

Even such a geopolitical and energy superpower as the US can still be vulnerable and have some limitations to the extent it can support its European allies in crisis

A similar situation emerged in the natural gas sector: the US administration considered restricting its exports to reduce the domestic prices but, having understood that this would affect America's allies badly, quickly abandoned the idea.[65] In June 2022, an explosion at Freeport – one of the largest LNG export facilities that processes around 20% of

[55] Andreas Rinke, Jarrett Renshaw, and Gabriela Baczynska, "U.S. promises to deliver 15 bcm more of LNG to Europe in 2022 – sources," *Reuters,* 25 March 2022; Anna Shiryaevskaya, "For the First Time, US Is Sending More Gas to Europe Than Russia," *Bloomberg,* 1 July 2022.

[56] Krassen Nikolov, "Bulgaria to replace Russian gas supply with cheaper US LNG," *Euractiv,* 12 May 2022.

[57] Arathy Somasekhar and Marguerita Choy, "U.S. becomes top LNG exporter in first half of 2022 – EIA," *Reuters,* 26 July 2022.

[58] Marianna Parraga and Matt Spetalnick, "U.S. to let Eni, Repsol ship Venezuela oil to Europe for debt," *Reuters,* 6 June 2022.

[59] White House, *Fact Sheet: United States Bans Imports of Russian Oil, Liquefied Natural Gas, and Coal* (Washington, D.C.: The White House Briefing Room, 8 March 2022).

[60] White House, *Fact Sheet: United States Bans Imports*.

[61] White House, *Fact Sheet: United States and European Commission Announce Task Force to Reduce Europe's Dependence on Russian Fossil Fuels, Briefing Room* (Washington, D.C.: The White House Briefing Room, 25 March 2022).

[62] White House, *Statement by President Biden on Consumer Price Index (CPI) in May* (Washington, D.C.: The White House Briefing Room, 10 June 2022); Olivia Rockeman, "US Inflation Quickens to 40-Year High, Pressuring Fed and Biden," *Bloomberg,* 10 June 2022.

[63] Steve Liesman, "Biden's economic approval rating falls to new low on fear about inflation, CNBC survey finds," *CNBC,* 18 July 2022.

[64] White House, *Statement from National Security Advisor Jake Sullivan and NEC Director Brian Deese* (Washington, D.C.: The White House Briefing Room, 5 October 2022); "Crude in U.S. emergency reserve falls to lowest since Dec. 1984," *Reuters,* 29 August 2022.

[65] Jarrett Renshaw and Trevor Hunnicutt, "Exclusive: White House rules out ban on natural gas exports this winter," *Reuters,* 4 October 2022.

American LNG –significantly affected the US export capabilities and had implications for the global prices. Along with the OPEC+ diplomacy failure, the incident clearly demonstrated that even such a geopolitical and energy superpower as the US can still be vulnerable and have some limitations to the extent it can support its European allies in crisis.

2.3. What the Future Holds

In the context of the international energy trade rapidly changing and the Russian supplies strengthening their grip in Europe, the US has always sought to play a bigger role in shaping European energy markets and policy. It has not always been successful – especially when it comes to pushing across the message that energy trade has major geopolitical implications and that Russia represents a significant threat in this regard. However, ever since the EU pledged to cut energy ties with Russia, transatlantic ties at the nexus of energy and geopolitics have been growing stronger. If this trend continues, it will be a win-win partnership that will accelerate the energy transition and strengthen allied resilience against the common adversaries.

2.3.1. Diversified Energy Supplies

In 2022, the European Commission decided to end dependency on Russian energy, marking a historic step of the same magnitude as the energy transition policy. Yet, Russia's oversized role in the EU's energy imports warrants searching for new suppliers. In 2021, the US exported around 102 bcm of LNG, thus becoming the third largest exporter globally.[66] In 2022, it took the top spot and planned to expand its LNG export capacities by 40% by 2026.[67] Hence, together with other big exporters like Qatar and Australia, LNG will play the pivotal role in the EU's energy diversification and transition, as well as in diminishing Russia's role in global energy trade.

The US will also contribute to the development of nuclear energy in Europe. Poland has already negotiated the construction of several new nuclear power plants with the US companies. There is considerable interest in other countries, such as Estonia and Romania, in the small modular reactor technology that is being developed in the US.[68] On nuclear technology and, more broadly, clean energy, Washington is assiduously courting countries in the Central and Eastern Europe, as reflected in the agenda of the Partnership for Transatlantic Energy and Climate Cooperation (P-TECC).[69]

Together with other big exporters like Qatar and Australia, LNG will play the pivotal role in the EU's energy diversification and transition, as well as in diminishing Russia's role in energy trade globally

This certainly rubs against the anti-nuclear stance of several EU member states (Germany, Austria, and Denmark). There are, however, some tentative signs of a nuclear renaissance in Europe; for instance, the Netherlands has recently announced plans for two new nuclear power plants. Taken together, it binds well with the return of the US to the nuclear energy technology markets that have been heavily dominated by Russian and Chinese state-owned corporations.[70]

2.3.2. The Geopolitical Underpinnings

A suggestion that energy or energy technology exports are the only – or even the key – US goal, as many believed when Washington tried to block the Nord Stream 2 pipeline, would be a mistake. This, indeed, could have been

[66] Victoria Zaretskaya, "U.S. exported record amounts of liquefied natural gas in 2021," *U.S. Energy Information Administration*, 28 March 2022.

[67] Victoria Zaretskaya and James Easton, "U.S. LNG export capacity to grow as three additional projects begin construction," *U.S. Energy Information Administration*, 6 September 2022.

[68] Tomas Jermalavičius, Max Bergmann, Peter Crail, Thomas O'Donnell, Tomas Janeliūnas, and Tõnis Idarand, *Developing Nuclear Energy in Estonia: An Amplifier of Strategic Partnership with the United States?* (Tallinn: The International Centre for Defence and Security, September 2022).

[69] "The Partnership for Transatlantic Energy and Climate Cooperation (P-TECC)," Office of International Affairs, U.S. Department of Energy, accessed on 16 March 2023.

[70] "Nuclear makes a comeback in the Netherlands," *World Nuclear News*, 15 December 2021; International Energy Agency (IEA), *Nuclear Power and Secure Energy Transitions: From today's challenges to tomorrow's clean energy systems* (International Energy Agency, June 2022).

an important driver for President Trump's administration, given his policy oriented towards economic growth and disregard for the importance of transatlantic relations as a geopolitical imperative. In his push to boost the US energy exports to Europe, Donald Trump was talking about the golden age of the energy business rather than the concern about Europe's geopolitical vulnerability.

Fortunately, this approach has not been dominant throughout transatlantic history. As demonstrated earlier in this chapter, in the 1980s, the US tried to prevent the construction of the Urengoy-Pomary-Uzhhorod pipeline – something that could increase threats to Europe – yet failed to provide an American alternative to the Russian gas supplies. The key US goals have always been related to the geopolitical influence and prevention of the rising powers that could pose a danger to Western and NATO unity. Today, it has a unique opportunity – due to better-aligned threat perceptions on both sides of the Atlantic and the availability of energy resources in the US – to completely transform the transatlantic nexus of energy and geopolitics.

Critics claim that the EU would simply switch energy dependency from Russia to the US – yet another manipulation happily promoted by the Kremlin in the hope of building upon strong anti-Americanism in some European political and societal circles.[71] At the same time, it is clear that even the increased dependence of the EU on the US and other external suppliers will be temporary. The RePowerEU plan, together with the commitment to reduce energy dependency on Russia, stipulates higher targets for domestic renewable power, hydrogen, and energy efficiency enhancement. In the long-term, transatlantic cooperation in accomplishing energy transition will become more important than the transatlantic flows of LNG that are now helping to withstand Russian geopolitical blackmail.

Transatlantic cooperation with the EU – a current leader of energy transition visions and solutions – would be helpful to the US, both in terms of achieving climate neutrality goals and stemming China's dominance in future green technology markets

2.3.3. Expansion of Energy Transition Cooperation

In the transatlantic community, Closer energy ties may open gates for fruitful bilateral collaboration towards energy transition. Compared to the US, European energy companies made significant progress in exploring opportunities related to decarbonisation: developing solar and wind power, biogas, and biofuels; studying green hydrogen production and options for capturing carbon emissions; investing in plastics recycling and production of e-polymers, etc.

The US oil and gas majors remain mostly focused on decreasing the carbon footprint of traditional oil and gas operations, improving their efficiency, decreasing methane emissions, and using renewable power to source their current operations. Some US companies considered enhancing the efficiency of operations as an adequate step to decrease pollution and help achieve the Paris Agreement goals. In addition, the US-EU memorandum on the energy taskforce of March 2022 stipulated the US would undertake efforts to reduce the greenhouse gas intensity of its energy exports to Europe.

In the long-term, however, this approach is unsustainable and may imperil the US global energy leadership and power. In 2021, US Secretary of State Antony Blinken said that insufficient efforts to address climate change "will have major repercussions" for the US national security and its economy, warning that the country was falling behind China on renewable energy and pushing for greater investment in green technologies.[72] Transatlantic cooperation with the EU – a current leader of energy transition visions and solutions – would be helpful to the US, both in terms of achieving climate neutrality goals and stemming China's dominance in future green technology markets.

[71] "Europe is simply switching gas dependency from Russia to U.S.-RIA cites Kremlin," *Reuters*, 11 December 2022.

[72] Jennifer Hansler, Nicole Gaouette and Kylie Atwood, "Blinken warns US is falling behind China in race to capitalize on climate opportunities," *CNN*, 19 April 2021.

3. War and EU Energy Policy: A Game Changer or More of the Same?

Christian Egenhofer
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In many policy areas, the Russian invasion of Ukraine has been a watershed moment for the EU.[73] Energy policy is one of the major areas impacted by the war and has witnessed some very prompt actions by the Commission and the member states aimed at alleviating the energy crisis, such as a long-term plan to phase out Russian fossil fuel imports.[74] The Council was able to agree on a series of exceptional and transitional measures on the basis of Article 122 of the Treaty on the Functioning of the European Union (TFEU), for instance, on coordinated demand reduction for gas or on emergency interventions to address high energy prices. In parallel, a near-unanimous agreement emerged on the need to 'double down' on the energy transition.

Some old divisions persist within the EU – for example, on the role of nuclear energy, natural gas, European solidarity, or the merit of joint purchasing

Yet, some old divisions persist within the EU – for example, on the role of nuclear energy, natural gas, European solidarity, or the merit of joint purchasing. By the end of 2022, member states had struck six solidarity agreements pertaining to the security of gas supply regulation. Three of them predated the war and the risks of supply disruptions that would follow in 2023 and apparently in 2024. Since April 2022, no new agreements have been concluded.[75] Is such reluctance to rely on EU-wide rules objective? Or does it hide some deeper divisions? Will the Russian aggression encourage the EU to adopt a common energy policy? Or will we see more of the same? To answer these questions, we need to look beyond the energy policy and factor in the wider climate and industrial implications.

3.1. The EU's Energy Landscape

The rise of global energy – as well as of other commodity – prices predates the war.[76] Natural gas prices, in particular, have been exceptionally high since September 2021, when they tripled against the pre-COVID-19 levels. Although commodity prices tend to have fluctuations cycles, there has been an unprecedented surge in demand combined with a slowdown of storage injections. The main contributing factors were the global post-pandemic recovery, a wind-poor summer in Europe (leading to lower-than-expected wind power output), a long and cold spring, and severe droughts hitting Brazil and Turkey and thus hampering global hydropower production.[77]

In addition, lower-than-usual gas supplies from the UK, the Netherlands, and Russia put further pressure on the EU market. Industrial accidents and higher-than-expected domestic demand could be the legitimate reasons that Russia used to explain the contracting supplies. However, *Gazprom*'s decision to cease selling to the spot market in October 2021 left few doubts about the geopolitical motives originally behind it.[78]

[73] Pieter De Groen, Tinatin Akhvlediani, Karel Lannoo, Cinzia Alcidi, Daniel Gros, Christian Egenhofer, Vasileios Rizos, Milan Elkerbout, and Andreas Kopp, *A Transformational Moment? The EU's response to Russia's war in Ukraine* (Brussels: Centre for European Policy Studies, 30 May 2022).

[74] "REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition," European Commission, 18 May 2022.

[75] Regulation formulated a solidarity mechanism in the event of an extreme gas crisis. In order for the solidarity mechanism to become operational, member states need to agree on necessary technical, legal, and financial arrangements in a bilateral agreement. See: European Parliament and the Council, *Regulation (EU) 2017/1938 Of The European Parliament And Of The Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010* (Brussels: Official Journal of the European Union, 18 October 2017).

[76] Mike Fulwood, "Surging 2021 European Gas prices - Why and how," *The Oxford Institute for Energy Studies (OIES)*, January 2022.

[77] "Statement on recent developments in natural gas and electricity markets," International Energy Agency (IAE), 21 September 2021.

[78] Fulwood, "Surging 2021 European Gas prices."

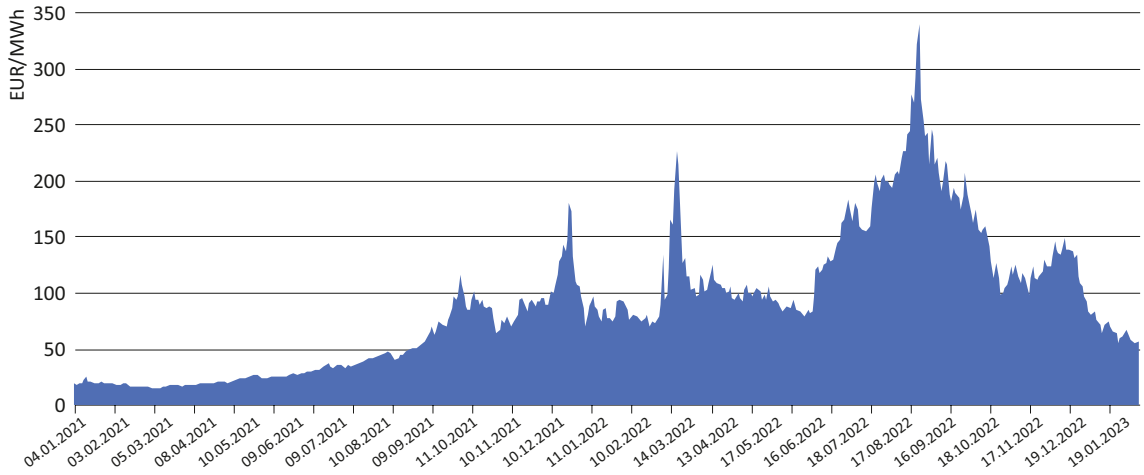

Figure 1. Dutch TTF natural gas futures, historical data. *Source*: ICE

To fend off political pressure from consumers and voters, the Commission reacted at record speed in October 2021 with the 'Toolbox' Communication.[79] This contained an analysis of the impact that high energy prices had in each member state and a set of compensation measures that governments could take to address the temporary price spikes. In addition to the Toolbox, the EU response began with the Versailles Declaration of March 2022 that proposed a strategy to reduce and phase out dependence on Russian fossil fuels and other strategic commodities, such as critical raw materials.[80] In May, this was followed up by the European Commission's REPowerEU plan, a long-term strategy to rein in energy prices, increase gas storage levels, diversify away from Russian fossil fuel imports, and cope with industrial decarbonisation.[81]

At that time, limited attention was given to whether the price signal needed to be passed on to end-customers. Since the summer of 2022, even with gas storage sites filled to 'secure' levels, it has been clear that some member states – including Germany and some countries in Northwestern Europe— would be facing a serious risk of shortages in the coming winter (and probably in the winters to follow). High energy prices were a bigger concern than potential shortages in Spain, Portugal, and some Nordic countries, as well as in Central and Eastern Europe. Still, with an eye to the winter of 2023-24, it is hard to see how the member states can achieve necessary savings without passing the price signal on to consumers.[82]

With an eye to the winter of 2023-24, it is hard to see how the member states can achieve necessary savings without passing the price signal on to consumers

In August 2022, the Council agreed that the 15% voluntary demand reduction target of natural gas demand would be made mandatory if triggered by a "Union alert" over the security of supply.[83] Following the Council's regulation, member states started developing national reduction plans and targets, with different levels of ambition. In Germany, the *Bundesnetzagentur* (Network Agency) called for a 20% gas reduction requirement to prevent shortages, while more conservative targets were announced in France (10%), Spain (8%), and Italy (7%).[84] Overall, EU's natural gas consumption decreased by 20.1% between

[79] European Commission, *Tackling Rising Energy Prices: A Toolbox For Action And Support*, Com/2021/660 Final, Document 52021DC0660, Brussels, 13 October 2022.

[80] European Council, Council of the European Union, *Informal meeting of the Heads of State or Government Versailles Declaration*, Versailles, 11 March 2022.

[81] European Commission, *REPowerEU Plan*, COM(2022) 230 final, Brussels, 18 May 2022.

[82] A paper published by the Centre for European Policy Studies (CEPS) has estimated that fully passing on current prices to the customer could reduce demand by up to 130 billion cubic meters (BCM) per year in the combined Europe-Asia market of 1 200 BCM. This is roughly equivalent to Russian gas imports to Europe. See: Daniel Gros, "When the taps are turned off How to get Europe through the next winter without Russian gas," *CEPS Policy Insights* no. 2022/07 (March 2022).

[83] The 15% reduction is to be achieved compared to the average consumption in the past five years, between 1 August 2022 and 31 March 2023.

[84] Lee Ying Shan, "Shorter showers, slower drives and an Eiffel Tower blackout: How Europe plans to cut gas usage this winter," *CNBC*, 21 September 2022.

August and November 2022.[85] Some countries achieved gas reductions well beyond the 15% target, such as Finland (−52.7%), Latvia (−43.2%), and Lithuania (−41.6%).[86]

Another option that the EU explored was to jointly contract additional gas – mainly in the form of liquified natural gas – as one single buyer. On 25 March 2022, the Council agreed to set up a "voluntary coordination mechanism […] supporting the purchase of gas and hydrogen for the Union, by making optimal use of the collective political and market weight of the EU."[87] The mechanism was meant to be temporary "to secure the EU's energy supply at affordable prices in the current geopolitical context and to phase out dependency on Russian gas."[88] In December 2022, the Council formalised it in a regulation on coordinated gas purchasing, requiring member states to aggregate gas demand for at least 15% of the respective 2023 gas storage filling obligations (which would be equivalent to about 13.5 billion cubic metres in the EU as a whole).[89] Implementation details are still being discussed, and the first joint purchases are expected by the summer of 2023. However, several large gas companies have already shown a reluctance to join the platform, arguing that such a scheme will not lower the prices.[90] So far, there seems to be no agreement (and only limited analysis) on the purpose of this instrument.

Beyond the storage services mutualisation (and security of supply costs), the platform could be a tool for the Western Balkans to ensure gas supplies for the next winter. Countries in that region are highly dependent on Russian gas, with its share going well over 90%. Given the political risks and uncertainties, as well as low demand and customers' inability to pay their gas bills at the current price, an emergency mechanism to support them may be needed. Via this platform, the EU may offer valuable technical assistance to the countries affected, which may also extend to Moldova, Ukraine, and Georgia should they apply.

3.2. A Common EU Energy Policy at Last?

To judge whether the turmoil in the markets and the EU reaction will lead to a more unified EU energy policy, one has to keep in mind the limitations that the EU Treaty imposes. While energy policy – in the same way as, for example, environmental and climate policy – is a shared competence, the EU Treaty also stipulates that the choice of energy sources – and, by extension, the security of supply at large – remains a prerogative of member states.[91]

The Russian invasion of Ukraine has not done away with the member states' ultimate responsibility for supply security

The Russian invasion of Ukraine has not done away with the member states' ultimate responsibility for supply security. If anything, the extreme situation has, instead, amplified the differences among member states, which have been developing over decades due to different energy endowments, carbon intensities, levels of energy efficiency, per capita GDPs, historical experiences, and political choices.

One example is the different views on price caps for electricity and natural gas. On the one hand, member states – such as Germany or Austria – that have a 'volume problem' (meaning that they risk running out of gas supplies) have been hesitant to implement price caps on gas. They argue that such intervention would ultimately increase domestic demand and divert supply

[85] Compared to average gas consumption during the same months between 2017 and 2021. See: "EU gas consumption down by 20.1%," Eurostat, 20 December 2022.

[86] "EU gas consumption," Eurostat.

[87] European Council, *European Council meeting (24 and 25 March 2022) – Conclusions*, EUCO 1/22, Brussels, General Secretariat of the Council, 25 March 2022.

[88] European Commission, "Energy Security: Commission hosts first meeting of EU Energy Purchase Platform to secure supply of gas, LNG and hydrogen," Press corner, 8 April 2022.

[89] Council of the European Union, *Council Regulation (EU) 2022/2576 of 19 December 2022 enhancing solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders*, Document 32022R2576, *Official Journal of the European Union*, 29 December 2022.

[90] On the contrary, one could argue that in a situation with tight global gas markets, pooling demand risks achieving the opposite reaction—i.e., increasing prices. See: "EU hires firm to launch countries' joint gas buying," *EUROACTIV / Reuters*, 31 January 2023.

[91] Art. 194 (2) says that measures under Art. 194 "shall not affect a Member State's […] choice between different energy sources and the general structure of its energy supply".

towards countries paying the full market price. The price signal, these countries argue, should be passed on to customers to secure the necessary savings. On the other hand, those member states that predominantly have a 'price problem' (Spain, Portugal, Belgium, and some countries in Central and Southeast Europe) have largely been supporting forms of price caps to shield consumers and industries alike from extended periods of high energy prices.

These objective differences will not disappear overnight, and we should expect that member states will continue to pursue their own individual interests and political preferences in line with Article 194. If member states' policies diverge, however, they risk eroding the integrity of the internal energy market. In an extreme scenario, this could lead to a re-nationalisation of energy regulation and policy. This, in turn, might result in deepening tensions within the EU's internal market and among member states and potentially reactivate the 2012 split over fiscal union and intra-EU solidarity. A case in point is the controversy over Germany's 200-billion-euro package to shield industry and consumers against high energy prices.[92]

Yet, while such differences persist, there seems to be a consensus on doubling down on the energy transition. Accelerating renewables deployment, gaining efficiency in electrification, or, more generally, increasing energy efficiency are options that have no downsides and that also offer long-term economic benefits.[93]

Large-scale deployment of renewables will require faster permitting of generation, grid, and storage facilities, as well as social acceptability thereof

There are few long-term alternatives – except perhaps for nuclear energy – to this strategy. However, the large-scale deployment of renewables will require faster permitting of generation, grid, and storage facilities, as well as social acceptability thereof. Moreover, low-carbon solutions – whether in electricity or industry – require large amounts of raw materials, some of which are concentrated in China. The Russian invasion of Ukraine has also accentuated the risks of new overdependence and global competition in raw materials. The challenge that the US Inflation Reduction Act poses to the EU is a case in point.

The Russian invasion of Ukraine has also accentuated the risks of new overdependence and global competition in raw materials

Even if differences among member states have not converged because of the war, the political agenda has certainly changed. The war has brought home the geopolitical and economic costs of excessive dependence on Russian gas. At the same time, the EU has found itself financing the Russian aggression against Ukraine. The lesson is clear: never let such overdependence happen again. In parallel, the Russian invasion has put into question the concept of *Wandel durch Handel* (change through trade) in view of European dependence on China. [94] One question remains unresolved: whether the notion of interdependence, which has long been a guiding principle of the EU's policies, should be pursued in the future.

3.3. Industrial Implications of the War

Not a part of the narrow energy agenda, future industrial development is the policy area that has been most affected by the war. Energy-intensive and materials industries have been experimenting with transformative technologies: steel production with green hydrogen; the use of bio-based or recycled plastics as feedstock to produce new plastics; new types of low-carbon or 'green' cement and concrete; and carbon captured from industrial processes being stored or reused for high-value products, such as fuels or building materials. Such breakthrough technologies will be required not only to meet the EU's and global

[92] Virginie Malingre, "Germany's energy package sparks a wave of criticism in Europe," *Le Monde*, 29 November 2022.

[93] Typically, an electric motor is more energy efficient than internal combustion, sometimes by a factor of almost four.

[94] "Wandel durch Handel" describes the approach of increasing trade with, for example, authoritarian states, even hostile ones, in an effort to induce change. In Germany, this approach is largely seen as having worked with the Soviet Union and the German Democratic Republic – i.e., East Germany.

climate objectives but also to maintain the EU's industrial competitiveness and, therefore, its industrial capacity in the long term. A majority of member states have seen (affordable) gas as the transition fuel on the way to a renewable energy and electricity system. With the war in Ukraine, this strategy no longer seems viable.

The EU and member states have no option other than to speed up the deployment of renewable energy

This brings us back to accelerating the energy transition. The EU and member states have no option other than to speed up the deployment of renewable energy – solar photovoltaics (PV) and wind turbines – combined with energy efficiency and smart energy solutions. Theoretically, nuclear energy could also be part of the solution, but new nuclear reactors will require as long as 15 years to become operational.

The acceleration of the energy transition will also have a profound impact on the industrial geography in Europe. For two hundred years, the industry has been following (cheap) energy. Initially, it was coal and a combination of coal, lignite, electricity, and gas later. Industries of the future are likely to settle where abundant cheap renewable energy is available (i.e., offshore wind or massive solar in combination with wind).

When it comes to industrial policy, the EU can build upon the political and strategic perspectives on energy that have been forged by the Juncker Commission. It can do this by linking the internal energy market and climate change agendas to the security of supply, solidarity, infrastructure, and innovation.[95] At the same time, the war makes it urgent to speed up the permission process and construction of necessary infrastructure. The Recovery and Resilience Facility provides significant resources to do so. Similar to what was started during the Juncker Commission, the EU will continue to pursue strategic political actions and projects in order to address trade-offs and differences among member states.[96] Potential new projects – possibly but not only under the Important Projects of Common European Interest (IPCEI) at the energy-climate-industry interface – could focus on electrolysers and the hydrogen industry. It includes import hubs, solar and wind power, nuclear industry (for those member states who wish to develop it), or charging infrastructure for electromobility or hydrogen fuel cells, to name a few. A more strategic approach is even more urgent as an answer to the challenge posed by the US Inflation Reduction Act. The first part of the answer was given by the Green Deal Industrial Plan in early February 2023.[97] More operational initiatives are expected to be presented in spring 2023 with the Net-Zero Industry Act and the Critical Raw Materials Act on the agenda.

3.4. The European Green Deal after the Russian Invasion

In many respects, the watershed moment in the EU's energy and climate policy predates the war. The European Green Deal and the EU Climate Law have made the EU one of the first entities legally committed to climate neutrality by 2050. This will require an overhaul of all economic policies with a view to reducing and ultimately eliminating carbon emissions. The first attempt was made with the "Fit for 55 package." Building upon the 2018 long-term strategy "A Clean Planet for All," the European Green Deal, and the Climate Law, the package brings forward a comprehensive set of legislative proposals to update and align EU policies with the 55% emissions reduction target by 2030 (another legal obligation under the EU Climate Law).[98] Revisions include the energy efficiency and renewable energy

[95] Christian Egenhofer, "Redefining the Energy Union," in *What Comes After the Last Chance Commission? Policy Priorities for 2019-2024*, ed. Steven Blockmans (Brussels: Centre for European Policy Studies, February 2019), 104-105.

[96] Under the Juncker Commission, previous strategies, which had long been pending, were, for example, the Baltic synchronisation of the electricity system of the EU, the France-Spain electricity interconnector, the proposal to harmonise EU rules on gas import pipelines in the context of Nord Stream 2, the screening of foreign investment, the European Battery Alliance and the Central and South East European Connectivity Initiative (CESEC).

[97] European Commission, *A Green Deal Industrial Plan for the Net-Zero Age*, COM(2023) 62 final, Brussels, 1 February 2023.

[98] European Commission, *A Clean Planet for All: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy*, COM(2018) 773, Brussels, 28 November 2018.

directives and the EU emissions trading scheme, with a proposal to create a parallel trading system for buildings and transport emissions, the effort-sharing regulation, and transport and land use legislation.

Russia's aggression is the kind of shock that can challenge climate change as the main EU and even global challenge. Not surprisingly, just as at the beginning of the pandemic in the spring of 2020, some opportunistic stakeholders have questioned the need for ambitious climate action in light of the crisis.[99] This time, energy security and the impact of high energy costs were cited. Yet, just as in the case of the COVID-19 crisis, the facts did not support the claim by some heads of state that climate policy – and notably the Emissions Trading System (ETS) – were responsible for excessive energy prices.

On the contrary, climate action has expanded the options for reducing fossil fuel imports from Russia and could also assist in the eventual reconstruction of Ukraine itself. Even if the geopolitical situation demands rapid short-term action, implementing – and accelerating – the energy transition will help scale down both energy dependence on Russia and continued collective reliance on fossil fuels, while also reducing Russia's fossil fuel revenues.[100] Finally, there is a broad consensus that the energy transition must be accelerated, not slowed down. After all, it is imported fossil fuel (i.e., natural gas procured from global markets) that is responsible for high EU gas and electricity prices.

Climate action has expanded the options for reducing fossil fuel imports from Russia and could also assist in the eventual reconstruction of Ukraine itself

Still, the war and a political environment marked by shrinking public budgets and a parallel emphasis on security will affect member states' priorities. Although the EU is legally committed to climate neutrality by 2050, the political and economic situation could affect both the implementation of the 2030 targets and the setting of new 2040 targets. Notably, as long as the EU energy and economic situation remains severely impacted, some member states may find it more difficult – and be less willing or capable – to achieve such ambitious climate neutrality targets. With the need to move away from (Russian) fossil fuels and to use less energy, a renewed focus on sector-specific policies and technologies such as nuclear energy and sector-specific energy efficiency targets or policies could become more attractive than simply focusing on the overall greenhouse gas (GHG) reduction target. This will mainly be seen under the Effort Sharing framework.[101]

As long as the EU energy and economic situation remains severely impacted, some member states may find it more difficult – and be less willing or capable – to achieve ambitious climate neutrality targets

Globally, the war puts into question both existing and new multilateral processes under the United Nations Framework Convention on Climate Change (UNFCCC) and beyond. It is almost impossible to imagine a scenario under which Russia and Belarus, who together are responsible for some 6% of global GHG emissions, would engage with the EU or the US on climate action.

3.5. Outlook

The Russian invasion of Ukraine has laid bare the shortcomings of the EU's energy policies of the past, or at least the policies of those member states that relied on Russian gas imports. However, huge differences between member states remain. The war revealed the cost of high dependence, both in political

[99] Milan Elkerbout, Christian Egenhofer, Jorge Núñez Ferrer, Mihnea Cătuţi, Irina Kustova, and Vasileios Rizos, "The European Green Deal after Corona: Implications for EU climate policy," *CEPS Policy Insights Thinking Ahead for Europe* no. 2020-06 (March 2020).

[100] Milan Elkerbout, "The Ukraine war: short-term pain but long-term gain for Climate Action?," in *A transformational moment? The EU's response to Russia's war in Ukraine,* ed. Steven Blockmans (Brussels: CEPS Ideas Lab, 2022), 26-29.

[101] Elkerbout, "The Ukraine war," 26-29.

(i.e., EU financing of the Russian war) and economic terms, through the high risk and high costs of gas supply disruptions. The notion of interdependence – so often cited in the EU – has proved to be a failure, as has *Wandel durch Handel*.

Given the depth of the energy crisis, we should not be surprised that member states, as a result of their different needs and political preferences, have pursued national responses and paid less attention to, for example, the EU internal energy market, the state aid policy framework or the security of gas supply regulation.

It is not that the political agenda has changed radically but rather taken an important turn. The strategy of relying on abundant and relatively cheap natural gas (as a transitional source of energy) has failed. At the same time, the EU's net zero commitment – reinforced by the economic modernisation agenda – remains in place, which means that the energy transition will accelerate. More common infrastructure planning and operation, notably for electricity but also for CO_2 and hydrogen, as well as more integrated markets, will be required in the EU and possibly with neighbouring countries. In the longer term, the industrial geography will change. Finally, the implications of the Russian invasion for the EU and the resulting energy price crisis have laid bare the vulnerability of the EU's industry to high energy prices and dependence on the critical raw materials required by low-carbon and IT technologies.

4. Impact of Russia's War on Energy Security in the Baltic Region: A View from Lithuania

Arūnas Molis

Years of Lithuanian, Latvian, and Estonian dependency on electricity and natural gas supplies from Russia forced the Baltic states to search for opportunities that would eliminate the related risks. Strategic decisions made many years ago have finally been implemented. EstLink, NordBalt, and LitPolLink electricity interconnections were completed; internal networks were strengthened; an LNG terminal opened; common electricity and natural gas markets were created; trading platforms were established; and significant progress was made in decentralisation and liberalisation of production and trade. Renewable energy – with a focus on offshore wind – as well as integration of the electricity system into the Continental European networks, dominated the national political agendas and public debates. And yet, the 2022 crisis has not been averted.

At a time when energy bills were going up not by several percentage points but by several times, industry representatives and households, governments and energy suppliers alike had to constantly repeat one an American idiom to themselves: freedom is not for free. *Gazprom*'s decisions to reduce and then halt supplies via the Yamal-Europe pipeline, having first threatened and then suspended supplies via Nord Stream 1, was followed by an act of sabotage against both the Nord Stream 1 and 2 pipelines. All those developments combined sent European gas prices through the roof.

The Baltic region had first been hit by the rocketing prices in the summer of 2021 – much earlier than the Russian missile began hitting the Ukrainian cities. LNG supplies and domestic energy production helped avoid shortages but did not shield local businesses and private citizens against the exorbitant prices, with many relying on state subsidies just to survive the season. Governments struggled to mitigate the crisis whilst hit with parliamentary inquiries and no-confidence votes themselves.

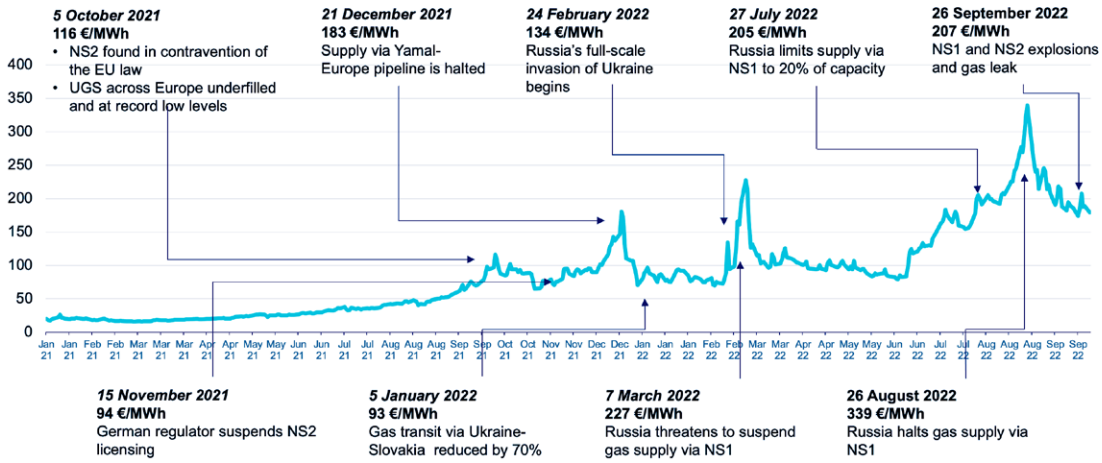

Figure 2. Dynamics of natural gas price in Europe and key events. *Sources:* ICE and Ignitis

The spring and summer months of 2022 were no less tense, but greater challenges loomed ahead with the fast-approaching winter.

This chapter assessing the impact of the war in Ukraine on the energy security of the Baltic states and provides an overview of the resilience measures designed and implemented to mitigate the energy crisis. With energy security in the Baltic Sea region intertwined with policymaking in Brussels, the chapter studies the EU-wide measures and those adopted by the Baltic states, as well as the effect they had on public opinion and political discourse. The chapter further explores some political decisions that would not have been made had the energy sector not been shaken by Russia's full-scale invasion of Ukraine. With lessons learned and energy security strategies in the pipeline, this chapter concludes that we will come out much stronger than we used to be.

4.1. The Immediate Impact – The Price Hike

Europe's energy security came under pressure in mid-2021 when the Kremlin had limited supplies of Russian natural gas via the Yamal-Europe pipeline, a strategically important piece of energy infrastructure. While typically pumping 81 mcm per day, the figure had dropped first to 49 mcm in late July and further down to 20 mcm per day in mid-August.[102] In response, the European gas prices catapulted by 116% against the early months of the year, with analysts speculating about the reasons behind the development. Was it Russia's commercial tactic to boost profits? Or was it trying to blackmail Europe into approving the Nord Stream 2 license? Supplies via the Yamal-Europe pipeline were finally terminated on the Christmas Day of 2021, and Europeans had the first taste of what would become routine post-February 2022. Natural gas at the Title Transfer Facility (TTF) was trading at a staggering price of 183 EUR/MWh, and Europe accused *Gazprom* of deliberate market manipulation.[103] Not only did *Gazprom* refuse any cooperation or explanation but responded with its own accusations of "groundless, unacceptable and, simply put, lies."

Russia's full-scale invasion of Ukraine on 24 February 2022 resulted in a price spike less dramatic than the one of March 2022, after Moscow had threatened to suspend supplies via Nord Stream 1 if sanctions against the Kremlin regime were not dropped (see Figure 2). It appeared to be the turning point in the EU-Russia energy cooperation. The EU Commission's climate policy promised that the EU would have completely decoupled from Russian gas in the coming years but would begin reversing its energy dependence already within the following months – it would be "not easy, but feasible."[104] Later supply cuts via Nord Stream 1 (20% in July 2022) and the final termination (by late August 2022) translated

[102] Sam Meredith, "Russia is pumping a lot less natural gas to Europe all of a sudden — and it is not clear why," *CNBC*, 24 August 2021.

[103] Vitaly Sokolov, "Gazprom: Europe to Blame for Low Yamal Gas Flows," *Energy Intelligence*, 27 December 2021.

[104] Martin Farrer, "Russia threatens Europe's gas supplies as west mulls oil import ban over Ukraine invasion," *The Guardian*, 8 March 2022.

	Lithuania	Latvia	Estonia	Finland	Poland
Share in total final energy consumption, 2020[105]	11%	8.5%	9%	3.6%	13.7%
Share in the overall energy mix, 2020[106]	25%	20%	8%	7%	17%
Imports from Russia, 2021[107]	49%	90%	95%	92%	60%
Import dependency, 2021	101%	60% (gas storage)	100%	99%	84%

Table 1. Consumption of natural gas in the Baltic states

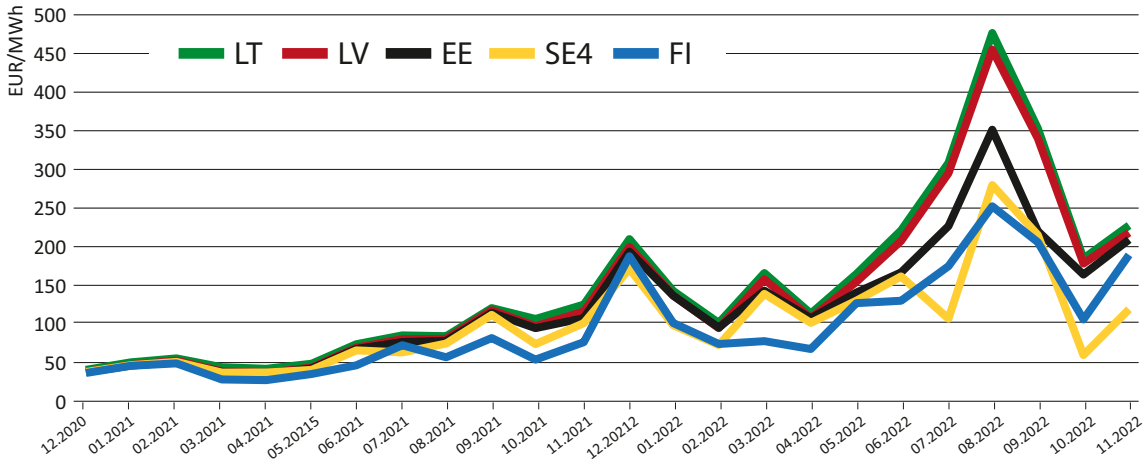

Figure 3. Dynamics of electricity prices in the day-ahead market. *Source:* Nord Pool AS, Entso-E.

into the record-high prices for natural gas throughout Europe. It was not as much due to the real shortage as the fear thereof. Nations rushed to fill their storages as the peak consumption period was approaching. It heightened the demand – and inflated the price – for LNG while triggering the debate about how to redistribute the burden among companies and countries. Who should be responsible for purchasing, and transporting, storing gas or paying the bill? And thus, who would have access to that gas?

With natural gas' traditionally large share in energy consumption balances (see Table 1), the Baltic states were also engaged in the debate. How to deliver natural gas via the LNG terminals? How to fill the Inčukalns underground gas storage (UGS)? What else should be done to foster regional energy cooperation and mitigate the risks?

Sudden and record-high natural gas prices sent shockwaves across many sectors. Electricity prices were the first victim (see Figure 3) as renewable energy production was insufficient.[108] On 17 August 2022, the extreme spike of 4 000 euro/MWh was reported. The reasons behind this particular spike (that lasted only for one hour) had little to do with natural gas – electricity production, maintenance, transmission, and trading had the crucial impact. Yet, it had a devastating effect on consumers who were paying market – not fixed – electricity prices. High prices also cascaded onto electricity suppliers (i.e., utility companies) who had to go into crisis mode: offer only market-based prices to industry and business clients and raise the fixed price for households. Policymakers reacted by introducing measures to cap the electricity and gas price increases at 50%.

Nevertheless, the government's credibility was put into question. For instance, the approval rating of Lithuanian Energy Minister Dainius Kreivys dropped by more than 20%, according

[105] "What kind of energy do we consume in the EU?," Eurostat, accessed on 20 March 2023.

[106] "Energy mix import dependency," Eurostat, accessed on 20 March 2023.

[107] Michał Paszkowski, "The Baltic States stop Russian natural gas imports," *Instytut Europy Środkowej*, 29 April 2022; "Share of energy imported from Russia 34 per cent of total energy consumption in 2021," Statistics Finland, last modified on 6 May 2022; Adriana Sas, "Gas imports from the East and liquefied natural gas (LNG) imports to Poland from 2016 to 2021," *Statista*, 11 April 2022.

[108] At the peak of gas prices in August 2022, domestic electricity production in Lithuania was at 31%; in Latvia and Estonia, it was at 27% and 68%, respectively.

to a poll conducted in September 2022.[109] He survived a no-confidence vote in the Seimas but had to take shock-absorbing decisions such as suspending electricity market liberalisation process for households for at least 3 years (as if these were the reason behind the peaking energy prices).

In the 2022-23 budget period, the household compensation scheme cost 1.6 billion, 1 billion, and 0.3 billion euros in Lithuania, Latvia, and Estonia, respectively. The measure was regarded as urgently needed and, therefore, perceived as successful. For some, it proved to be a rather handy campaign issue. Ilze Indriksone (appointed as Latvia's Minister of Economy in 2022) kept her office after the October elections, at least partially owing to the "affordable" energy promise. Other governments narrowly avoided collapses – such as Estonia in May 2022 – by introducing a "family benefits package." Some financial support was available to businesses as well, yet the outcomes were rather controversial. Less subsidised businesses made countries less competitive as the production of goods and services became relatively more expensive.

What could not be easily mitigated was the financial blow that the prices had on utility companies. First of all, it became clear that those who fail to manage the risks will have to cease operations. Lithuanian *Perlas Energija* announced on 5 August 2022 that it could no longer fulfil its obligations to the household customers.[110] This event shook both the market and political establishment but was solved at a comparatively low price – with minor government involvement and consequences for energy companies. Larger companies were forced to introduce some measures to limit price volatility for the most vulnerable consumers. For example, *Ignitis* negotiated application principles for the financial derivatives in the natural gas sector with the national regulator.[111]

By late 2022, all Baltic states had avoided insolvencies in the energy sector, yet some utility companies in the region had to be rescued by the governments. For instance, Sweden and Finland resorted to liquidity guarantees, allocating 25 and 10 billion euros, respectively, to electricity producers on the verge of insolvency.[112] Similarly, it required 51 billion euros to stabilise *Uniper* after the German government had decided to scrap the levy that would have allowed gas companies to pass most of the costs over to consumers.[113]

Even those who successfully and independently coped with their commitments were in dire need of net working capital. From January through September, *Ignitis* was scrabbling for 1.07 billion euros – double the previous estimate. LNG cargo price skyrocketed from 20 million euros up to 200 million euros. With relatively high consumption and LNG as the only means to import since April 2022, this Lithuanian energy giant was the most affected. It resulted in a negative free cash flow of minus 626.6 million euros and a net debt increase of up to 1.5 billion euros.[114]

4.2. The Mid-term Impact – Consumption and Solidarity

4.2.1. Changing Habits and Shifting to LNG

Europe did anticipate future shortages and suffered from the associated price volatility. Nevertheless, Russia's continuing war against Ukraine and the barrage of accusations against

[109] "Elektros kainos aukštyn, Kreivio populiarumas žemyn: ministro reitingas – rekordinėse žemumose [Electricity prices up, popularity of Kreivys down: minister's approval rating – in record lows]," *LRT*, 1 October 2022.

[110] James Robert, "Consumer representative: Leaving Perlas Energija is not the worst option for consumers," *The Postedia*, 18 August 2022.

[111] See: Ignitis Group, *Finansinių instrumentų ir kitų tarifų stabilumą įtvirtinančių priemonių taikymo gamtinių dujų tarifų buitiniams vartotojams kainodaroje gairės* [Pricing guidelines for the application of financial instruments and other measures establishing the stability of tariffs for natural gas tariffs for domestic consumers], No 2822, 10 November 2022.

[112] Supantha Mukherjee and Essi Lehto, "Sweden, Finland step in to avert Lehman-like situation for power companies," *Reuters*, 4 September 2022.

[113] Christoph Steitz and Tom Käckenhoff, "Germany's Uniper sees bailout cost rising to $53 billion," *Financial Post / Reuters*, 23 November 2022.

[114] Ignitis Group, *Interim report for the first nine months of 2022: strong Green Generation performance but ongoing challenges on net working capital* (Vilnius: Ignitis Group, November 2022).

the Europeans did provoke some needed discussions. Ultimately, they led to strategic decoupling from the Russian energy supplies and a transition to renewables. In the EU, natural gas consumption fell by 16% in the second quarter of 2022 against the same period in 2021.[115] However, Finland and the Baltic states recorded an astounding drop of 21-50%.[116] Moreover, both businesses and private citizens were rushing to (over)invest in solar panels, while companies developed energy solutions that facilitated their transition to renewables.

A few revolutionary steps followed that diversified and secured natural gas supplies. First, Lithuania took the final decision to purchase the floating storage regasification unit (FSRU) Independence from *Höegh* LNG, a Norwegian company, which would guarantee the terminal's service till the end of 2044. Although the acquisition is remarkable in and of itself, lasting economic gains include more business opportunities for *Klaipėdos Nafta,* the terminal's operator, commercial activities such as ship management, demand for new services and products, as well as the potential to export the acquired know-how. The decision to keep the terminal in operation till at least 2044 encouraged transportation companies to invest in the development of the LNG infrastructure and merchant ships to replace 'heavy' diesel fuel with LNG, thus saving money and improving the ports' image.

Second, not only the Latvian and Estonian but also Polish and Finnish governments finally acknowledged the importance of the Klaipėda terminal for the entire region by continuing to utilise it despite higher tariffs. In addition, Finland and Estonia decided to invest in two LNG terminals and one FSRU that both states would then be able to use. The strategic importance of the natural gas infrastructure – the Gas Interconnection Poland-Lithuania (GIPL), Balticconnector bi-directional natural gas pipeline, Lithuania-Latvia Interconnection Gas Pipeline, Inčukalns UGS, etc. – for the region has also been recognised, leading to the harmonisation of tariffs and trading regulations. Furthermore, Poland completed its strategically important Baltic Pipe Project gas pipeline from Norway across the Baltic Sea in the second half of 2022.[117]

On the one hand, all these changes meant that the existing infrastructure was utilised more extensively and effectively. On the other hand, it raised the capacity question: were terminals, storages, and interconnections at risk of shortages? To mitigate those risks, several regional cooperation agreements were signed. In August 2022, the heads of governments and energy ministers of the 8 countries of the Baltic Sea region signed the Marienborg Declaration, setting a joint offshore wind development goal of 19.6 GW and calling for the diversification of gas supplies. At the state level, energy supply emergency plans had to be prepared and tested to protect both producers and consumers domestically. Hence, the natural gas sector has revolutionised in just one year – and as paradoxically as it might sound, the Kremlin is to thank for it.

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4.2.2. Solidarity Challenged

After coming together to, essentially, halt the Nord Stream 2 project – a moment of solidarity that would be hard to imagine even a year ago – the EU institutions and member states concentrated on measures that could mitigate the price shock effect. Stricter self-regulation and market correction mechanism (the so-called price cap) were the first to be tabled. Decisions of this kind and magnitude, however, required coordination among the EU member states, whose interests might vary depending on their energy security, economic development, and attitude to Russia. In other words, the EU solidarity was tested, especially when the decisions concerned punitive measures against the aggressor state.

[115] "Market analysis The Commission produces quarterly reports on EU gas and electricity markets," European Commission, accessed on 20 March 2023.

[116] Brendan A' Hearn, "The Baltic gas market: a microcosm of Europe's struggle to quit Russian gas," *Energy Insight* 123 (The Oxford Institute for Energy Studies, September 2022).

[117] This pipeline (with the annual capacity of 10 bcm) further strengthened Poland's independence from Russian gas and confirmed its strategic goal not to renew the contract with *Gazprom* that expires this year. *Polskie Górnictwo Naftowe i Gazownictwo S.A.* (PGiNG), a Polish oil and gas company, signed the first 8 bcm natural gas supply contract with Norwegian *Equinor*.

The first signs of faltering solidarity started to emerge when the member states had the power to individually decide on the type of fuel that they would either reintroduce temporally or form a long-term energy production trend with. Although the EU's Green Deal promoted wind, solar, and hydrogen energy, as well as other renewable sources, some nations used the opportunity to reintroduce fossil fuels.

Although the EU's Green Deal promoted wind, solar, and hydrogen energy, as well as other renewable sources, some nations used the opportunity to reintroduce fossil fuels

For instance, Lithuania went back to heavy oil for heat generation; Estonia returned to shale oil for electricity production; and Germany opted for coal. In the meantime, Poland and Czechia chose to advance their nuclear energy ambitions.

The Commission continued working to incorporate waste incineration and disposal into the EU Emissions Trading System (ETS), thus tightening market competition in this sort of energy production. Whereas some member states – specifically, Lithuania, Finland, and Poland – had already invested in the waste-to-energy units, which they considered as part of recycling mechanism that would widen domestic non-fossil fuel energy production.

Amidst curtailed supplies from Russia and Europe's inability to (abruptly) cut its consumption, LNG seemed like the only quick fix possible

The LNG sector was caught in the crosshairs. Although the European Investment Bank (EIB) maintained its policy of non-financing this type of fossil fuel infrastructure development, some member states continued major investments and signed long-term deals on LNG imports. For example, Germany plans to open five LNG terminals by end of 2023 and has secured a fifteen-year deal for LNG imports with Qatar. However, the opposition to the LNG infrastructure development failed to articulate any solid argumentation. Hence, amidst curtailed supplies from Russia and Europe's inability to (abruptly) cut its consumption, LNG seemed like the only quick fix possible.

Lithuania's heavy reliance on electricity imports (up to 60-70% depending on the month) was another stress test to the Baltic solidarity. Although the EU Regulation 2022/1854 set a price ceiling or the redistribution of the surplus revenue for the electricity producers, Lithuania had nothing to redistribute due to its low domestic production. Thus, Vilnius tried to negotiate to share the surplus income of Swedish producers since Sweden is the country from which Lithuania imports most of its electricity. However, it had not reached an agreement until December 2022; the European Commission had step in and mediate. Lithuania's energy executives occasionally voiced their suspicions regarding Estonia. They claimed that frequent maintenance works on the interconnectors between Estonia and Latvia were deliberately timed to limit the flow of cheaper electricity from Finland to Latvia and Lithuania, thus reducing domestic price pressure in Estonia, which it denied.[118]

4.3. Long-term Impact – Regulation and Transition

Prices increased, forcing both producers and consumers to fight for survival. National governments and the EU Commission could not mitigate the crisis by simply injecting more money. Neither could they rely on diversification and energy saving. The sheer volume of compensations and bailouts was, indeed, impressive.[119] Yet, those measures failed to systematically target and tackle key energy security challenges: high energy prices on the global markets and increasingly probable supply disruptions during the cold winter season (anticipated throughout 2024). The situation thus demanded unconventional regulatory measures on the EU level.

[118] Gabrielė Sagaitytė, "Elektros kainos kaimyninėse šalyse verčia pavydėti: kodėl Estija ir Lenkija moka mažiau? [Electricity prices in neighbouring countries make envious: Why are Estonia and Poland paying less?]," *LRT*, 22 September 2022; "Estonia-Latvia power link maintenance to lower price of electricity Tuesday," *ERR*, 12 September 2022.

[119] For specific measures applied by the EU MS, see: Giovanni Sgaravatti, Simone Tagliapietra, Cecilia Trasi, and Georg Zachmann, "National fiscal policy responses to the energy crisis," *Bruegel*, 13 February 2023.

4.3.1. A Turn in the EU Energy Policy – The Market Correction Mechanism

The war in Ukraine triggered a debate on price regulation and the so-called price caps on electricity, natural gas, and oil. By late August, few details had been made public. What would the European Commission actually propose? How would it function? What targets was it meant to achieve? What was clear was the urgent need to do something. First, the all-time high electricity prices had to be managed. Second, the EU member states had to demonstrate that they still had – and could exercise – the normative power to punish Russia for its military aggression.

The first measure on the EU agenda involved the above-mentioned Regulation 2022/1854 which covered electricity production that was not dependent on expensive fossil fuels. The price ceiling was set at 180 euro/MWh; it applied to energy traders and producers – but not the consumers who would still pay the full price. The state was empowered to expropriate the surplus profit and use the money to compensate the most vulnerable consumers. Although the producers' appetite was suppressed, the electricity did not go significantly down.

Thus, states have continued to brainstorm alternative ideas. Locking in the prices at the current level – not at their peak but still far from the 2021 levels – appears most likely. Both producers and consumers rushed to enter into volatility-limiting agreements, such as power purchase agreements (PPA). Hedging and financial derivatives were also common, with companies making significant capital investments in the hope of protecting themselves from future shocks.

Natural gas is still widely used for electricity production and has a huge impact on the price

Natural gas is still widely used for electricity production and has a huge impact on the price. However, it was not easy to reach a consensus on regulations. Anxiety about the rising prices was overshadowed by the fear to lose significant volumes of gas required by the industry. In November 2022, the Commission proposed to set a fixed – but dynamic (monthly) – ceiling for transactions at the Dutch TTF trading point. It would be activated 1) should the following month's gas price exceed the limit for two weeks and 2) should the LNG reference price exceed the defined price for ten days during the two-week period. Experts immediately noted that the initially-proposed threshold of 275 euro/MWh was highly unlikely – even at the peaks, it was only exceeded for several consecutive days. Hence, the threshold agreement proved to be difficult.

With regards to oil, the goal has always been to deprive the Russian federal budget of this revenue, thus reducing its ability to attack Ukraine. The EU and UK tankers and insurance companies are not to provide their services should the oil price cross the proposed threshold. The measure, however, has been rather symbolic. In November 2022 – even before it was in place – Russia used to send, on average, 95 000 barrels via Rotterdam, the only available port in the region. Prior to the invasion, Russian oil shipments to Northern Europe used to stand at 1.2 million barrels per day. In the same month, the EU member states started deliberations on the price ceiling for Russian oil and ultimately agreed on 60 US dollars per barrel (to be revised every two months). Poland, Lithuania, and Estonia proposed to take into account the actual price of Russian oil which, at that time, was around 65 US dollars per barrel and which made it possible for the Kremlin to balance the federal budget. They suggested a much lower ceiling of 30 US dollars per barrel.

An EU-wide agreement, however, appeared to be a challenge, although it might have had the biggest impact on the aggressor state. Were European insurance companies to refuse their services to the more expensive Russian oil, Moscow would likely not be able to manage alternative logistics. Additionally, it would be a milestone political achievement for the Baltic states and Poland vis-à-vis Russia with zero damage to their own supplies. A Polish-owned domestic refinery in Mažeikiai stopped importing and refining Russian oil in May 2022, replacing it with crude oil from Saudi Arabia and the Northern Sea suppliers.[120]

[120] "Oil refinery in Lithuania to only import Saudi crude – minister," *BNS / LRT*, 25 March 2022.

4.3.2. Fundamental Decisions in The Renewables Sector

The first political reaction to the peak prices – lasting for an hour on 17 August 2022 – was to blame the *Nord Pool*'s spot exchange price forming algorithm that declined bids from some of the key producers due to the so-called 'paradoxical rejection' rule. *Litgrid AB,* a Lithuanian transmission system operator (TSO), suggested changing the algorithm and soon increased its share in *TSO Holding*, a Norwegian company that owns the exchange operator, from 2% to 39%. *Nord Pool Holding* responded with some important amendments. Thus, the war forced the national authorities and their proxies – state-owned energy enterprises – to learn how to exert their shareholder leverage in international business entities.[121]

The war forced the national authorities and state-owned energy enterprises to learn how to exert their shareholder leverage in international business entities

Renewable energy emerged as the number one long-term priority, with investment commitments made not only by state-controlled companies but also by the private sector. For instance, *Modus Asset Management*, a renewable energy company, established a 200-million-euro clean energy infrastructure fund. The *Green Genius* fund announced that it would install 500 MW solar and 200 MW wind power plants by 2025 worth 750 million euros in investment. In November 2022, Latvian *Latvenergo* has concluded two long-term loan agreements – totalling 200 million euros – to construct hydropower plants and solar energy parks.[122] *Eesti Energia* will develop a pumped-storage hydroelectric power plant in Paldiski in northern Estonia that would greatly contribute to energy security and stability in the region and compete with a similar facility in Lithuanian Kruonis.[123]

Local governments have also made several decisions in the renewable direction. Lithuania has passed legislation that enables the construction of two offshore wind parks of 700 MW each. By 2030, Lithuania alone will have been producing 3.6 GW from onshore wind and 4 GW from solar power plants. In the meantime, Estonia and Latvia announced they were selecting the location in the Baltic Sea to build a joint offshore wind energy project – that would generate 700-1 000 MW – by 2023. In November 2022, Poland approved a plan to build the country's first NPP together with an American *Westinghouse Electric Company.* Warsaw promises to invest 20 billion euros in the new power plant to be located in the west of Poland.[124] Estonia set up an interagency working group to explore the possibility of constructing an NPP based on small modular reactor technology by the mid-2030s.[125] Finally, natural gas infrastructure managers across the region are now considering their potential to repurpose the existing gas networks and construction of new hydrogen transmission infrastructure to begin the 2030s through the 2040s.[126]

For the wind and solar energy projects to proceed as rapidly and smoothly as possible, the EU has been updating guidelines, inventing financial support instruments, and accelerating the permit granting process, with the relevant EU regulations to follow. For instance, measures pertaining to energy saving and gas storage, as well as electricity demand reduction and infra-marginal regulations, have already been adopted and will have a major impact on the Baltic states. The EU Regulations on Solidarity and Market Correction Mechanism are underway.

[121] Tautvydas Lukaševičius, "Litgrid didina savo netiesioginį akcijų paketą elektros biržoje Nord Pool [Litgrid increases its indirect shareholding in the electricity exchange Nord Pool]," *Verslo žinios*, 16 September 2022.

[122] "Latvenergo AS will invest EUR 200 million in sustainable energy projects," Latvenergo, 25 November 2022.

[123] "Eesti Energia gets funding for pumped-storage hydro plant," *ReNews.Biz*, 28 October 2022.

[124] In the light of the war in Ukraine and related energy supply risks, 75% of Poles support the construction. The government seems to have used the right momentum to initiate the programme that, in other circumstances, would be questioned and may even be discontinued. This powerplant may serve as an important electricity generator for the German market and ease the pressure on the Baltic states by generating more electricity.

[125] Toomas Pott, "Estonia could get nuclear power plant by 2035," *ERR*, 17 October 2022.

[126] N. Biknius, the CEO of *Amber Grid*, stressed that Lithuania is seen as part of the common European Hydrogen network. See: Amber Grid, "„European Hydrogen Backbone" paskelbtoje Europos vandenilio tinklo vizijoje numatytas ir vandenilio koridorius per Lietuvą [In the vision of the European hydrogen grid unveiled by the European Hydrogen Backbone, there is also a hydrogen corridor across Lithuania]," News, 7 April 2022.

Figure 4. Future hydrogen infrastructure in the region. *Source:* Gasgrid Finland

RePowerEU Communication is the key element to achieving energy independence from Russian fossil fuels by 2027, building a more resilient energy system, and boosting energy efficiency. It has already launched the European Hydrogen Network that unites 31 energy infrastructure operators. A new iteration of the European Hydrogen Backbone study (published in April 2022) envisioned how hydrogen infrastructure in Europe would develop, serving as a solid foundation and a roadmap for the many initiatives at the national level.[127]

Amidst the EU's political attention and financial support, 'smart' energy solutions began to appear. Solar power plants have grown in popularity, having reached over 40 000 generating users in Lithuania alone. The total installed capacity of the prosumers (e.g., producing consumers) and remote generating consumers (those who rent the share in remote solar power plants instead of installing them on their private property) has reached 432 MW. The government has kept pace by introducing a support mechanism that covers around one-third of related expenses per household. In mid-2022, *Ignitis* pioneered a service that allowed the citizens to rent a part of a wind turbine – until then, they had only been able to rent or acquire remote solar parks (another novelty proposed several years

[127] Amber Grid, Bulgartransgaz, Conexus, CREOS, DESFA, Elering, Enagás, Energinet, Eustream, FGSZ, FluxSwiss, Fluxys Belgium, Gas Connect Austria, Gasgrid Finland, Gassco, Gasunie, Gas Networks Ireland, GAZ-SYSTEM, GRTgaz, National Grid, NET4GAS, Nordion Energi, OGE, ONTRAS, Plinacro, Plinovodi, REN, Snam, TAG, Teréga, and Transgaz, *A European Hydrogen Infrastructure Vision Covering 28 Countries* (European Hydrogen Backbone, April 2022).

prior).[128] All the measures taken today will ultimately lead to decentralised, decarbonised, and sustainable energy production, as well as empowered, independent, and proactive consumers in the future.

All the measures taken today will ultimately lead to decentralised, decarbonised, and sustainable energy production, as well as empowered, independent, and proactive consumers in the future

The risks entailed, as well as the financial burden, are shared by consumers, companies, governments, and the EU. A great variety of stakeholders, however, presupposes that concepts may change while projects may evolve, be postponed or cancelled. Nevertheless, the signals sent today are more than clear: European governments are resolute to satisfy all their energy needs from domestically produced renewable sources. In 2022, Estonia announced that it would be accelerating its energy transition and set an ambitious target: to generate 100% of electricity for domestic consumption from renewable sources by 2030.[129]

If successful, the green transition will soon lower the prices. In the earnest, the process has just begun. However, the war has already made renewable energy more competitive. It has also imprinted on the mindset of the decision-makers, whose risk appetite and risk tolerance changed dramatically.[130] In terms of geopolitics and energy security, the green transition will lock Russia out of the Baltic region, and perhaps wider European energy markets.

[128] The wind farm rental offer for private customers became possible due to the installed capacity at *Vėjo Galia*: out of 63 MW of total capacity, 4.5 MW will be leased to up to 1 000 residents (up to 5 kW of capacity per household to cover its electricity needs).

[129] "Estonia sets 2030 target for renewable-only electricity," *ERR*, 25 August 2022.

[130] In nine months of 2022, *Ignitis Group's* green electricity production Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) increased by more than 4 times, to 185.8 million euros. The Group's total EBITDA rose to 582.3 million euros, which allowed to triple investments and reach the record volume of 367.8 million euros. With renewables accounting for most of these investments, green generation capacity has almost doubled since 2021 to 4.5 GW.

4.4. Energy (in)security is Here to Stay

The overall attitude of the energy stakeholders in the Baltic region, nevertheless, is not to let a good crisis go to waste. And it is safe to say that the war in Ukraine, as well as high uncertainty and volatility in the energy markets, has accelerated decision-making, changed consumer habits, and created new opportunities that otherwise would have taken decades.

- **High energy prices** will remain for a while, resting upon the long-term power purchase agreements, as well as financial instruments applied and capital investments already in place. Households and businesses, alike have suffered considerably, but their pain has been partially alleviated at the expense of the growing national debt. Compensations and similar measures allowed the governments to stabilise the political scene and prevent major social unrest.

- **The golden age of (Russian) gas** is coming to an end. Moscow's threats to suspend supplies via Nord Stream 1 have been the turning point for the EU-Russia energy cooperation. The Cold War logic (i.e., trade balanced by political opposition) has been fully replaced by the notion of energy weaponisation.[131] In this new era, the EU policymaking and common measures seem to have an even greater effect on the Baltic region.

  Energy cooperation among Western nations, as well as cooperation between Europe, the US and the Middle East, has been consolidated and new LNG supply contracts signed. It has and will continue have a spill-over effect in other regions. Polish energy companies – *Polska Grupa Energetyczna* (PGE) and *Zespół Elektrowni Pątnów-Adamów-Konin* (ZE PAK) – will join forces with *Korea Hydro & Nuclear Power Co., Ltd*. (KHNP) to develop nuclear energy in Poland.

[131] Timothy Gardner, Mark Porter, and Richard Chang, "Russia using energy as weapon, White House says about Nord Stream shutdown," *Reuters*, 3 September 2022.

The solidary principle in energy affairs finally has both shape and meaning. The EU member states have concluded bilateral agreements for cooperation in case of emergency, whereas the Commission continues working on institutionalising the solidarity principle with a separate regulation. Relations with like-minded non-EU countries have been strengthened as well.

- **Green transition, diversification, and burden-sharing** framework has been, likewise, promulgated. Decision-makers in Europe have finally arrived at a consensus: energy decoupling from Russia is painful yet inevitable. Wind, solar, hydro, and hydrogen will gradually replace traditional fossil fuels. The EU's vision, national legislative proposals, and corporate investments have been prepared and adopted at record speed.

  The financial institutions' attitudes and the EU's financial support mechanisms have survived some turbulent times due to the dire situation on the ground – i.e., in the European, regional, and national energy markets, economies, and societies. Fossil fuel infrastructure as a safe bridge into the carbon-neutral future is no longer anathema. And thus, LNG and nuclear power will develop as complementary or transitional energy sources.

LNG and nuclear power will develop as complementary or transitional energy sources

- **The balance between the free market and regulations** is to be maintained. Despite the overall trend for liberalisation, a new regulatory mechanism – the price cap – has been introduced, surplus profits redistributed, and obligations imposed. The energy sector has become more complex for producers, suppliers, investors, and consumers. The latter were forced to educate themselves, as well as to demand better services and greater responsibility from governments and industry representatives.

On the one hand, increased risk tolerance stimulates investments that facilitate carbon neutrality and energy independence. On the other hand, potential over-investment may not only grow energy prices but even lead to failed business models and curtailed projects.

5. War as a Stress Test for Estonian Energy Policy

Priit Mändmaa

Just as most European countries, Estonia has not been spared from the impact of Russia's efforts to weaponise its energy supply in the run-up to and during the invasion of Ukraine. The ensuing energy crisis became a stress test to the resilience of its energy policy, energy markets, national economy, governance, and society at large. It brought into focus past mistakes in developing the national energy sector, as well as the lack of cohesion between the EU member states in mitigating the impact. But it also presented new opportunities for putting the sector on a more sustainable and climate-friendly path of development.

This chapter aims to present Estonia's responses to this crisis and lessons that can be drawn for the future. Partially dwelling upon a series of interviews with the senior energy sector executives and policymakers, it mostly represents the author's perspective that is based on his observations of how the situation evolved in 2021-22 and what was done (or not done) to address the main challenges during this period.

5.1. The Impact

Estonia has been taking steps to minimise energy dependence on Russia well before the outbreak of the war. It has been successful in interconnecting the energy grids with the neighbouring countries and thus integrating into the common regional and European energy markets. Following the agreement between the Baltic states, Poland, and the EU that was concluded in 2018, preparations have been made to desynchronise the electricity grid from the Russian grid and synchronise it with continental Europe by the end of 2025. According to the Estonian TSO *Elering*, as a result of the large-scale investments made before 2022, the Estonian electricity grid is already able to operate separately from the Russian grid if needed. However, it would be costly. Therefore, it is financially wiser – if possible – to follow the initial timeline of desynchronisation – something that Lithuania, for instance, has been urging to reconsider in light of Russian aggression.[132]

In contrast to some neighbouring countries, Estonia has not been reliant on Russian electricity supplies, but experienced the ripple effects of their exposure

In contrast to some neighbouring countries, Estonia has not been reliant on Russian electricity supplies, according to the annual security of supply assessment reports.[133] The natural gas consumption has halved in the last 15 years, mainly due to the fuel switching in the district heating sector. On the regional level, Estonia has never supported Nord Stream 2 and warned its allies that relying on Russian energy imports is a security risk. Overall, the belief that Russia cannot and should not be trusted, along with all the steps that have been taken to minimise the dependence on Russian energy in Estonia, have been proven prescient and prudent by the crisis that erupted in 2022.

In the energy crisis that struck because of Russia's actions, it became obvious that there was a lack of both electricity generation capacities and accessible natural gas sources

For a long time, the energy policy in Estonia and in many EU countries have relied on the market. The underlying sentiment has been that a competitive market will generate the best results for the energy sector and meet the demand, whereas energy security and security of supply will be achieved through a common European energy market. In the energy crisis that struck because of Russia's actions, it became obvious that there was a lack of both electricity generation capacities

[132] Elering, "Elering koos teiste Balti elektrisüsteemihalduritega on valmis vajadusel Balti riikide sünkroniseerimiseks Mandri-Euroopa elektrisüsteemiga [Elering, together with other Baltic electricity transmission system operators, is ready for the synchronisation of the Baltic states with the power system of continental Europe in case of need], 23 September 2022; Giedrius Gaidamavičius, "Lithuania could speed up grid synchronisation with Europe – minister," *BNS/LRT.lt,* 3 May 2022.

[133] See: Elering, *Annual Report* (Tallinn: Elering, 2021), 6.

and accessible natural gas sources. Therefore, a well-interconnected common energy market could not provide a quick solution. It also became clear that the risk of not being able to import energy from neighbouring countries is not always fully accounted for when assessing or defining energy security and the security of supply. Estonia's reduced direct dependence on Russia failed to protect it from turbulence. Other countries that are part of the common markets had much greater exposure to Russian strategic coercion. Hence, Estonia experienced the ripple effects of this exposure.

Furthermore, governments started providing financial guarantees for building energy infrastructure, as the market had failed to create an environment that would enable sufficient investments. This might have a long-term impact on the energy sector if countries that are part of the integrated markets become more protectionist and, in pursuit of self-sufficiency, turn away from the free market. In the context of Estonia, which had been an electricity exporting country until 2019, the discussions on restoring and maintaining self-sufficiency were pushed into the margins by the low price of electricity imports from across the region through the interconnections, as well as the high price of CO_2 emissions that rendered Estonian oil shale power plants uncompetitive. However, it has changed since the start of the war in Ukraine, which put the discussions about affordable generation capacities in a new light. Affordability is one of the key elements underpinning a sustainable energy sector that supports the economy as a whole.[134]

5.2. Crisis Preparedness and Government Responses

In different parts of the Estonian energy sector vulnerability to the crisis in the markets and supply chains has been different. In the transportation fuel sector, Estonia was in a favourable position. The reason for this was that the supply chains were diverse; dependency on Russia was very low; and the market was competitive, with two major oil refineries in the region – *Orlen*'s in Mažeikiai (Lithuania) and *Neste*'s in Porvoo (Finland) – that were not dependent on oil supply from Russia. Disruption of the supply chains that resulted from sanctions imposed on Russia has not affected them. Therefore, there has not been a crisis in the transportation fuel sector – even though affordability was briefly an issue due to the impact of the war on the prices in the global oil markets.

The electricity generation sector was facing a crisis – not only in Estonia but all over Europe – already before the outbreak of the war in Ukraine

The situation has been much more complicated in the electricity sector. The extremely high electricity prices were a clear signal of the imbalance in the market and the overall unpreparedness to cope with such a crisis. The electricity generation sector was facing a crisis – not only in Estonia but all over Europe – already before the outbreak of the war in Ukraine. Since the second half of 2021, electricity prices have already been on an upward trajectory. Yet, the invasion of Ukraine, Russia's manipulations of natural gas export to Europe, and Moscow's decision to halt electricity exports to Finland that accounted for about 10% of Finnish consumption made the situation much worse for the Baltic region.[135]

There was little doubt among the energy sector players in Estonia that Russia had been using energy as a weapon to destabilise Europe. However, it is also important to admit that, for years, the dispatchable old electricity generation capacities have been experiencing

[134] In 2019 and 2020, the annual average electricity price in Estonia was 45.86 euros/MWh and 33.69 euros/MWh, according to the *NordPool Power Exchange* spot market data, with most electricity in Estonia generated using oil shale. As a rule of thumb, to generate 1 MWh of electricity out of oil shale about 1 ton of CO_2 is emitted. As the CO_2 emission price in the EU increased rapidly, while the electricity price at the time dropped, it was not economically feasible anymore to generate electricity from oil shale. This changed again in the second half of 2021 when the average monthly electricity price increased by 2-5 times compared to the previous years, to 83.78 euros/MWh in July 2021 and 202.65 euros/MWh in December 2021. The high price enabled the oil shale-based generation plants to be operated again.

[135] "Russia cuts off electricity to Finland; industry group sees Nato link," *YLE,* 14 May 2022.

closures due to administrative decisions that were made without having a policy framework and regulatory environment to incentivise sufficient investment and thus replace those capacities. For years, policymakers' attention has been focused primarily on environmental concerns. The energy crisis has prompted a shift towards the security of supply and affordability as key considerations. Thus, discussions about new generation capacities – whether renewable, nuclear, or fossils-based – along with access to the source of energy needed for specific power plants (e.g., a gas turbine without a source of natural gas does not serve its purpose) have become the centre of everyone's attention.

In the worst-case scenario, the Estonian grid can already operate as an island until synchronised – possibly through an emergency procedure – with continental Europe

At the same time, preparations have been carried out for years to desynchronise the Estonian electricity grid from the Russian grid and thus eliminate the last remaining dependency on Moscow.[136] The risk of Russia undertaking punitive action and desynchronising the Baltic states – thus potentially causing instability in their power grids – was highlighted, in a rather dramatic manner, in September 2022 by Estonian Prime Minister Kaja Kallas. During a televised speech, she issued a warning about potential electricity supply disruptions were Russia to use grid tests in the Kaliningrad exclave as a cover; the prime minister urged the population to enhance their readiness.[137] According to the system operator, however, in the worst-case scenario, the Estonian grid can already operate as an island until synchronised – possibly through an emergency procedure similar to Ukraine's synchronisation in February 2022 – with continental Europe.[138]

In the natural gas sector, Estonia did not have any alternative sources and relied on the Russian pipeline gas and the LNG terminal in Lithuania. It also did not own any dedicated natural gas reserves in storage facilities. Nevertheless, the state-owned TSO, in cooperation with two private companies, managed to react quickly by approving and building, in record time, an LNG terminal dock in Paldiski that was completed in late 2022.[139] It remains unused for the reasons that require a separate case study analysis of what went wrong in the relations between the TSO and the private companies involved in the project. Regardless of those complications, it provides an option for plugging in an additional entry point – a floating storage and regasification unit (FSRU) – into the gas grid if and when necessary. It may well become a maintenance burden for the owner and a sunken cost – a potential example, among many others, of what a stampede to build additional LNG infrastructure across Europe might result in.[140] Gas market players also began using the LNG terminal in Lithuania more extensively, while the Baltic Interconnector undersea gas pipeline provided access to a similar newly built facility at Inkoo in Finland.[141]

The state also bought dedicated natural gas reserves for protected consumers in the amount of 0.1 TWh that covers a month of heating and formed a state-owned strategic natural gas reserve of 0.65 TWh.[142] As a result of such an extremely high natural gas price, the annual consumption of natural gas in Estonia decreased from 5 TWh in 2021 to about 3.78 TWh in 2022.[143] The decrease reflects fuel switching (e.g., to biofuels in heating), as well

136 "Synchronisation with continental Europe," Investments, Elering, last updated July 2022.

137 Government of Estonia, "Peaminister Kallas: kaitsevõime tähendab valmisolekut ja kindlustunnet [Prime Minister Kallas: defence capabilities mean readiness and confidence]," News, 22 September 2022.

138 "Estonian system operator: We are ready to synchronize Baltics with continental Europe," *The Baltic Times*, 23 September 2022.

139 "Paldiski LNG terminal dock completed ahead of schedule," *ERR*, 28 October 2022.

140 Institute for Energy Economics and Financial Analysis, "Over half of Europe's LNG infrastructure assets could be left unused by 2030," Press Release, 21 March 2023.

141 "Eesti Gaas to receive ten LNG carriers at Klaipeda, Inkoo ports this year," *ERR,* 3 February 2023.

142 Elering, "Elering ostis kaitstud tarbija varuna ühe kuu tarbimise mahus gaasi [Elering bought one month's worth of gas as a reserve for a protected consumer]," 25 March 2022; "Varude keskus sai valitsuse nõutud gaasivaru kokku [The stockpiling agency amassed the gas reserve required by the government]," *ERR*, 23 January 2023.

143 "Majandusminister soovib gaasile kehtestada varumakse [The Minister of Economy wants to introduce a reserve tax for gas]," *ERR,* 8 March 2023.

as industries closing, many of which are not able to compete with foreign counterparts who enjoy energy subsidies from their governments.

The prices caused major problems for the consumers – be they households or enterprises. Subsidies related to electricity and gas consumption were introduced for households and small businesses. After 9 years of spot market-based electricity prices, a regulated price (also called the "universal service") was added as an option for household consumers.[144] For several months, the regulated price stayed below the spot market price. However, there was a downside: it eliminated the motivation for a response on the 'demand side.' The regulated price remained the same for all hours of the day and thus did not encourage decreasing consumption during peak hours. Eventually, the problem was alleviated by the markets themselves, as the spot prices dropped well below the "universal service" fixed price and prompted many households to quit the "universal service" arrangement.[145]

Estonian government did not manage to maintain a levelled playing field for the Estonian companies

At the same time, medium and large-size businesses have been left on their own to cope with the increased energy costs. Comparing different energy subsidies available in other EU member states, the Estonian government did not manage to maintain a levelled playing field for the Estonian companies. When compared to the governments of Latvia, Lithuania, and Finland, it failed to make use of the support mechanisms endorsed by the EU, which negatively affected the competitiveness of the local companies compared to their counterparts in the neighbouring countries. The reason might lie in the fact that the apparatus that is in charge of devising the energy policy and advising decision-makers on state aid rules is very small. Therefore, it has never been meant to cope with the increased workload at the time of crisis or war. However, there seemed to be some ideological differences between the governing coalition partners, with some being supportive of the state's role in ensuring a levelled playing field through general subsidies. Others argued for greater innovation to reduce energy costs and providing subsidies for specific energy efficiency measures.[146] In any case, many representatives of the business sector felt that that the government had failed to understand the role of exports of goods and services in the national wealth, as well as the importance of maintaining a levelled playing field at least across the EU's common market.

5.3. Lessons, Opportunities, and Prospects for the Future

It can be argued that, in a time of a severe energy crisis, having a state-owned energy incumbent might be beneficial to finding quicker and more flexible solutions. For example, the "universal service" for electricity or a governmental decision to build an LNG terminal dock would not have been possible without the Estonian state owning both the main energy company, *Eesti Energia*, and the gas and electricity TSO, *Elering*. With a publicly listed energy incumbent, this type of flexible solution would have been much more difficult, if not outright impossible, given that the profit maximisation interest of various shareholders might not be aligned with the strategic interests of the state.

In a time of a severe energy crisis, having a state-owned energy incumbent might be beneficial to finding quicker and more flexible solutions

In the electricity sector, a key conclusion is that there has been a lack of appreciation of the need for generating capacities and especially for dispatchable capacities. The sector has been moving away from self-sufficiency, making it dependent on neighbouring countries. For many years, there has been an entrenched

[144] Parliament of Estonia (Riigikogu), "The Riigikogu passed the Act enabling a universal service for electricity," Press Releases, Plenary Assembly, 15 September 2022.

[145] "Over 40,000 customers left Eesti Energia's universal service last week," *ERR*, 14 March 2023.

[146] "Minister: No plans for state aid to cover business electricity costs," *ERR*, 13 February 2023.

belief – also shared by the Estonian TSO – that power plants in other countries are as good as the ones in Estonia as long as they provide reliable and affordable power. Moreover, it was assumed that cross-border interconnections are a reliable way to ensure the security of supply and energy security.

However, the crisis has shown that the above is true only as long as the neighbouring countries themselves have enough generating capacities. Unfortunately, many of the neighbouring states are in deficit – a situation anticipated in the ICDS report published in 2020.[147] Taking that into account, thorough assessments are needed to agree on the level of self-sufficiency that should be maintained in Estonia while also considering the times when the renewables – the most important future source of electricity in the national vision and plans – are not productive and require other power generation or storage solutions.[148] From the energy security perspective, it is also important to consider how to make most important power plants less exposed to the risk of capture or destruction in the event of military aggression. Such understanding is critical to integrating their protection into national defence plans.

The crisis has clearly highlighted the value of diversification and flexibility – i.e., having multiple sources of supply and being able to switch fuels if needed. In the natural gas sector, there has been a trend towards decreasing consumption as a result of halting supplies from Russia. However, taking into account that LNG has made natural gas into a globally tradeable commodity with no ties to Russia, natural gas could, in principle, play a much larger role in the Estonian energy mix (as a relatively clean fossil fuel) to bridge the energy transition towards zero-carbon future. That would require reliable solutions for the LNG supply, potentially in the form of long-term contracts with companies from geopolitically reliable or allied countries (e.g., Norway, the United States, and Australia). Last but not least, the Estonian government must decide if nuclear energy – in the form of new generation small modular reactors (SMRs) – can have a role in the decarbonised energy mix of the future and proceed accordingly. But even in the case of an affirmative decision, the most realistic timeframe for introducing this form of energy will be the early or even mid-2030s.[149]

The electricity sector has a structural problem because the market design has not been providing sufficient incentives for large-scale investments

From the market design perspective, it is important to point out that, despite such high electricity prices, the marginal cost-based spot market has been functioning as expected. The high prices did not result from the spot-market malfunctioning but from the lack of generating capacities and, with Russia's exclusion, of energy sources available to satisfy the existing demand. The electricity sector, however, does face a structural problem because the market design, along with inadequate policies and regulations, has not been providing sufficient incentives for large-scale investments. This has locked Estonia into dependency on foreign power generation sources, as well as – in times of crises – on its old and climate-damaging oil shale power plants. Even by the TSO's own admissions, they might need to continue as a strategic reserve to ensure the security of supply perhaps even in the second half of the 2020s.[150]

With fast-paced regulatory changes comes the risk of an unstable market which would hinder potential new investments

The energy crisis has created a window of opportunity as politicians are interested in finding quick solutions. On the one hand, it

[147] Tomas Jermalavičius, Priit Mändmaa, Emma Hakala, Tomas Janeliūnas, Juris Ozoliņš, and Krystian Kowalewski, *Winds of Change, or More of the Same? Impact of the 2018-19 Election Cycle on Energy Security and Climate Policies in the Baltic states, Poland and Finland* (Tallinn: International Centre for Defence and Security, 2020), 44-45.

[148] "Estonia sets 2030 target for renewable-only electricity," *ERR*, 25 August 2022.

[149] Tomas Jermalavičius, Max Bergmann, Peter Crail, Thomas O'Donnell, Tomas Janeliūnas, and Tõnis Idarand, *Developing Nuclear Energy in Estonia: An Amplifier of Strategic Partnership with the United States?* (Tallinn: International Centre for Defence and Security, 2022).

[150] "Elering report: Estonia needs oil shale plants for strategic reserve," *ERR*, 6 December 2022.

is possible to use this political momentum to approve regulatory changes that are suitable in the long term and provide a basis for sustainable solutions in energy security. On the other hand, with fast-paced regulatory changes comes the risk of an unstable market which would hinder potential new investments.

There is a need for new generation capacities and a great opportunity to develop large-scale renewable energy projects such as offshore wind farms in the Baltic Sea. The market design and regulation have not been supportive of investments into new capacities. Yet, steps have been taken to speed up the licensing procedures for new renewable energy projects, and more consideration has been given to the system stability requirements resulting from such projects.[151] The key challenge with regards to the latter will be significant investments that the grid operator will need to make to cope with large-scale and numerous but intermittent renewables and enable much-increased exports of their output.[152]

There is a common understanding that the future energy sector in the region shall not become, in any way, dependent again on Russian energy sources. But financing long-term projects with a high capital expenditure might prove more difficult than before because of increasing interest rates and Estonia's geographical neighbourhood. The role of regional businesses and local capital might become more important because foreign investors, who are located farther away, might see Estonia as an exposed and dangerous location due to the proximity of Russia. In this regard, the positive impact of NATO's and national measures to deter Russia's aggression cannot be underestimated. What is being done militarily to bolster deterrence and defence in Estonia – and the wider Baltic region – should be clearly communicated to the wider community of energy investors and serve to reassure them that the country remains a safe and secure destination for their much-needed investments.

There are no quick methods to solve the fundamental issues that have lied dormant – or been ignored – for many years but now have been exposed by the Russia-instigated war and energy crisis. Still, the Estonian and European decision-makers have been awakened, and initial steps have been already taken to find long-term sustainable solutions. Furthermore, the national crisis management plans have been readjusted to better cope with the new geopolitical reality and energy security threats. Costly and stressful as the crisis has been, it also has provided a much-needed impetus to strengthen the resilience of the Estonian energy system. It has successfully cast aside some naive assumptions about the security of supply in a major geopolitical crisis that affects the entire continent and even the global markets.

At the time of writing, Estonia and the entire Europe seem to have survived the worst impact of the energy crisis, even though the war in Ukraine continues and thus carries further risks of disruption. Broader confrontation with Russia is also accompanied by legitimate threats to European energy infrastructure, political cohesion, and solidarity in Europe. It is clear, however, that Estonia's past decisions and steady actions to systematically reduce its dependence on Russia was a strategically wise course. It reflected Estonia's foreign policy interests and enabled the strongest possible geopolitical stance vis-à-vis Russia.

Still, Estonia had to adapt quickly to the abrupt change in the energy landscape and absorb the second- and third-order effects of the crisis that hit its less-prepared or more-exposed European partners. The country also had to re-evaluate some of the tenets underpinning its energy policy – i.e., the effectiveness of free markets, the limited role of the government or government-owned energy sector entities, and reliance on cross-border electricity trading for the security of supply – as well as the adequacy of the regulatory framework and investment incentives for power generation sector. The changes that have followed and will follow from this re-evaluation, along with the action that Estonia takes together with its European partners, give a reasonable hope that – when the next large energy crisis strikes the continent – there will be a highly resilient and robust national, regional, and European energy ecosystem in place and prepared.

[151] Parliament of Estonia (Riigikogu), "The debate in the Riigikogu focused on resolving the energy crisis," Press Release, Plenary Assembly, 24 November 2022.

[152] "CEO says Elering needs mandate to build grid connections with Europe," *The Baltic Times*, 24 November 2022.

6. Critical Energy Infrastructure: Lessons from Russia's War Against Ukraine

Tony Lawrence
with research contribution by Isabella Martin

The proper functioning of modern societies and economies depends greatly on the continuous supply of inexpensive energy. The global energy trade, which developed in response to the uneven distribution of energy resources around the world, is a source of both prosperity and conflict. At the level of regions and states, reliable energy supply is ensured through complex systems of interdependent and often widely distributed physical components that extract, refine, and supply fuels and generate, store, and distribute electricity. These components are frequently connected and controlled by information and communication technology systems. Collectively, these systems of systems are known as energy infrastructure or sometimes — to reflect their importance to a society's functioning – critical energy infrastructure. The vulnerabilities of such systems are widely recognised by governments, intergovernmental organisations, energy companies, and researchers.[153] These vulnerabilities are occasionally brought to public attention by disruptive events such as extreme weather or more dramatic occurrences such as the 2011 Fukushima nuclear accident.[154]

Risks to energy infrastructure include natural events, accidents caused by technological failure or human error, and deliberate attack. Deliberate attack is often regarded as an asymmetric tool, employed by the weaker party to a conflict to cause, simply and cheaply, a potentially huge amount of physical, economic, and psychological damage to its adversary. Most research and policy attention in recent years has thus focused on the threats posed by terrorism rather than state-on-state violence.[155] More attention has also been paid to the possibility of cyber-attacks, than physical attacks.[156]

Russia's war against Ukraine is not an energy conflict (i.e., a conflict for the control of energy sources or infrastructure), but a conventional war with an energy and other non-military dimensions. If Russia has cyber-attacked Ukraine's energy infrastructure during the war, it has apparently had little success. However, its deliberate large-scale targeting of energy infrastructure with kinetic means has been a defining feature of the conflict. This chapter explores the lessons for energy infrastructure highlighted by the war.

6.1. Ukraine's Energy Infrastructure

Ukraine has abundant hydrocarbon resources, mostly found in the Carpathian region, the Dnieper-Donetsk region, and onshore and offshore in the Black Sea and Sea of Azov region.[157] However, their potential has not been fully realised, leaving the country very dependent on imports from Russia, Belarus and, increasingly, the EU (in 2021, 83% of oil, 33% of natural gas, and 50% of coal were imported).[158]

[153] Heiki Jakson, James Brendan Byrne, Emanuele Nicola Cecchetti, Jan Ciampor, Jaroslav Hajek, and Maximilian Hausler, *Energy in Conventional Warfare* (Vilnius: NATO Energy Security Centre of Excellence, 2016), 35-36; Carl Amritt, Dan Lauf D, and Michele Woods M, "States' Role in Addressing Foreign Threats in U.S. Critical Energy Infrastructure Sectors," *National Governors Association Center for Best Practices*, January 2022; John Raffensperger, "Why are cyberattacks a major threat to energy companies?," *GE Gas Power*, accessed on 17 March 2023.

[154] "US power outages from severe weather have doubled in 20 years," *The Guardian*, 6 April 2022; "Fukushima Daiichi Accident," World Nuclear Association, last modified in May 2022.

[155] Organization for Security and Co-operation in Europe (OSCE), *Good Practices Guide on Non-Nuclear Critical Energy Infrastructure Protection (NNCEIP) from Terrorist Attacks Focusing on Threats Emanating from Cyberspace* (Vienna: OSCE, 2013); Daniel Yergin, "Ensuring Energy Security," *Foreign Affairs* vol. 85, no. 2 (March-Aprril 2006), 69-82; Sampath Kumar Venkatachary, Jagdish Prasad, and Ravi Samikannu, "Cybersecurity and cyber terrorism - in energy sector – a review," *Journal of Cyber Security Technology* vol, 2, issue 3-4 (2018), 111-130.

[156] "A future-proof security environment," European Commission, accessed on 17 March 2023; Ijeoma Onyeji, Morgan Bazilian, and Chris Bronk, "Cyber Security and Critical Energy Infrastructure," *The Electricity Journal* vol. 27, issue 2 (March 2014), 52-60; Jeh Charles Johnson, "Cyberattacks on our energy infrastructure: The need for a national response to a national security threat," *The Atlantic Council*, 13 December 2021.

[157] International Energy Agency (IEA), *Ukraine Energy Profile* (IAE, September 2021), 14.

[158] IEA, "Ukraine Energy Profile," 7.

Ukraine has also depended heavily on nuclear power, with 15 reactors at four plants (Khmelnitsky, Rivne, South Ukraine, and Zaporizhzhia) delivering more than half of its electricity needs.[159] These have, in turn, depended on Russian fuel supplies, although Ukraine had taken steps even before Russia's full-scale invasion to pivot away from such dependencies including a 2021 deal with *Westinghouse* to build a new reactor at Khmelnitsky. Through a further deal signed in June 2022, *Westinghouse* will build more reactors and supply all Ukraine's nuclear fuel.[160]

The Ukrainian grid, largely designed and built during the Soviet period to have high survivability during wartime has proved surprisingly resilient

Ukraine had also planned to synchronise with the Continental European Synchronous Area (CESA) in 2023. This was completed as an urgent measure in March 2022, removing the prospects of Russian interference.[161] The Ukrainian grid, largely designed and built during the Soviet period to have high survivability during wartime has proved surprisingly resilient, allowing engineers to reroute electricity supplies, improvise repairs, and cope with periodic disruption.[162] In fact, Ukraine has been able to export electricity throughout much of the war, providing an important source of income.[163] It has also continued to earn transit fees for the supply of Russian gas through its territory, although the number of routes has been reduced. While the payment of fees has been a source of dispute, the closure of the Nord Stream pipelines has left the Ukrainian routes and TurkStream as the only viable options for Russia to supply gas to Europe.[164]

6.2. Russia's War

Deliberate attacks on energy infrastructure during a conventional conflict may serve two primary purposes. The first is to shape the battlefield, for example, by denying armed forces the fuel they will need to operate vehicles, generators, and other vital equipment, or by disrupting the civilian electricity supplies on which military installations also rely. The second is to weaken an adversary economically and psychologically by preventing energy supply to government, industry, and civilian populations. These attacks do little or nothing to change the military situation on the ground. They are intended to grind down a nation's resilience, not damage its warfighting ability. Attacks that target energy supplies to civilians are thus considered by many to be violations of the law of armed conflict, although in the complex circumstances of modern warfare, the legal case may sometimes be more ambiguous than the moral one.[165] Through such attacks, the aggressor will usually wish to coerce the attacked population into making concessions or surrendering, but may also anticipate broader outcomes such as reducing support in neighbouring countries by preventing energy exports or generating destabilising flows of refugees. There have been suggestions that in its war in Ukraine, Russia sought to magnify this effect by targeting energy infrastructure in neighbouring states. The (at the time of writing, unattributed) attack on the Nord Stream pipelines is well known.[166] Less well known is the suspicious failure of a satellite communications link connecting 5 800 wind turbines across central Europe, which occurred

[159] "Nuclear Power in Ukraine," World Nuclear Association, last modified in January 2023.

[160] "Ukraine signs deal with Westinghouse to end Russian nuclear fuel needs," *Reuters*, 3 June 2022.

[161] European Commission, *Statement by Commissioner for Energy Kadri Simson on Synchronisation of the Continental European Electricity Grid with Ukraine and Moldova* (Brussels: European Commission, 16 March 2022).

[162] "Economist: Ukrainian energy grid highly 'resilient'," *Deutsche Welle*, 18 October 2022.

[163] "Ukraine Launches Electricity Exports To European Union With Support From The U.S. Department Of Energy," U.S. Department of Energy, 2 July 2022; "Ukrainian energy ministry halts electricity exports due to Russian missile strikes," *Reuters*, 10 October 2022.

[164] Nina Chestney, "Analysis: Russia's Ukraine gas transit sanction threat a fresh blow for Europe," *Reuters*, 28 September 2022.

[165] Ursula von der Leyen (@vonderleyen), "Russia's attacks against civilian infrastructure, especially electricity, are war crimes," Twitter, 19 October 2022; Charlie Dunlap, J.D, "Is attacking the electricity infrastructure used by civilians always a war crime?," *Lawfire*, 27 October 2022.

[166] Sergey Vakulenko, "Shock and Awe: Who Attacked the Nord Stream Pipelines?" *Carnegie Politika*, 30 September 2022.

just as Russian troops entered Ukraine.[167] Again, the origins of this failure are unclear (although the manufacturer has ruled out a technical malfunction), but the incident underlines that a country need not be a combatant in a war to be required to deal with attacks on its energy infrastructure.

Both types of attack have been evident in Russia's war in Ukraine. Russia and – probably – Ukraine have targeted each other's warfighting capability by attacking fuel depots.[168] There is, however, little evidence that Russia has otherwise attempted to degrade Ukraine's military defence by attacking other energy infrastructure either by kinetic or cyber means, although energy installations have certainly suffered collateral damage during the fighting.[169] Russia's disinclination to attack Ukraine's armed forces in this way may simply be a reflection of its overconfident assumption that the country would be easily and rapidly defeated by conventional military means. In this event, Russian occupying forces would rely on Ukraine's energy infrastructure, and would presumably not wish to bear the cost of repairs. It is also the case that Russia's military options for attacking energy infrastructure have been limited. Precision guided munitions are expensive and have been in short supply, while platforms delivering Russia's unguided bombs have proved vulnerable to Ukrainian air defence, and these weapons are in any case unlikely to be accurate enough to destroy small targets such as electricity substations. It was not until Russia secured a supply of cheap, accurate Iranian loitering munitions that it was able to pursue a strategy of attacking energy infrastructure on a large scale. In the cyber domain, meanwhile, Ukraine likely implemented additional protective measures following Russia's 2015 attack on its electrical grid.[170] More generally, Russia's cyber-attacks on Ukraine appear to have been largely unsophisticated and thus easily defeated.[171]

It was not until Russia secured a supply of cheap, accurate Iranian loitering munitions that it was able to pursue a strategy of attacking energy infrastructure on a large scale

As it suffered setback after setback in its conventional war, however, Russia turned to attacking energy infrastructure as a means of coercing the Ukrainian population. The Zaporizhzhia NPP was first occupied by Russian forces in early March and shortly afterwards damaged by shelling (the Chornobyl plant and exclusion zone were also occupied by Russian forces in late February). While there do not appear to have been any attempts to deliberately damage the reactors, the stationing of Russian forces in the line of fire at Zaporizhzhia has raised the spectre of an accidental nuclear release and has been a useful tool in Russia's information operations against the Ukrainian population and Ukraine's international supporters.[172]

The most devastating operation of this type, however, has been Russia's large-scale assault on the civilian energy system, which began in earnest on 10 October. Clearly aimed at breaking the will of the population, attacks using missiles and Iranian-supplied Shahed-136 loitering munitions had, by mid-November, resulted in energy blackouts for around half of the population.[173] These attacks focused on high-voltage nodal switching stations, which are often easy targets since they are above ground, not hardened, and need to be located away from other obstacles. More than a third had been damaged or destroyed after two weeks of attacks in October; once damaged, their bespoke constructions makes them hard

[167] Ajit Niranjan, "War highlights energy systems vulnerability," *Deutsche Welle*, 7 March 2022.

[168] In keeping with its policy of minimal commentary on operational matters, Ukraine has generally denied responsibility for such attacks. See: Andrian Prokip ,"Russian Air Attacks on Ukraine's Power System," *Wilson Center*, 19 October 2022; "War in Ukraine: Russia accuses Ukraine of attacking oil depot," *BBC News*, 1 April 2022.

[169] Phillip Gordon, "Ukraine: Attacks on critical energy infrastructure increase as fighting intensifies," *Power Engineering International*, 4 March 2022.

[170] Donghui Park and Michael Walstrom, "Cyberattack on Critical Infrastructure: Russia and the Ukrainian Power Grid Attacks," *The Henry M. Jackson School of International Studies*, 11 October 2017.

[171] Dmytro Dubov, "The War in Cyberspace," *Russia's War in Ukraine Series* no. 2 (ICDS, May 2022), 1; Josephine Wolff, "Why Russia Hasn't Launched Major Cyber Attacks Since the Invasion of Ukraine," *Time*, 2 March 2022.

[172] Henry D. Sokolski, "Present Danger: Nuclear Plants in War," *Parameters* vol. 52, no. 4 (2022), 5-7.

[173] "Ukraine: Russian Attacks on Energy Grid Threaten Civilians," *Human Rights Watch*, 6 December 2022.

to replace.[174] The attacks were apparently carefully designed to cause maximum harm, to weaken the resilience of the grid, and to make it increasingly difficult for Ukrainian engineers to reroute electricity supplies, suggesting that Russia's own power engineers were closely involved in their planning.[175] In addition to the physical, economic, and psychological damage caused by such attacks, Ukraine has been forced to divert resources, including air defence systems, from the front lines and to seek additional foreign assistance in securing spare parts and repair equipment.

In addition to the physical, economic, and psychological damage Ukraine has been forced to divert resources, including air defence systems, from the front lines and to seek additional foreign assistance

6.3. Lessons

Researchers have identified three perspectives from which energy security has traditionally been viewed: the sovereignty perspective, which is concerned with malicious attacks by malevolent foreign actors; the robustness perspective, which focuses on the physical survival of energy infrastructure; and the resilience perspective, which emphasises economic and complex systems factors.[176] Russia's attacks on Ukraine's energy infrastructure include challenges that can be seen from each of these perspectives. Many years of work by practitioners and researchers in these overlapping disciplines have led to the identification of a range of measures to enhance energy security, including generic responses such as reducing energy demand and diversifying energy options, and more perspective-specific responses such as holding emergency stocks, diversifying supply and supply routes, infrastructure redundancy, and decentralisation. These and other measures have been used to build bodies of best practice that have been adopted to varying degrees by the energy industry and its regulators.[177]

Russia's war against Ukraine has not fundamentally challenged these basic principles of energy security. Good practice such as hardening against physical and cyber threats, redundancy, diversity, and training for emergency response remain relevant to preserving energy security during armed conflict. Nonetheless, Russia's war has highlighted several factors that can stress energy security concepts and need to be taken into account in risk management:

- **Scale**. While terrorist threats are likely to be localised, a wartime attack on energy infrastructure may be large-scale and widely geographically distributed. Ukrainian sources report that Russia attacked Ukraine with 84 missiles on 10 October and a further 28 the following day.[178] In such circumstances, likely coupled with degraded transport and logistics options, heavier responsibilities will fall on local site managers, who will not necessarily be able to rely on outside assistance. Stocks of spare parts and consumables, as well as supplies for personnel, will need to be held in larger quantities and at lower operating levels and more emphasis may need to be placed on repair, rather than replacement of components. Novel solutions such as 3D printing may be useful in bringing flexibility to such operations. Training should encourage innovation and improvisation in problem solving.

  An approach that seeks full self-reliance at local levels is, however, likely to be prohibitively expensive. Mutual assistance agreements with neighbouring

[174] Michael Birnbaum, David L. Stern, and Emily Rauhala, "Russia's methodical attacks exploit frailty of Ukrainian power system," *The Washington Post*, 25 October 2022.

[175] Michelle Lewis, "How Ukraine's power system is coping in the face of Russian strikes," *elektrek*, 20 October 2022.

[176] Aleh Cherp and Jessica Jewell, "The three perspectives on energy security: intellectual history, disciplinary roots and the potential for integration," *Current Opinion in Environmental Sustainability* vol. 3, issue 4 (September 2011), 206-8.

[177] "Secure gas supplies," European Commission, accessed on 14 March 2023; "Security of electricity supply," European Commission, accessed on 14 March 2023; "Securing Energy Infrastructure Executive Task Force," Office of Cybersecurity, Energy Security and Emergency Response, U.S. Department of Energy, accessed on 14 March 2023.

[178] Marichka Ilyina, "Mass Air Strikes of October 10-11. What Do They Mean, and What to Expect Next," *Lviv Now*, n.d.

administrative regions and states, which may not be affected at the same time, and centralised support teams able to provide rapid response will also be necessary to provide flexibility and high resilience in the face of a large-scale military attack.

Finally, investment in energy solutions that can be isolated in times of crisis to serve the local level – microgrids – may also be useful in building resilience against large-scale, widely distributed attacks.[179]

- **Nature**. Kinetic attacks bring different dangers when compared to natural disasters or terrorism. Personnel will need training to operate as safely as possible in combat conditions and different types of equipment. Among the items listed as priorities for foreign donor supply by Ukrainian utility company *DTEK*, for example, were ballistic vests and helmets.[180] Public-private partnership (for military-style training, for example) may be useful here.

- **Responsibility**. More broadly, the share of responsibility between government and the private sector for securing critical energy infrastructure may need to shift. While it is reasonable to expect private companies to bear the brunt of the task of protecting against cyber-attacks (with support as required from Computer Emergency Response Teams) the division of labour for protection against munitions is perhaps not so simple. Regulators may require companies to meet certain standards of hardening in constructing new facilities (likely at higher levels and for a wider range of facilities than apply today), but will not, presumably, require them to provide, for example, air defence.

  Governments already expect to provide military protection, including air defence, for some critical energy infrastructure (the details are classified). These plans may need to be reviewed in light of Russia's actions in Ukraine and greater priority given in defence planning to protecting critical infrastructure. This would, of course, remove resources from the military campaign. In any event, as part of resilience building, both the energy sector and wider public should be made aware that because of the high cost of air defence (and other military assets), it will likely not be possible to provide 24/7 coverage of every object.

  A further consideration regarding responsibility is the role of NATO and the EU. NATO considers resilience to be a national responsibility, but it is hard to imagine that in wartime Allies would not benefit from some form of coordination and cooperation in critical infrastructure protection, for example, for undersea cables and pipelines. The EU, meanwhile, will need to consider whether its requirements for resilience in energy supply need to be updated in response to Ukraine's experiences.

- **Scope**. Additional government input will also be necessary in prioritising the scope of service to be maintained. At present, energy supplies are mostly prioritised according to customer type (government, media, industry etc). Ukraine's concern that it may need to evacuate Kyiv raises an entirely different requirement for prioritisation in which the degradation of supplies in certain cities or regions and its preservation – perhaps increase – elsewhere to cope with movements of displaced persons must be managed.[181]

- **Deterrence**. Governments and alliances can also be more specific in their deterrence statements regarding energy infrastructure. Attacks on civilian energy supplies must carry the expectation that they will be met with a punishing response.

Russia's deliberate targeting of Ukraine's civilian populations through attacks on their energy supplies was an act of weakness, resorted to after its failures on the conventional battlefield. The defender facing such attacks has the substantial advantage of knowledge of their

[179] "The Role of Microgrids in Helping to Advance the Nation's Energy System," Grid Systems & Components, Office of Electricity, U.S. Department of Energy, accessed 14 March 2023.

[180] "The Role of Microgrids," Office of Electricity; Robin Pomeroy and Juliet Masiga, "Ukraine calls on the world to help its energy system and avoid nuclear disaster," *World Economic Forum*, 12 March 2022.

[181] Marc Santora and Ben Hubbard, "Kyiv Planning for Total Evacuation if It Loses Electricity," *The New York Times*, 5 November 2022.

own systems. This advantage can be boosted by implementing well-known and understood best practice policies of energy security.

Nonetheless, the scale and relentlessness of Russia's attacks suggest that higher levels of resilience need to be built into lower operating levels of a country's energy infrastructure, and that the share of responsibility for energy security between the public and private sectors needs to be reconsidered.

Russia's deliberate targeting of Ukraine's civilian populations through attacks on their energy supplies was an act of weakness, resorted to after its failures on the conventional battlefield

7. Ukrainian Energy Sector under Military Attack: Lessons for Resilience

Oleksandr Sukhodolia

In the autumn of 2022, Russia shifted its military strategy towards systematic large-scale destruction of Ukraine's energy infrastructure, using long-range munitions such as cruise missiles and drones. Having suffered battlefield defeats inflicted by Ukraine's Armed Forces and being forced to withdraw from large swathes of previously occupied territory, the Kremlin clearly hoped to coerce Kyiv to surrender by depriving its population of electricity, heating, water, and other critical services during winter. The newly coined term *Kholodomor* ('starvation through cold' echoing the *Holodomor,* or the Great Famine of 1932-33, caused by the Soviet extermination policy) is already in common parlance, reflecting the twist in the genocidal nature of the Russian military campaign against Ukraine.

Despite all the destruction, Ukraine – as of December 2022 – was still managing to restore these services, even if they had to be severely rationed, although interruptions became more frequent and prolonged. This resilience is remarkable and holds many important lessons for the policymakers and critical infrastructure managers responsible for energy security and war contingency. This chapter explores the sources of such resilience in Ukraine by examining several pre-war characteristics of its energy system and preparedness measures implemented with a war scenario in mind, as well as the actions undertaken in response to the Russian attacks.

7.1. Pre-war Characteristics of Ukraine's Energy System

Ukraine has designed an energy industry that includes a powerful electricity generation industry, coal, oil, and gas sectors, and, more

recently, fast-developing renewables.[182] The country has an extensive gas transportation system that served as the main route for Russian gas transit to Europe and a large power grid that was synchronised with the Russian network – until 2022.[183] Ukraine's nationwide grid – Integrated Power System (IPS) – was itself the result of merging five large regional grids, each with its own control system.

Aware of the Kremlin's practice to use energy as a hybrid weapon, Ukraine has been implementing a range of measures to reduce dependence on Russia for almost a decade

Aware of the Kremlin's practice to use energy as a hybrid weapon, Ukraine has been implementing a range of measures to reduce dependence on Russia for almost a decade. Cross-border pipeline projects created the possibility to import natural gas from EU countries (Poland, Slovakia, Hungary, and Romania). Since 2015, Ukraine has not purchased natural gas from *Gazprom*, satisfying its needs through its own production (75-85% of consumption) and imports from Europe. At the same time, Ukraine maintained the transit of Russian gas (40 bcm/year) to the EU.[184]

Ukraine's nuclear power plants have historically been dependent on both nuclear fuel supplies from Russia and shipments of used fuel to Russia. Within the diversification policy, Ukraine has built the Centralised Spent Fuel Storage Facility within the territory of the Chornobyl Exclusion Zone that was due to launch in April 2022. In cooperation with *Westinghouse Electric Company*, Ukraine has diversified its nuclear fuel supply. At the beginning of 2022, the share of electricity produced at Ukrainian NPPs from *Westinghouse*'s fuel stood at 50%.

At the same time, Ukraine remained dependent on Russia in other areas. It was importing around 70% of consumed oil-refined products mainly from Belarus and Russia, even though some oil products arrived from Lithuania by rail through Belarus.[185] After the Russian invasion in 2014, Ukraine lost its resources of anthracite used as fuel by around half of the thermal power plants (TPPs) in the country. Since 2015, Ukraine has implemented projects to shift some TPPs to use types of coal produced in other parts of the country. However, it still had to either import the necessary volumes either from Russia by rail or buy it on the world market and ship via the Black Sea ports of Odesa, Mykolaiv, and Kherson.

By early 2022, the Ukrainian energy system was believed to be rather resilient to kinetic attacks, because of its size, surplus of electricity generating capacities, the geographical distribution thereof, and diverse transportation routes

By early 2022, the Ukrainian energy system was believed to be rather resilient to kinetic attacks, mainly because of its size, surplus of electricity generating capacities, the geographical distribution thereof, and diverse transportation routes. At the same time, Ukraine remained vulnerable to the potential disruption of oil supplies and damage to the oil refining infrastructure.

[182] Before the war, Ukraine used to have a powerful electricity-generating industry, with a surplus of generating capacities. It consisted of coal and gas thermal power plants (TPP), hydropower plants (HPP), nuclear power plants (NPP), and renewables capacities (wind, sun, and biomass). NPPs provided 45-55% of total electricity generation, while TPPs generated 23-28%, and HPPs supplied up to 7%. Ukraine had 15 nuclear power units, including six at the 6 000 MW Zaporizhzhia NPP, Europe's largest NPP. Centralised district heating plants that provide heat and electricity for cities run on coal and natural gas.

[183] On the morning of 24 February 2022, Ukraine's power grid separated from the Russian grid to test its ability to stable work in an 'island' mode, according to the plan to join the Continental Europe Synchronous Area (CESA), and, on 16 March 2022, its national grid was fully synchronised with the CESA, well ahead of the initially scheduled date. The gas transmission system (GTS) of Ukraine is one of the most powerful and extensive networks of trunk gas pipelines in the world. Russia tried to bypass Ukraine's territory by building pipeline routes through the Baltic and Black Seas. With a transit agreement, signed at the end of 2019 for a period of five years, *Gazprom* booked transit capacities of Ukrainian GTS in the amount of 40 bcm (110 mcm/day) in 2021-24. The total transit capacity of Ukrainian GTS was 146 bcm/year.

[184] Gas from Russia used two main points of entry: Sudzha (Sumy Oblast) and Novopskov (Luhansk Oblast).

[185] In 2021, the share of Lithuanian diesel and gasoline in the Ukrainian market was 9% and 11%, respectively.

7.2. Russia's Objectives and Approach

Resilience is a dynamic phenomenon that exhibits different characteristics and relies on different sources as the situation evolves.[186] This is particularly true in wartime when the enemy has a say in what happens next. Russia's approach to Ukraine's energy system as an object of its military strategy has also evolved: from the initial efforts to capture it, through the later attempts to destroy those elements that support Ukraine's military defence, to the current campaign of systematic and widespread kinetic destruction to terrorise the entire population. These approaches have posed a different set of challenges to the maintaining energy supply across Ukraine.

7.2.1. Disrupt, Capture, Hold

Control over Ukraine's energy sector was one of Russia's goals while planning the full-scale invasion. As it appears now, Moscow had calculated that it would overrun Ukraine and install an occupation regime within weeks – or even days – from the start of the military campaign. Thus, it had no interest in wreaking Ukraine's energy sector as it was supposed to be absorbed into the Russian system once the occupation had been completed.

The Kremlin had pressed ahead with its plans well before the actual day of the invasion. In early November 2021, Russia blocked coal supplies to Ukraine across its border, saying that the Russian railway operator encountered some technical problems. Amidst high energy prices, Ukraine had to purchase coal on the global market. On 7 February 2022, Minsk stopped the transit of oil products from Lithuania's refinery, *Orlen Lietuva*, via the Belarusian territory, which strained some parts of the Ukrainian energy system and put political pressure on the government. Yet many observers still interpreted it as usual peacetime strategic coercion: using energy supply as a weapon rather than an attempt to weaken Ukraine ahead of the full-scale invasion.

Russia's priority tasks in the energy sector during the early stage of the war (i.e., the first two weeks following the invasion) focused on: establishing control over the NPPs and resuming their operation on Russian *TVEL* fuel produced by *Rosatom*; capturing electricity facilities such as the power grid, distribution networks, and generators (TPPs and HPPs); and taking over the gas transportation system (GTS).

The practical examples of such actions were:

- On 24 February, Russian forces seized the territory of the Chornobyl NPP and the Chornobyl Exclusion Zone. In addition to some specific military goals, it was meant to prevent Ukraine from launching the Centralised Spent Fuel Storage Facility.

- On 24 February, the Russian units seized the Kakhovka HPP in Kherson Oblast and moved heavy weapons to its premises.

- On 24 February, Russia launched a navy blockage while shelling the Ukrainian ports on the Black and Azov Seas, which deprived Ukraine of the possibility to import energy resources or equipment by sea.

- On 4 March, the Russian army captured the Zaporizhzhia NPP, deliberately shelling the site with heavy weapons. Since then, Russia has used the NPP as its military base. On 11 March, employees from *Rosenergoatom* arrived at Zaporizhzhia NPP to supervise the Ukrainian personnel. In November 2022, the Russian occupational authorities announced that the Zaporizhzhia NPP would be transferred to *Rosenergoatom* and thus under Russian jurisdiction.

- On 10 March, the Russian military took control of the gas compressor stations at Novopskov in Luhansk Oblast and Kupyansk in Kharkiv Oblast. It marked the first attempt to intervene in the technological operations of gas transportation and distribution (later, the occupational authorities took over the operational control over these stations).

During the first stage of the war, Ukraine's energy infrastructure suffered mostly due to the massive and indiscriminate bombardment

[186] Jake Bornstein, "The Dynamics of Social Resilience," *Minding Nature* 6, no. 2 (May 2013).

of population centres.[187] The national power grid and distribution networks, as well as some generation capacities and electricity substations, were significantly damaged all over Ukraine. Shelling of regional gas distribution stations and networks further strained the energy infrastructure and supplies to millions of consumers were interrupted.

During the first stage of the war, Ukraine's energy infrastructure suffered mostly due to the massive and indiscriminate bombardment of population centres

Centralised heat supply facilities were also heavily damaged in most cities close to areas of active hostilities. In Chernihiv, the heat-generating plants, distribution network, and supporting facilities were under a direct military attack when Russians sought to break through towards Ukraine's capital. Heat and hot water have been missing in the city since 10 March. In Okhtyrka (Sumy Oblast), the town's combined heat and power (CHP) networks were destroyed by Russia's indiscriminate airstrikes on 28 February and 8 March.

Realising that its *blitzkrieg* campaign to capture Ukraine in days was a complete failure, Russia changed its approach. And thus, targeted attacks against Ukraine's energy infrastructure – to both put pressure on the operations of the Armed Forces of Ukraine (AFU) and disrupt the civilian economy – emerged as a weapon of choice in Russia's strategy to defeat Ukraine.

Oil refining infrastructure was the first to come under attack: all refineries and big depots were destroyed by missile strikes to halt the supply of motor fuel

7.2.2. Targeted Damage

Oil refining infrastructure was the first to come under attack: all refineries and big depots were destroyed by missile strikes within a very short period. Their goal was to halt the supply of motor fuel to the military and civilian transport:

- In March-April 2022, rocket attacks destroyed oil depots in the central and western regions. The Kremenchuk refinery in Poltava Oblast was destroyed by two waves of cruise missile strikes on 24 April and 12 May. The Shebelinsky gas processing plant near Balaklia in Kharkiv Oblast suspended operations on 26 February due to a threat of shelling; in June, it sustained irreversible damage from the Russian multiple-launch rocket systems (MLRS).

- In June, the previously destroyed Kremenchuk and Lysychansk refineries, as well as many oil depots suitable for the operation as mini-refineries, were shelled again. It – combined with the limited import capacities – created a significant shortage of motor fuels in May-July 2022.[188] The main sources of petroleum products needed for the country's civilian sector and the AFU simply disappeared.

- In late April and early May, Russia fired 18 cruise missiles at eight regions of Ukraine, targeting the country's railway infrastructure. In Zakarpattia, Lviv, Rivne, and Vinnytsia oblasts, it destroyed or badly damaged electricity substations powering the railway. Those strikes were meant to disrupt the supply routes leading to the western border.

- The previously damaged centralised heat supply system in Kremenchuk was hit again. Two waves of cruise missile strikes – on 24 April and 12 May – completely destroyed the Kremenchuk CHP which used to be the largest supplier of heat and hot water to the city. Later, in August, Kharkiv's CHP-3 that used to generate heat for one-third of the city was damaged.

[187] Russia's actions in Ukraine regarding civilians are a manifestation of state terrorism as defined by the Geneva Declaration on Terrorism, "*the armed attack by the military forces of a state on targets that put at risk the civilian population residing in another state*" (UN General Assembly, 1987). Russia also violates international humanitarian law, in particular Protocol I (8 June 1977) to the Geneva Conventions and Articles 52, 54, 56 to the Protection of Victims of International Armed Conflicts (UN, 1977) that prohibit attacks against civilian infrastructure.

[188] Over 680 thousand tons of petroleum products had burned because of Russian shelling in 8 months of the war.

Constant and indiscriminate shelling over such a large area led to significant damage to power lines, electrical substations, and gas distribution facilities. From March through October 2022, about 800-1 000 settlements and more than 700 000 customers had to live without electricity; over 300 000 customers lost gas.

Multiple cyberattacks against critical infrastructure and energy companies were reported. In particular, *Energoatom* (Ukraine's largest private energy company that owns power generation and distribution networks in several regions) and the industrial control system (ICS) of one of the distribution system operators (DSO) were attacked.[189] According to the Ministry of Energy of Ukraine, several thousand attempted cyberattacks in the field of energy were recorded on a daily basis.

7.2.3. System-Wide Campaign

Amidst military defeats, Russia switched to a strategy of terror by seeking to systematically destroy the key elements of Ukraine's critical energy infrastructure. The first signs started to emerge in the early days of autumn, with a massive kinetic attack on 11 September. In Kharkiv Oblast, missiles hit CHP-5 – the second largest in the country– and many elements of the power grid, such as high-voltage lines, substations, and the regional distributional network.[190]

Another massive kinetic attack was launched on 10 October. That strike damaged 11 major energy infrastructure objects – TPPs, high-voltage lines, substations, etc. – in eight regions of Ukraine, leaving parts of the country with no electricity, water, or heat. Daily strikes continued for two weeks; in just two days of such bombardment, nearly 30% of Ukraine's entire electricity infrastructure was damaged.

On 22 October, Russia repeated the large-scale attack on Ukraine's power grid, resulting in the same level of devastation.[191] On 31 October, Russia followed up with a targeted attack against a cascade of power stations on the Dnipro River and the HPPs on the Dniester River, as well as other partly restored power substations and grid all over Ukraine.[192]

The campaign continued through November, with a particularly devastating attack on 15 November, when the missile strikes impaired the electricity supplies in seventeen oblasts. At that time, the Ukrainian authorities estimated that about half of the country's entire energy system was crippled, with many critical parts of it destroyed, damaged, or put out of service.[193] Subsequent attacks in December were of a similar scale and impact.[194]

Starting with the first attacks on 10 October, millions of consumers experienced daily short-term losses of power. Since then, the Ukrainian TSO introduced pre-planned schedules to moderate consumption nationwide.[195] The attack on 15 November was even more devastating and left over 10 million people without electricity. To avoid a complete blackout ("fall to zero"), the TSO was forced to introduce crisis shutdown schedules.[196] Following the attacks on 23 November, the

[189] Computer Emergency Response Team of Ukraine (CERT-UA), "Кібератака групи Sandworm (UAC-0082) на об'єкти енергетики України з використанням шкідливих програм INDUSTROYER2 та CADDYWIPER (CERT-UA#4435) [Cyber attack of the Sandworm group (UAC-0082) on energy facilities of Ukraine using malware INDUSTROYER2 and CADDYWIPER (CERT-UA#4435)]," 12 April 2022.

[190] The damage led to the blackouts by 40 substations; 2 overhead lines of 750 kV and 5 overhead lines of 330 kV were disconnected. Poltava, Dnipropetrovsk, Kharkiv, Sumy, and Donetsk Oblasts were left without electricity.

[191] Ukrenergo (@Ukrenergo), "Сьогодні, 22 жовтня, рашисти здійснили ще одну ракетну атаку на енергетичні об'єкти магістральних мереж західних регіонів України [Today, on October 22, the Rashists carried out another missile attack on energy facilities of main networks in the western regions of Ukraine]," Telegram, 22 October 2022.

[192] Denys Shmyhal (@Denys_Shmyhal), "Російські терористи вкотре масовано атакували Україну [Russian terrorists again massively attacked Ukraine]," Telegram, 31 October 2022; Ukrenergo (@Ukrenergo), "Сьогодні вранці ворог знову завдав масованого ракетного удару по об'єктах енергетичної інфраструктури [This morning, the enemy again launched a massive missile attack on energy infrastructure facilities]," Telegram, 31 October 2022.

[193] Max Hunder and Jonathan Landay, "Ukraine says half its energy system crippled by Russian attacks, Kyiv could 'shutdown'," *Reuters*, 19 November 2021.

[194] Alexander Query, "Ukraine downs 60 Russian missiles amid another mass strike on energy system," *The Kyiv Independent*, 5 December 2022.

[195] A state-owned company *Ukrenergo* is the electricity TSO. See: "About Us," UKRENERGO National Power Company, accessed on 16 March 2023.

[196] Volodymyr Kudrytskyi (@vladimir.kudrytskyi), "Ситуація серйозна, найсерйозніша за всю історію, але ми зберігаємо керованість системою [The situation is serious, the most serious in history, but we are maintaining control of the system]," Facebook, 15 November 2022.

entire IPS was automatically split by the control system into 3 separately operating islands that were reconnected within about 10 hours.[197]

By employing such a barbaric tactic, Russia hoped to undermine Ukraine's capability to provide vital services to the population and force the government into capitulation. In some cases, there was a clear intent to make living conditions in the de-occupied territories unbearable and governance of those liberated areas very difficult. For instance, having retreated from Kherson, Russian forces left the local energy system ravaged and the city without electricity, heat, water, and communication infrastructure.[198]

Moscow's campaign was designed not only to depopulate some areas and put pressure on the government in Kyiv but also to sap the morale of the Ukrainian troops on the frontlines who had to operate, knowing that their families were suffering without vital services.[199] Even though Ukraine can take comfort in historical analysis that such strategic coercion has never yielded the desire outcomes, it is also true that such damage has never been inflicted on the energy infrastructure in modern history.[200] Resilience of Ukraine's energy system – and its complex society at large – is critical to defeating Russia.

Resilience of Ukraine's energy system – and its complex society at large – is critical to defeating Russia

7.3. Preparation, Mitigation, and Adaptation

Since the beginning of the Russian invasion in 2022, Ukraine has implemented solutions aimed at preserving the state's ability to maintain supplies of energy and energy-related services. Some of those solutions rested upon the measures that had been put in place ahead of the war, while others required improvisation and quick adaptation. In many cases, however, the impact of destruction was too severe to achieve full recovery, so mitigation measures were enacted. This chapter reviews how the Ukrainian energy sector prepared for and responded to the war.

7.3.1. Protection of Energy Facilities

The physical security of Ukraine's energy infrastructure has been strengthened since day one of the invasion. However, the measures implemented failed to provide the necessary level of protection, as the scale of Russia's armed aggression exceeded Ukraine's capabilities. Peacetime preparedness has always been based on assumption that the highest level of threat to critical infrastructure is a threat of sabotage or an act of terror. Although the existing physical protection forces – police or private security companies – were reinforced, it was often at the expense of newly organised territorial defence units with limited capabilities and experience.

Regular police units – tasked with guarding critical infrastructure – did not have sufficient means to deter and repel a regular army that would use tanks, MLRS, bomber planes, or cruise missiles. With some Western air defence systems delivered to the AFU, the level of protection against Russian air attacks increased significantly but could not guarantee a full shield against missiles and drones.[201]

[197] "Енергосистему відновили після блекауту, ввечері запрацюють АЕС, - Галущенко. ВІДЕО [The power system has been restored after the blackout, the NPP will be operational in the evening, - Galushchenko. VIDEO]," *CENSOR.NET*, 24 November 22.

[198] "Окупанти зруйнували всю енергосистему Херсона, на відновлення піде місяць, – ДТЕК [The occupiers destroyed the entire energy system of Kherson, it will take a month to restore it, - DTEK]," *Biznes.CENSOR.NET*, 12 November 2022.

[199] "An interview with General Valery Zaluzhny, head of Ukraine's armed forces. Edited highlights of our conversation," *The Economist*, 15 December 2022.

[200] Robert A. Pape, "Bombing to Lose: Why Airpower Cannot Salvage Russia's Doomed War in Ukraine," *Foreign Affairs*, 20 October 2022.

[201] On 11 September, Russia fired 12 sea and air-launched cruise missiles. Ukraine's anti-aircraft systems managed to destroy 9 out of 12. On 10 October, Russia fired 84 cruise missiles and 24 drones (with 13 Iranian Shahed-136 drones among them). Ukraine intercepted 43 cruise missiles and 13 (including 10 Iranian Shahed-136) drones. The 15 November attack reported over 90 cruise missiles and 10 drones; 73 cruise missiles and all 10 drones were successfully intercepted.

7.3.2. Continuity of Technological Processes

The experience that Ukraine gained from 2014 through 2015 contributed to emergency preparedness at an industry level. The largest energy companies developed reserve control centres and plans to transfer operational activities to these centres in case of aggression or emergency. Companies had drawn up evacuation plans to guide the personnel amid the dangerous developments on the ground, moved management staff to the reserve centres hours before the invasion, and rerouted communication lines and control of technological processes via these centres.

At the local level, energy companies established crisis response and management groups. These groups closely cooperated with similar crisis response groups of TSOs in electricity and gas sectors, ministries, and local authorities.[202] Operational and technical network maintenance personnel remained in place, and the number of repair teams was increased – up to 40 and 30 teams in electricity and gas TSOs and the DSOs, respectively; their task was to ensure energy infrastructure would be restored and functioning. A system of interaction between energy companies, military, and law enforcement units was established to facilitate repairs when needed.[203]

To provide a reliable line of communication, duplicate channels were established. In addition to the traditional means, companies used new satellite systems – provided by *Starlink* – to coordinate between the production facilities or repair crews.[204] Diesel generators, batteries, or renewable sources (solar, wind) were installed to provide an autonomous energy supply for their own needs.[205] Not only did the energy companies regularly inform consumers about service disruptions and restoration works but also developed platforms for consumers to report the damage. Consumer appeals and questions were received via websites, social networks, call centres, chatbots in messenger applications, etc.

Effective and direct communication channels played a pivotal role in the TSO's efforts to stabilise the situation. TSO and DSOs, government officials, and local authorities, as well as journalists and bloggers, constantly addressed the Ukrainian people with appeals to reduce electricity consumption during the peak hours.[206] This initiative helped ease the demand, avoid critical operation modes, stabilise the energy system, and reduce the frequency of emergency shutdowns.[207]

7.3.3. Restoration of Damaged Energy Infrastructure

Energy companies developed plans, as well as prepared resources and means to repair the damaged energy infrastructure, well in

[202] A state-owned company *Gas Transmission System Operator of Ukraine* is the gas TSO. See: "About Us," Gas Transmission System Operator of Ukraine, accessed on 16 March 2023.

[203] D.TEK,"ДТЕК Київські регіональні електромережі повернули світло ще для 8 900 родин Київської області [DTEK Kyiv regional power grids restored the light for another 8 900 families in the Kyiv region]," News, 10 March 2022.

[204] NAFTOGAZ, "Оперативна інформація щодо роботи підприємств Групи Нафтогаз станом на 18.00 10 квітня 2022 року [Operational information on the work of Naftogaz Group enterprises as of 18.00 on April 10, 2022]," News, 10 April 2022; D.TEK, "Енергетики отримали ще 170 терміналів Starlink Ілона Маска, - ДТЕК [Energy companies received another 170 Starlink terminals of Elon Musk, - DTEK]," News, 18 March 2022.

[205] Gas Transmission System Operator of Ukraine, "Українська ГТС продовжує транспортування газу споживачам попри воєнні дії [Ukrainian HTS continues to transport gas to consumers despite military operations]," News, 24 February 2022; Gas Transmission System Operator of Ukraine, "ОГТСУ обладнає сонячними панелями газорозподільні станції для забезпечення резервного живлення [OGTSU will equip gas distribution stations with solar panels to provide backup power]," News, 17 March 2022; Gas Transmission System Operator of Ukraine, "Польський оператор GAZ-SYSTEM S.A. передав ОГТСУ генератори та комп'ютерну техніку [Polish operator GAZ-SYSTEM SA handed over generators and computer equipment to OGTSU]," News, 10 April 2022.

[206] Ukrenergo (@Ukrenergo), "Укренерго закликає киян не вмикати потужні електроприлади під час вечірнього піку споживання [Ukrenergo urges Kyiv residents not to turn on powerful electrical appliances during the evening consumption peak]," Telegram, 10 October 2022; Denys Shmyhal (@Denys_Shmyhal), "Десятки ракет влучили в об'єкти енергетичної інфраструктури в 11 областях і місті Києві [Dozens of missiles hit energy infrastructure facilities in 11 regions and the city of Kyiv]," Telegram, 10 October 2022; "Як підготуватися до аварійних відключень електрики [How to prepare for emergency power outages]," *Slovo I Dilo*, 10 October 2022.

[207] In the evening hours, residents of the city of Kyiv and Kyiv Oblast reduced their electricity consumption by 26.5% compared to a normal autumn day. See: Ukrenergo (@Ukrenergo), "Сьогодні у вечірні години мешканці Києва та Київської області зменшили споживання електроенергії [Today in the evening hours, residents of Kyiv and Kyiv region reduced their electricity consumption]," Telegram, 10 October 2022.

advance. Although all companies established repair teams, when the high-intensity war broke out, their number proved inadequate. Thus, gas and electricity TSOs had to allocate additional resources; a similar trend was observed among the DSOs, especially in regions where intense fighting took place.[208] DSOs from other regions assisted by sending materials, spare parts, equipment, and workforce. These joint efforts by all stakeholders – the industry, military and local authorities – combined with the voluntary decrease in consumption, often allowed them to restore energy supplies rather expeditiously.

Joint efforts by all stakeholders – the industry, military and local authorities – combined with the voluntary decrease in consumption, often allowed them to restore energy supplies rather expeditiously

For instance, after the attack on the energy infrastructure in Kharkiv Oblast on 11 September 2022, supplies were restored within 4.5 hours. However, it took over 50 hours to partially restore supplies following the attacks across the entire country on 10 October. On the morning of 13 October, the Ukrainian TSO announced that the system was stabilised and restrictions on electricity supply were lifted in most regions. Further strikes forced the TSO to apply – from 20 October – emergency shutdown schedules that lasted for weeks.[209] The prepared stock of repair equipment started running out in some energy companies after 20 days of such targeted bombardment.[210]

The war highlighted the importance of coordination between energy companies, the military, law enforcement, and local authorities. The ability to conduct the repair works – as well as their speed – depends directly on the intensity of hostilities. Damage detection, coordination, delivery of materials and equipment, and local ceasefires had to be agreed upon separately and on the ground in each individual case. The Russian military, however, usually rejected any ceasefire arrangements, thus significantly restraining Ukraine's ability to restore energy supplies.

7.3.4. Alternative Energy Supply Options

When destruction was too large, restoration required solutions of an urgent and short-term nature: quick repairs and temporary energy supply schemes.[211] At the same time, long-term measures were developed and implemented as well. For example, to ensure heat supply to the town of Kremenchuk, the solution was not to rebuild the CHP to its previous capacity but to decentralise the heat supply system by building two new boilers in the largest districts and switching to individual heating of apartments in remote houses.[212]

When destruction was too large, restoration required solutions of an urgent and short-term nature: quick repairs and temporary energy supply schemes

[208] 30 emergency repair teams were working non-stop for thirteen to repair the damage sustained in intense fighting in first month of the Russian invasion. See: UKRENERGO National Power Company, "#ЕнергетичнийФронт: Робота енергосистеми України на ранок 7 березня 2022 року [#EnergyFront: The operation of the energy system of Ukraine on the morning of March 7, 2022]," News, 7 March 2022; The company cooperated with the Territorial Defence Force and the AFU to gain safe access to the damaged sites. See: D.TEK, "ДТЕК Київські регіональні електромережі повернули світло ще для 8 900 родин Київської області [DTEK Kyiv regional power grids restored the light for another 8,900 families in the Kyiv region]," News, 10 March 2022.

[209] Ukrenergo (@Ukrenergo), " Дорогі українці, нам знову потрібна ваша допомога [Dear Ukrainians, we need your help again]," Telegram, 19 October 2022.

[210] Група ДТЕК (@DTEKcompany), "Виконавчий директор ДТЕК Dmitriy Sakharuk про ситуацію в енергосистемі України після чергового масованого удару окупантів [DTEK Executive Director Dmitriy Sakharuk on the situation in the energy system of Ukraine after another massive attack by the occupiers]," Facebook, 31 October 2022.

[211] The strike on 11 September 2022 caused damage to the Kharkiv CHP-5 and more than 40 electric substations and power transmission lines in the region; all main lines were returned into operation in 4.5 hours. See: Ministry of Energy of Ukraine, "Маємо забезпечити надійність електропостачання на Харківщині навіть за резервного заживлення – Юрій Власенко [We must ensure the reliability of electricity supply in Kharkiv Oblast even with backup power supply - Yuriy Vlasenko]," News, 16 September 2022.

[212] Kremenchuk's CHP was built as part of a single industrial complex with the oil refinery; the facility's proximity increased kept the risk of damage to the CHP.

Okhtyrka (Sumy Oblast) decided to switch to heat-generating equipment that could use different types of fuel, such as boilers running on natural gas or locally produced biomass fuel. Other towns also developed similar projects to decentralise heat supply systems by installing additional water-heating equipment running on electricity and biomass fuel, as well as mobile gas boilers and boilers that used renewable energy sources.

Following the massive damage to the power grid in October 2022 and under the threat of blackouts, many municipalities have tried to lower their energy demand. Such measures included turning off outdoor advertising and street lights; reducing the occupied area of office premises and promoting work from home; shifting from municipal electric transport (trolleybuses and trams) to combustion engine buses; encouraging businesses (shopping and office centres) to install power generators; and using backup generators to power critical infrastructure and municipal facilities.

7.3.5. Reserve Routes and Sources

When the full-scale war broke out, most routes to import energy resources and equipment were blocked; the western border remained Ukraine's only connection to the outer world via rail and truck shipping. Thus, expanding Ukraine's cross-border shipping capacity has become critical to the energy sector's functioning.

In coordination with Poland, new border control points were opened for road transport, with separate passage lanes for trucks bringing motor fuel.[213] Complicated by the different railway gauges (1 520 mm in Ukraine versus 1 435 mm in most EU countries), projects were quickly designed and implemented to open cross-border lines between closest stations in the neighbouring countries to boost speed and volume of trans-border hauling.[214]

Hours ahead of the invasion, Ukraine's IPS was disconnected from the Russian network to undergo the necessary testing and prepare for synchronisation with the Continental European Synchronous Area (CESA). On 16 March, having confirmed its ability to operate in an 'island mode', Ukraine's energy system was synchronised with CESA. TSOs of Ukraine and its neighbours agreed on the rules of operation for cross-border power transmission lines.[215] The Ukrainian and Polish TSOs also started restoring the power transmission line. New cross-border connections allowed – in the event of critical damage to power generation – to import electricity from the EU, which was successfully tested at the end of October 2022.[216]

New cross-border connections allowed – in the event of critical damage to power generation – to import electricity from the EU

Additionally, Kyiv reached key agreements with the EU partners to reserve guaranteed volumes of cross-border capacities for gas supplies. For instance, Slovak *Eustream* extended the validity period of the increased guaranteed capacities in the amount of 42 mcm at the Budintse point.[217] Agreements with the Polish and Hungarian TSOs enabled Ukraine to import natural gas through the LNG terminals

[213] Dana Hordiichuk, "На кордоні України зроблять пункт пропуску лише для імпорту пального [A checkpoint will be made at the border of Ukraine only for the import of fuel]," *Ekonomichna Pravda*, 13 May 2022.

[214] Yurii Samoilov, "Потягом в Європу: як війна змінила потенціал залізничних сполучень між Україною і Польщею [By train to Europe: how the war changed the potential of railway connections between Ukraine and Poland]," *Yevropeiska Pravda*, 30 August 2022; "УЗ збільшить удвічі пропускну спроможність залізничних прикордонних переходів з ЄС [UZ will double the capacity of railway border crossings with the EU]," *Ekonomichna Pravda,* 12 March 2022.

[215] UKRENERGO National Power Company, "Укренерго та польський системний оператор PSE відновлюють міждержавну лінію електропередачі [Ukrenergo and the Polish system operator PSE are restoring the interstate power transmission line]," Press Release, 9 August 2022.

[216] Energy Company of Ukraine (ECU), "Державний енерготрейдер АТ «ЕКУ» здійснив повторну тестову поставку імпорту електроенергії з Європи, [The state energy trader JSC «EKU» carried out a repeated test delivery of electricity imports from Europe]," Press Release, 19 November 2022.

[217] Cabinet of Ministers of Ukraine, "2 листопада: Ситуація в енергетиці [2 November: Situation in the Energy Sector]," Communications Department at the Secretariat of the Cabinet of Ministers of Ukraine, Kyiv, 2 November 2022.

in the EU.[218] It marks a positive development for both the Ukrainian customers and for the international partners, who have gained access the underground storage facilities in Ukraine. The challenge, however, is that many countries in Europe have themselves been experiencing difficulties with availability, prices, and import capacities from sources other than Russia, which tends to overshadow their solidarity with Ukraine.

7.3.6. Cybersecurity

Ukraine learned its lessons from cyber-attacks on the energy infrastructure from 2015 through 2017. The national cyber security system has become fully functional, with a sector-specific cybersecurity sub-system up and running since 2021. Ukraine's Ministry of Energy has established a network coordinated by two Security Operational Centres (SOCs): one for the electricity sector at *Ukrenergo* and one for the oil and gas sector at *Naftogaz*. These centres are in charge of interaction among the cybersecurity teams at energy companies and their counterparts at the national level.

The joint efforts by experts from the Ministry of Energy, the State Special Communications Service, the Security Service of Ukraine (SBU), the National Coordination Centre for Cybersecurity, and the Computer Emergency Response Team of Ukraine (CERT-UA) have prevented or repelled most cyber-attacks against critical energy infrastructure. Such coordination, for instance, allowed preventing a cyberattack on an Industrial Control System (ICS) of an electricity distribution system in the central region. The CERT-UA acted to the intelligence data and – together with the sectoral SOC and the regional DSO – managed to neutralise the large-scale cyber-attack.[219]

7.3.7. International Crisis Support

Quick restoration of the damaged energy infrastructure would not have been possible without international support. The necessary equipment, spare parts, and materials for repairs, as well as the resources to ensure that the energy system was functioning properly, were delivered to Ukraine as humanitarian aid from Europe under the coordination of the Ministry of Energy.

Quick restoration of the damaged energy infrastructure would not have been possible without international support

Upon requests from Ukraine, the Secretariat of the Energy Community would arrange supplies necessary from The EU member states. For instance, by June 2022, Ukraine had received 40 containers and 35 trucks with electrical equipment (generators, transformers, cables, insulators, couplings, etc). The EU activated its emergency response mechanisms, while many countries assisted Ukraine with fuel deliveries on a bilateral basis. Individual countries such as Australia helped to secure the necessary amounts of coal to create reserves for the winter period; Norway allocated 200 million US dollars to purchase natural gas for Ukraine.[220] Assistance was also provided by various energy companies and international financial institutions.

Following the October 2022 attacks, Ukraine sent requests for emergency assistance via the NATO Crisis Response System and the EU Civil Protection Mechanism.[221] And by the end of October 2022, over 12 countries had responded by sending the badly needed

[218] Gas Transmission System Operator of Ukraine, "ОГТСУ створив ще один гарантований маршрут для імпорту газу в Україну [OGTSU has created another guaranteed route for importing gas to Ukraine]," News, 5 March 2022; Gas Transmission System Operator of Ukraine, "Україна та Угорщина вперше пропонують квартальні гарантовані потужності для імпорту газу [For the first time, Ukraine and Hungary are offering quarterly guaranteed capacities for gas imports]," News, 24 January 2022.

[219] CERT-UA, "Cyber attack of the Sandworm group."

[220] Ministry of Energy of Ukraine, "Міненерго: Перші 39 вагонів вугілля з Австралії прибули на українську ТЕС [Ministry of Energy: The first 39 wagons of coal from Australia arrived at the Ukrainian TPP]," News, 9 August 2022; Government of the Kingdom of Norway, "Norway to use NOK 2 billion to help procure natural gas for Ukraine," Office of the Prime Minister and Ministry of Foreign Affairs, News, 29 August 2022.

[221] Ministry of Foreign Affairs of Ukraine, "Дмитро Кулеба: МЗС працює з партнерами над подоланням наслідків атак РФ на критичну інфраструктуру України [Dmytro Kuleba: the Ministry of Foreign Affairs is working with partners to overcome the consequences of Russian attacks on the critical infrastructure of Ukraine]," News, 20 October 2022.

equipment.[222] For smoother coordination, the International Advisory Council – co-chaired by the Minister of Energy of Ukraine and the European Commissioner for Energy – was established.[223]

7.3.8. Motor Fuel

Availability of motor fuel has become particularly acute since Ukraine's oil refineries and depots were destroyed. The Kremenchuk refinery and several other processing facilities used to cover only 18% of the country's pre-war consumption, while 82% of oil products used to be imported (via road, railway, sea, and pipelines).

Since March 2022, Ukraine has been rearranging its entire system of supply, storage, and distribution of petroleum products, with several successful measures to boost the daily imports volume from the EU, such as entry permits for trucks and customs clearance procedures at the border; imports via ports on the Danube River; price regulation; tanker slots at the EU ports. [224]

In addition to the private operators in the market, the Government of Ukraine authorised the state-owned companies – *Ukrzaliznytsia* and *Naftogaz* – to import motor fuel. With improved logistics, railways shipment increased five-fold, and separate 'green lanes' for trucks were launched at the Polish border crossing points. Threats to those supply routes were mitigated with a sophisticated logistics system, targeted small-batch deliveries directly to gas stations, and storage diversification at small oil depots. The petroleum crisis had been overcome by August 2022, leading to lower consumer prices.[225]

7.4. Lessons for Wartime Resilience

Already before the Russian invasion of 2022, Ukraine had been designing the legal framework to ensure the resilience of its critical infrastructure, with the landmark legislation enacted in December 2021. The Law on Critical Infrastructure introduced a set of tools to prevent crises and ensure functioning under stress. It established a system of interaction among multiple response systems and developed requirements for the private-sector owners.[226] However, it had only been at its infant stage when Russia invaded two months later. The war has proven to be a challenge of magnitude and complexity that is able to overwhelm even the best prepared of societies.

Critical infrastructure has been the main thrust of the Russian strategy, and Ukraine has not been properly protected

7.4.1. Physical Protection

The war has demonstrated that critical infrastructure must be the focus of defence planning by the military authorities. Critical infrastructure has been the main thrust of the Russian strategy, and Ukraine has not been properly protected. The task was initially assigned to the law enforcement agencies: the SBU, the police force, and the National Guard.

[222] The Ministry of Foreign Affairs of Ukraine negotiated imports of 954 units of energy equipment from 12 countries (Israel, Spain, Italy, Lithuania, Germany, North Macedonia, Poland, the Republic of Korea, Slovakia, Slovenia, Finland, and France). See: Ministry of Foreign Affairs of Ukraine, "Дмитро Кулеба: МЗС залучає допомогу партнерів для відновлення енергосистеми, щоб в оселях українців були світло, тепло і вода [Dmytro Kuleba: the Ministry of Foreign Affairs is enlisting the help of partners to restore the energy system so that Ukrainians have light, heat and water in their homes]," News, 31 October 2022; Ukraine received 700 generators from donors, with 900 more to be delivered. See: Cabinet of Ministers of Ukraine, "4 листопада: Ситуація в енергетиці [4 November: Situation in the Energy Sector]," Department of Communications at the Secretariat of the Cabinet of Ministers of Ukraine, Kyiv, 4 November 2022.

[223] Ministry of Energy of Ukraine, "При Міненерго створено Міжнародну енергетичну консультативну раду високого рівня [A high-level International Energy Advisory Council has been established under the Ministry of Energy]," News, 2 November 2022; Zoriana Stepanenko, "Як ЄС рятуватиме Україну від блекаутів. Ексклюзивне інтерв'ю з Кадрі Сімсон [How the EU will save Ukraine from blackouts. Exclusive interview with Kadri Simson]," *Radio Svoboda*, 11 November 2022.

[224] Ministry of Economy of Ukraine, "В травні Україна отримає 350 тис тонн палива з нових логістичних маршрутів [In May, Ukraine will receive 350 000 tons of fuel from new logistics routes]," News, 13 May 2022.

[225] In June-July 2022, the price of gasoline or diesel reached 70 hryvnias per litre; in September, it dropped to 50 hryvnias.

[226] Verkhovna Rada (Parliament) of Ukraine, *ЗАКОН УКРАЇНИ Про критичну інфраструктуру* [Law of Ukraine on Critical Infrastructure], 1882-IX, Kyiv, 5 December 2022.

The main functions of physical protection were performed by state security police or private security companies that were not equipped to counter military attacks.

There were some coordination failures between the military and the law enforcement units, which obstructed timely and adequate response in the early stages. For example, a territorial defence unit was in charge of defending the Zaporizhzhia NPP: it was blocking the advance of the Russian troops outside the facility but not protecting the plant itself. A National Guard unit was protecting the NPP's territory but did not have any heavy weapons. These units failed to coordinate their response in a way that might have delayed – or even prevented – the capture of the NPP. The lesson was learned and, amid the risk of the second wave of invasion from Belarus in October 2022, Ukraine started to reinforce the physical protection of the Rivne NPP with military units capable of defending the site against airborne and armoured ground assault.[227]

Ukraine did not possess adequate means to protect against air and missile threats. Although the legislation stipulated that the air defence system should be in place to defend the NPPs and large HPPs, it was not sufficient to shield other critical infrastructure objects – such as transmission substations, oil depots, or CHPs – against cruise missile and drone attacks. A series of missile and drone strikes destroyed the entire oil refinery industry and the system of large oil depots and gas stations in Ukraine. Developed for peacetime, the oil infrastructure did not have secure underground storages or reliably protected refineries; they were also located close to large consumption centres and/or transport hubs. This model of industry infrastructure created vulnerabilities that were exploited by the aggressor.

7.4.2. Sectoral Crisis Response System

At the industry level, the TSO is – by law – responsible for reliable and uninterrupted services. Therefore, there plans had been drawn up and put in place to ensure operational security and guide emergency response. In case of an emergency, the electric power industry (regardless of the ownership form) has to follow the operational safety standards and operational commands by the TSO.

To help the TSO manage a major crisis, it is necessary to establish a coordinating structure at the national level that would conduct rigorous and dynamic collaborative scenario planning. In Ukraine, those duties belonged to the Ministry of Energy. Together with *Ukrenergo*, the ministry developed options for the IPS operation in different scenarios (such as the destruction of separate generation capacities, substations, or power transmission lines). The energy sector analysis was conducted on a regular basis; response measures were adjusted according to the developments on the frontline.

The proposed scenarios were constantly discussed at the governmental level. The Crisis Group was created to coordinate all the actors, prepare the response measures, prioritise equipment and fuel supplies to the power plants, and strengthen the resilience of energy services.[228] Taking into account the strategic defence priorities, demands from the economic actors, and military dynamics, the Ukrainian government made the decisions pertaining

The Ukrainian energy companies had contingency plans to respond to natural disasters or technological accidents, yet the Russian incursion of 2014 has incentivised the country to prepare for renewed military aggression

[227] Віталій Коваль / Рівненська ОДА (ОВА) (@vitalykoval8), "Враховуючи «інтерес» ворога до енергетичної системи України, продовжуємо посилювати охорону Рівненської АЕС [Taking into account the enemy's "interest" in the energy system of Ukraine, we continue to strengthen the protection of the Rivne NPP]," Telegram, 17 October 2022.

[228] A Coordination Headquarters was formed for quick response to attacks against energy infrastructure. See: "Створюємо штаб по реагуванню на пошкодження енергетичної інфраструктури, - Зеленський [We are creating a headquarters to respond to damage to the energy infrastructure, - Zelensky]," *CENSOR.NET*, 13 September 2022.

to resource distribution, reserve funds, and appeals for international assistance.[229]

Preparedness is an important element of resilience. The Ukrainian energy companies had contingency plans to respond to natural disasters or technological accidents, yet the Russian incursion of 2014 has incentivised the country to prepare for renewed military aggression. At the level of TSOs, DSOs and extracting and power generating companies, the post-2024 developments contributed to establishing reserve control centres, accumulating resources and equipment needed to restore the damaged infrastructure, and plans for personnel relocations. As the Russian attacks intensified, TSOs and DSOs increased the number of repair teams – the main tool to provide continuity of technological processes. Crew members, however, had to be exempted from mobilisation, which required authorisation from the military. Crisis response and damage restoration, too, were coordinated with the defence forces, law enforcement units, and civil defence forces.

Corporate crisis centres, as well as their close cooperation with the national and local crisis headquarters, made it possible to balance the industry's capacities and communities' needs. Temporary legislation had to be enacted to ease some peacetime standards and bureaucratic burdens placed on the energy companies to minimise the disruptions.[230] Likewise, requirements for the temporary connection of electrical installations had to be liberalised for the duration of the martial law to achieve greater flexibility and responsiveness systemwide.[231] However, new restrictions on the spread of information related to energy facilities had to be introduced in order to prevent the Russian forces from gathering intelligence.

7.4.3. Flexibility and Adaptability through Diversification and Decentralisation

Mass destruction and fuel shortages from April through June 2022 were the results of the low level of diversification of sources, supply routes, and storage locations. Those vulnerabilities stemmed from the centralisation, which made the oil refining infrastructure an easy target for missile strikes. It was further aggravated by the contractual dependence on supplies from Russia and Belarus. A series of kinetic attacks dismantled the infrastructure, and the war terminated contracts with aggressor countries. Ukraine lacked pre-prepared alternative supply routes and fuel contracts, which required considerable time to arrange and led to serious energy disruptions.

Decentralisation by reconnection to the local energy systems and (renewable) sources proved effective

In contrast with motor fuel, gas supplies were a different story, with Ukraine's efforts to diversify ongoing since 2014. By 2022, Ukraine had already established alternative supply channels and entered into import agreements. As to the electricity supplies, Kyiv had some success to report at the beginning of the full-scale war. Moreover, the supply and distribution system had achieved a very high level of diversification and even had some surplus capacities. It allowed utilising backup supply routes and enacting of temporary schemes until the main infrastructure had been fully restored. Decentralisation by reconnection to the local energy systems and (renewable) sources proved effective. So did switching to renewable energy sources at

[229] Cabinet of Ministers of Ukraine, "Gov't has directed over UAH 4 billion to the rapid recovery of regions affected by the war, says Denys Shmyhal," Communications Department at the Secretariat, 4 October 2022.

[230] National Energy and Utility Regulatory Commission of Ukraine, *Постанова № 812 Про внесення змін до Тимчасового порядку дій операторів систем розподілу з відновлення електропостачання населених пунктів, знеструмлених через пошкодження об'єктів електричних мереж або їх складових внаслідок бойових дій, у період дії в Україні воєнного стану* [Decree No. 812 On making changes to the Temporary Procedures of Distribution System Operators for Restoring Electricity Supply to Populations Cut Off Due to Damage to Electrical Network Objects or Their Components as a Result of Military Operations, During the Period of Martial Law in Ukraine], v0812874-22, Kyiv, 26 July 2022.

[231] National Energy And Utility Regulatory Commission of Ukraine, *Постанова від 26 березня 2022 р. № 352 Про затвердження Порядку тимчасового приєднання електроустановок до системи розподілу у період дії в Україні воєнного стану* [Decree No. 352 On approval of the Procedure for temporary connection of electrical installations to the distribution system during the period of martial law in Ukraine], Kyiv, 26 March 2022.

remote facilities (such as gas pumping and gas compressor stations or boiler houses).

Ukraine benefited from the fact that its national power grid merged several regional grids with their own control centres and personnel. This added extra capacities and options to provide energy services and avoid nationwide blackouts had the larger grid been 'decentralised' by kinetic attacks. However, it will not be sustainable in the longer term, as there are limits to how many such 'islands' can be maintained. Therefore, decentralisation is not a panacea, even if it may have merits as a temporary backup solution.

7.5. Lessons for Resilience

Ukraine's experience shows that a national energy system needs to be resilient to targeted military attacks, as well as to other types of threats and hazards. Even with modern weaponry, it is impossible to guarantee full protection of energy infrastructure throughout the entire country. Critical objects and nodes can be destroyed by massive kinetic attacks or their functioning disrupted by cyber-attacks. The system's ability to reconfigure supply routes and grids, and provide alternative methods of energy services to consumers, as well as its readiness to use the potential of decentralised, locally generated energy sources, comes to the forefront of strategic planning. A sustainable ability to provide a continuous energy supply to the end-users under any adverse scenario, including a large-scale war, has become the main goal.

The system's ability to reconfigure supply routes and grids, and provide alternative methods of energy services to consumers, as well as its readiness to use the potential of decentralised, locally generated energy sources, comes to the forefront of strategic planning

Any system – even if built to be resilient to a wide range of threats – can suffer impacts that go beyond the design-based level of endurance. Therefore, the plans to ensure sustainable provision of vital functions and services must be developed; organisational structures and personnel must be prepared; and resources must be accumulated to ensure rapid recovery of disrupted functions. It is a duty and a task for the government which cannot be delegated to the private sector. The National Energy Resilience Plan should be drawn up together with the legislation regulating the actions of energy market entities during the war, natural disasters, social unrest, pandemic, etc. Interaction mechanisms for crisis response and resource management should be designed and activated when energy infrastructure has been damaged.

The current level of technological and socio-economic development requires nationwide systems. They also add vulnerabilities in case of a targeted attack against energy infrastructure by state actors or terrorist groups possessing heavy weapons. Designed for peacetime conditions, the existing physical protection measures are unable to secure critical energy infrastructure during an armed conflict. The national military forces – equipped with modern weapons to defend against ground attacks, air attacks, and cyber-attacks – are thus needed. Critical infrastructure security should be included in the strategic defence planning, with adequate resources and capacities allocated. At the international level, legal norms and binding requirements to outlaw attacks against critical civilian infrastructure are urgent tasks for diplomacy.

Globalisation, regional economic integration, and infrastructure connectivity are a challenge for a country that wants to rely on national capabilities. Yet cross-border threats require cross-border cooperation mechanisms to provide security for common energy infrastructure. As the war in Ukraine has shown, an individual country cannot quickly and independently restore its energy supplies, which is especially true for smaller nations with less diversified systems. Hence, there is a need for a Europe-wide system of mutual crisis assistance, including joint reserve stocks of equipment and spare parts.

Conclusions

Tomas Jermalavičius

Russia's war has become a major resilience test not only in Ukraine itself but in entire Europe. Energy is a major vector of strategic coercion (as it has already been for a number of years vis-à-vis such countries as Ukraine or the Baltic states) and thus could have been well anticipated. Having ignored persistent warnings from countries more conscious of the essence and *modus operandi* of the Kremlin regime, much of the continent is now grappling with the consequences of its over-dependence on Russian fossil fuels and the slow progress of the transition to climate neutrality. Russia predictably weaponised this over-dependence in the run-up and during the invasion in the expectation that Europe will abandon Ukraine to avoid the pain and the socio-economic costs of the energy crisis. In 2021, there were still many policymakers and experts who were too ready to explain away Russia's actions in gas markets as tough bargaining. By the end of 2022, it became obvious to everyone but most oblivious (or corrupted) Russia sympathisers that the Kremlin had woven the use of military force, powerful disinformation campaigns, and energy supply disruptions into one potent geopolitical strategy to support its neo-imperial ambitions. This report has thus accomplished three objectives.

Kremlin weaved the use of military force, powerful disinformation campaigns, and energy supply disruptions into one potent geopolitical strategy to support its neo-imperial ambitions

First, it conducted a historical 'forensic' analysis of how we ended up in this situation of overdependence, while empowering the aggressive and repressive Kremlin regime, as well as endangering pivotal transatlantic relations in the meantime. Chapters 1 and 2 demonstrated that the historical roots of the European strategic blundering go a long way back and have endured many geopolitical crises that should have caused the policymakers to reflect and reconsider some earlier decisions. Only the brutal war against Ukraine and Moscow's willingness to inflict costly disruption on Europe to achieve its geopolitical aims have finally prompted Europe to upend all the assumptions and expectations concerning energy relations with Russia. There is now a resolve and a momentum to abandon Russia's energy supply, even though there is a slight possibility it will be allowed back into the European markets under some strict conditions and in a limited way. The war has also underlined the importance of relations – including in the energy sphere – with the key strategic ally of Europe, the United States. Massive US support has been the main factor enabling both Ukraine's survival and Europe's energy resilience. To anyone with a strategic perspective, it should be obvious that European military and energy security are still impossible without the US.

It should be obvious that European military and energy security are still impossible without the US

Second, the report analysed how the current energy crisis driven by Russia's war impacted Europe and the Baltic region. Chapters 3, 4, and 5 examined how the EU common policies evolved and what actions the member states have jointly and individually undertaken to counter Russia's strategy. Despite its reputation for slow-moving decision-making, the EU acted, by historical standards, very quickly to bolster resilience through diversification and energy savings. It managed to impose costs on the aggressor through sanctions and lay the ground for an accelerated energy transition. Still, it is not clear whether the energy crisis will lead to more emphasis on common mechanisms and coordinated actions in a policy area where member states have a shared responsibility with the EU institutions. Just as the COVID-19 pandemic demonstrated earlier, in a large-scale crisis, there is a strong instinct to prioritise national approaches, interests, and solutions. Therefore, solidarity and cohesion among member states – as well as within them and with their non-EU neighbours – have constantly come under pressure. Although Russia has not succeeded in its efforts to coerce Europe into abandoning Ukraine politically, financially, or militarily, it remains to be seen how corrosive the energy

crisis will be to Europe's internal market, industrial base, societal cohesion, political will, and solidarity. The risk that some member states – especially the most vulnerable ones – would buckle under the pressure of high prices and energy shortages has not yet fully receded.

Third, the report studied the implications that Russia's military strategy in Ukraine has for the protection of critical energy infrastructure and the entire energy system. Chapters 6 and 7 examined how Ukraine has been coping with the evolved campaign of destruction and drew key lessons for energy, security, and defence planners. Sources of Ukraine's resilience are diverse – from the scale of the system that is able to absorb significant amounts of damage, through close coordination between the stakeholders in private and public sectors, to capacity for rapid adaptation, both in the energy sector and society at large, as well as international support and solidarity. The best remedy to Russia's strategy, of course, is offensive military action that disables its long-range precision-strike capability, combined with clandestine action to disrupt its targeting processes. However, these options are difficult to pursue. Therefore, defensive measures – from sufficient layered air and missile defence that cover key facilities to ground forces units designated to defend those facilities – combined with thorough planning, preparedness, and adaptivity in all parts of the energy supply chain remain essential.

Wartime places special demands on organisational agility of energy system operators, their human resources (especially the repair teams which need military training and equipment for self-protection, as well as capacity for secure coordination with the military units), and the availability of reserve stocks of fuels, equipment, and spare parts. War also tests – to the limit – and puts a premium on the capacity of various stakeholders for effective public-private and civil-military partnerships, as well as horizontal and vertical coordination within the energy sector and with other sectors. For years to come, Ukraine will remain a source of further insights and lessons that European energy enterprises, policymakers, and crisis management authorities will need to study in pursuit of resilient energy systems designed to withstand the shock of war.

By the spring of 2023, having withstood many destructive waves of Russian attacks on energy infrastructure, Ukraine stands strong. It has even resumed exports of its electricity surplus to Europe – a testimony of another Russian failure to coerce the country into defeat.[232] The EU member states previously most dependent on Russian natural gas – such as Germany but not Hungary or Austria – have completely cut their energy links to the aggressor state at record-setting timescales.[233] Democratic allies of the EU – such as Norway and the United States – have become key suppliers of energy resources, especially LNG. Electricity prices in the Baltic markets have declined, thus easing the pressure on businesses, consumers, political processes alike. Russia has completely failed at its energy blackmail against Europe, which also demonstrated what resourceful democracies are capable of if they are determined to back their values and interests with focused and quick actions.

Regulatory, policy, and technological flexibility and innovation are vital ingredients in responding to various forms of strategic coercion through the energy sector

The report highlights that regulatory, policy, and technological flexibility and innovation are vital ingredients in responding to various forms of strategic coercion through the energy sector – especially when such coercion is applied against targets under the duress of a major war, in which economic disruption, market uncertainty, geopolitical turmoil, and societal anxieties are abundant. They are important both in terms of coping with short-term energy shortages or supply disruptions and accelerating the transition to a climate-neutral future. They are also critical in coping with the wartime conditions in countries directly affected by large-scale use of military force.

There is still some residual (and further declining) risk, though, that the pressure

[232] "Ukraine to resume electricity export," *The Kyiv Independent,* 8 April 2023.

[233] "Germany says it is no longer reliant on Russian energy," *BBC,* 18 January 2023; Nikolaus J. Kurmayer, "Austria slides back into dependence on Russian gas," *EURACTIV,* 10 February 2023; "Hungary finalises deferred payments deal with Gazprom -minister," *Reuters,* 12 October 2022.

to opt for an easy path – resuming greater reliance on CO_2-intensive fossil fuels such as coal, cultivating energy relations with gas-rich authoritarian regimes other than Russia, or even allowing some re-entry for Russian fossil fuels into the European markets – will be too great of a temptation in the short and medium term, as securing sufficient gas supplies from non-Russian sources remains a pressing challenge.[234] This may well undermine or distract from the equally pressing need to cope with the climate emergency. There is also a risk that the appetite for resilience-enhancing investments and transformative solutions will diminish in the cost-conscious economic environment of the coming years or that the EU and US will start a vicious cycle of protectionist measures in green energy development that will undercut transatlantic cooperation in energy security. Europe therefore must remain razor-focused on fulfilling the goals of the European Green Deal and RePowerEU, use this crisis as a great accelerator, and incorporate candidate countries, such as Ukraine, as well as constructively engage with key strategic partners such as the US in this effort.

[234] Szymon Kardaś, "Conscious uncoupling: Europeans' Russian gas challenge in 2023," European Council on Foreign Relations (ECFR), 13 February 2023; Ben McWilliams, Simone Tagliapietra, Georg Zachmann, and Thierry Deschuyteneer, "Preparing for the next winter: Europe's gas outlook for 2023," Policy brief, Bruegel, 2 February 2023.

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