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Historical Dependencies And Immediate Impacts: Germany-Russia Energy relations and Consequences of Gas Supply Disruptions Post Ukraine War

Muhammad Shoaib Rasool
muhammadshoaibrasool8@gmail.com
MPhil Scholar, Department Of International Relations, University Of Sargodha

Dr. Ashfaq Ahmed
Professor, Department Of International Relations, University Of Sargodha

Corresponding Author: * Muhammad Shoaib Rasool muhammadshoaibrasool8@gmail.com

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ABSTRACT

The paper analyzes the reshaping of the Germany energy system following a full-scale Russian invasion of Ukraine in 2022, a fact that has upset decades of deep reliance on cheap Russian natural gas. Throughout its history, policy in Germany to rely on handel; Wandel Durch Handel, created considerable dependency on Russian resources supplying over 55% naturally fitting natural gas to the country as of 2021. What followed next was weaponization of energy by the Russians, which revealed very weak points and resulted in soaring prices, inflation, and industry overload in Europe. Germany responded by taking vigorous measures in terms of crisis-management, including the intensive erection of the liquid natural gas import infrastructure, the mandatory renewal of the storage, and the active energy-saving. These short-term measures were able to prevent a massive recession and black-outs. Though economically expensive in the short-run, the crises also had unintended positive consequences: a lasting reduction in gas demand, an increase in the use of renewable sources of energy (up to around 56% of electricity production by 2025), and a faster movement towards the goals of decarbonization. The episode disproved traditional energy security theories and highlighted the significance of energy versions that had been made more resilient and diversified in the context of an unstable geopolitical environment. It demonstrates the need to develop effective back-up strategies and constantly review the international energy reliance through the rapid transformation of national energy policy in response to geopolitical events.

Keywords: *Germen Energy Security, Russia-Ukraine War Impact, Geopolitical Energy Transition*

INTRODUCTION

Over the decades the German economic miracle, the Wirtschaftswunder that has helped it to maintain its post-war leading position in Europe as the industrial powerhouse relied heavily on a steady and cheap stream of Russian natural gas. Such pipelines like Nord Stream were not isolated examples of energy infrastructure but also a hidden actor in the modern landscape in which stability and mutual benefit were supposedly achieved through economic interdependence a concept of Wandel den Handel (transformation through trade) (Blumenau, 2022; Goodell et al., 2023). When at its greatest, Russia was importing over half of Germany natural gas, providing power to its factories, heating its homes, and underpinning the competitiveness of its intensive energy consumers such as chemicals, steel, and auto-productions. This alliance seemed to be impregnable, and it represented an expedient palisade between the world of the East and the West despite the occasional reverberations of the Cold War (Philipp, 2024; Vuving, 2020).

The invasion of Ukraine on a full scale on 24 February 2022, in effect disintegrated the so-called economic interdependence; what had been promoted as a stable bilateral relationship was shown to have serious strategic weaknesses when Moscow began to weaponise its energy supplies, cut flows through the transit routes, manipulate the use of storage facilities and finally caused sudden cuts in supplies that ripple effects

in the energy market in Europe. European major dependency Relatively more reliant on Russian energy than any other major EU state: Russia (which provided about 55% of its gas imports in 2021, 34 %. of its oil imports and 50% of its coal imports) experienced an existential crisis as energy prices increased, industry was pushed to shutdown levels, and the geopolitical map of the continent was being redrawn nearly in real time (BOUBOU, 2023; Ioannides, 2022). Russian gas imports into the pipeline have been virtually shut off and there will be no conceivable way to reopen the channel once its closing time is reached, which is late 2025 the sheer magnitude of the effect of that point on current ideas of energy security in a globalized world is hard to overestimate (Gritz & Wolff, 2023; Rogers, 2011).

The study explored the causes and short term effects of the breakup using a holistic evaluation of the energy policy adjustments that were instigated by the crisis in Germany. The major thesis of the underlying thesis is to check how far the energy policies of Germany have had to change due to the action of Russia to boycott gas supplies and the war in Ukraine. The bilateral relations before the conflict were marked by good relations and profound integration of Russia as a reliable partner on whose export revenues were strongly correlated with Germany. The war overturned this paradigm: it revealed the vulnerability of energy relations to acute security broke down supplies throughout Europe, with Germany being the most such victim, and had to undergo the comprehensive reorganization of policy to guarantee resilience and sustainability. Disruption of gas supplies led to the negative economic impacts with inflation as well as the industrial risk to which there were also some surprise benefits observed including the faster rate of efficiency increase and the replacement of renewable energy sources. The research lied on following questions: how were the historical energy connections between Germany and Russia creating the vulnerabilities as demonstrated by the war in Ukraine and what were the immediate economic and geopolitical consequences of the gas disconnections? This question directs an investigation into causal processes, by showing how deeply rooted dependencies intensified the shock and how temporary actions alleviated all the more which followed, though without removing it.

Historical Context: The evolution of Germany-Russia Energy Relation

The historical course of the relations between Germany and Russia with the energy question is one of the paradigmatic models of the European diplomatic development based on the principles of functional need, ideological rationalization, and geopolitical contingencies. Since the Cold War era, the active outreach to the Eastern Bloc by West Germany started in the late 1960s and early 1970s, led by the Ostpolitik then-Chancellor, Willy Brandt (Hagemann et al., 2020; Roberts, 2022). The idea to follow showed that even the ideological rifts could be softened by economic interdependence, the stability could be created, and the Soviet Union could be brought closer to the Western standards of political norms through one nature concisely summarized as the principle, Wandel durch Handel. In this strategic context, the energy cooperation became a very important lever. The first big gas deal elmatized in 1970, when West Germany transported large-diameter pipeline parts, which were absent in the USSR due to Western embargo, and obtained a similar amount of natural gas going to write to the West. During the 1980s under increasing pressure on the cold war, with the increases in the NATO double track decision and the Soviet invasion of Afghanistan the supply of Russian gas to Western Europe was never disrupted at all (Belov, 2022; Borovsky, 2019). Other European countries like Germany went on importing Soviet gas without much disturbance, although the United States under the leadership of President Reagan sharply objected to the agreement and imposed a set of sanctions against pipeline equipment. The constant accuracy of such deliveries contributed to the development of the dominant discourse of Russia (or, its predecessor, USSR) as a stable energy source that put fiscal interests ahead of political ones (Belov, 2022).

The bilateral relations between the Federal Republic of Germany and the Russian Federation developed after the end of the Cold War. With a new united Germany coming up as a major economic power player, the need to have cheap energy supplies to keep its export driven industrial sector running was now of

paramount importance. At the same time, following the disintegration of the Soviet Union, the Russian Federation sought ways of ensuring hard currency and an increased market access to its vast hydrocarbon reserves (Cetera et al., 2023; Surwillo, 2023). All these interlaced economic agendas increased the pace of expansion of contracts. The growth of the gas pipelines, including Yamal -Europe, which passed through Belarus and Poland, broadened the capacity in the seventies of the last century and forthcoming, the most acclaimed and paradoxical event took shape with the development of Nord Stream (Voytyuk, 2022; Żukowska, 2020).

Nord Stream 1, whose development was completed in 2011 -2012, was a direct under-sea pipeline connecting Russia and Germany via the Baltic Sea, thereby bypassing transit countries such as Ukraine and Poland. The project was approved by Chancellor Gerhard Schroder, who then became a board member of Gazprom an action that brought him into question, it nearly doubled the amount of gas throughput and was largely positioned along economic lines: to bring a cheaper and faster supply of gas to German industry (Spohr, 2023). The proponents furthered the argument that this embodiment of Wandel through Handel established the mutual benefit and would act as a warning to the world against the use of military aggression. To the Russian side of the pipeline, it gave Russia a strategic advantage and provided the country with a lot of revenue; to Germany, it was a way of accessing cheap oil, rather it enabled Germany to make that step of switching to Energiewende in which natural gas was seen as a relatively cleaner bridge to phase out coal and nuclear energy (Schreurs, 2023). Nord Nord Stream 2, which was passed in the 2010s and is scheduled to be completed by 2021, is an escalation of this strategic investment. Although there were more and more warnings on the part of the Eastern European neighbours, or even the imposition of sanctions by the United States, even by the political wing of the German political establishment, the project was carried through during the chancellorship of Angela -Merkel. The reason was always that Russia was described by certain policymakers and business executives as a reliable partner, and access to cheap gas was considered vital to the competitiveness of industry (Jong, 2023; Schreurs, 2023). According to Anna Bros, this move did not take place purely under economical factors; the move was supported by lobby influence of the large energy companies, politicians and a popular culture that reduced the perceived dangers. Similarly, ConstanzeMuller claims that the overdependence on the Russian gas was justified by Germany in terms of an interdependence of mutual benefit, in which case neither of the parties weaponizes the arrangement (LaBelle, 2023, 2024). However, there was still undermining risks. Critics noted that bilateral transit avoidance gave Russia an added bargaining power to undermine the neighbouring nations including Ukraine who lost the transit fees to the state. The asymmetry in the relationship between Germany and Russia was that Germany needed gas to fuel its power-hungry economy, and Russia needed revenue and retained the control over supply (Westphal, 2020). The alarms were sounded in 2008 by the war of Georgia by Russia and the annexation of Crimea in 2014, but they did not stop gas supplies, to confirm a state of complacency. By the late 2010s, over 50% of the natural-gas usage of Germany was in Russian supplies, giving the nexus a home.

Reflectively, this course masked substantive weaknesses. The Wandel durch Handel philosophy, which, arguably, had a very noble impulse in the epoch of the détente, was a blind street. It assumed the economical interdependence would moderate the Russian behavior hence neglecting the possibility of weaponizing energy. One of the most famous retrospective commentaries on post-crisis was Daggett as quoted writing, we were all wrong; it was pointed out that Germany had grown too reliant on Russian energy, not in diversification but just in short-term cheapness. This collaboration would produce fifty years of cheap and steady supplies, thus keeping the German industry strong. But on the eve of the invasion of Ukraine in 2021, this was already the most immense dependency of Europe, which would be abruptly revealed by the Ukraine war (Pirgaip et al., 2025; Zhou & Månberger, 2024).

Pre War Dependency: Scale and Vulnerabilities

By the early years 2020, Germany became the most vulnerable economy across the European Union due to relying on Russian energy resources as much as possible. Russia did not act as a simple source of energy but had dominating power on major portions of the German energy portfolio. Russian exports formed about 55% of the natural gas imports in Germany, 34 to 35% of its crude oil imports, and about 45 to 50% of its hard-coal imports in the one final complete calendar year, 2021. Such statistics were not one-off aberrations but they represented a trend of a continuous rise in the previous ten years which could be explained by both economic and policy choices (Huang & Dan, 2022; Malik, 2023).

Table 1: ***Germany's Energy Imports from Russia (Approximate Share 2019-2021)***

Year	Natural Gas (%)	Crude Oil (%)	Hard Coal (%)
2019	~40-45	~30-35	~45
2020	~50	~33	~50
2021	~55	~34	~45-50

This addiction was prominent in the EU. Though the overall amount of gas the bloc imported in 2021 reached approximately 40-45% of Russian gas, individual exposures were also widely distributed, and Germany, the largest consumer, had the biggest absolute load (Dreyer et al., 2023; Kulakevich, 2024).

Table 2: ***Russian Gas Dependency in EU countries (2021 Shares of Total Gas imports)***

Country	Russian Gas Share (%)	Notes
Latvia	~93	Near-total reliance
Finland	~94	High vulnerability
Germany	~55	Largest volume importer
Italy	~40-45	Significant but diversified
Austria	~80	Pipeline-heavy
Hungary	~80-95	High Eastern exposure
EU Average	~40-45	

The outlier situation in Germany was due to the fact that Germany was the industrial powerhouse in Europe. High energy consuming industries chemicals (e.g., BASF), metals, motor industry, and manufacture of products consumed huge volumes and cheap gas became a competitive advantage. A gap was perfectly sealed by Russia, a low-cost nuclear supplier, which was deemed to be reliable (Szulecki & Øverland, 2023).

One of the major amplifiers was the nuclear phase-out of Germany in the aftermath of Fukushima. The 2011 disaster in Japan led to an acceleration of the Atomausstieg by Chancellor Merkel who immediately shut eight reactors with the aim of departing completely by 2022 (but later a few weeks later due to the crisis). It had lost nuclear, which supplied the electrical power to nearly a quarter of pre-2011 needs (Jarvis et al., 2019). As the Energiewende increased renewables, the intermittency demanded the flexibility of backups. The bridge fuel became natural gas, which was said to be cleaner in comparison to coal. Imports swamped in and Russian supplies the cheapest and most readily available through the already existing pipelines met most of the demand. This choice, as it is observed in analysis, also became entangled with the increasing reliance of Russia, as Germany increasingly relied on gas, without shifting more to the baseload potential of nuclear power (Gleißner & Follert, 2022; Schneider, 2025).

Certain flaws were also undercover. The infrastructure was vastly east-west: pipelines such as Brotherhood, Yamal and Nord Stream to run Russian flows, with some little capacity to go reverse or north-south interconnectors. LNG terminals? Practically none before 2022, Germany lacked the capacity of regasification, as did Spain or the United Kingdom. Stocks were frequently low going into winters, in part due to Gazprom-controlled plants in Germany being underfilled in late 2021, which is an early indication of weaponization (Gritz & Wolff, 2023; Hartvig et al., 2024).

Such structural weaknesses made dependency to be weak. This lack of LNG flexibility in the globe resulted in Russian pipeline gas not being readily substituted in the short-term. The transit risks via Ukraine gave an upper hand to Moscow. And politically, the Wandel durch Handel spirit underestimated warnings bureaucracy and industry pressures and complacency with the status quo at the expense of options such as domestic fracking (prohibited) or closer Norwegian /US relations (Blumenau, 2022).

In short, the exposure of Germany in the pre-war period was not by chance; it was a result of taking affordable and expansionary decisions. But it exited the nation and with it, Europe was left in a highly vulnerable state by the time Russia switched the taps.

The 2022 Distribution: Invasion vs Gas Weapnization

The crisis came in, with a bit of shock, and shattered the balance in the European energy situation. Full-scale invasion of Ukraine by Russia on 24 February 2022 added a simmering conflict to an open war, turning energy relationships into the liabilities of the geopolitics at once and reducing energy resources to a pure economic asset. This was followed by a premeditated process of gas weaponization, diminished flows, altered maintenance, and eventual cut-offs which revealed how much vulnerabilities were deeply embedded over decades (Falkner, 2023).

The events elapsed with spooky accuracy. Tensions in the build-up towards an invasion were already tense: Russia had concentrated its forces on the border of Ukraine and Nord Stream 2 was not certified by Germany on 22 February in reaction to its recognition of separatist territories. But the invasion per se opened up immediate effects. Gazprom started to reduce supply in the already existing pipes in their claims of technical problems or contractual differences. By spring the flows through Nord Stream 1 were down to sporadic trickles as compared to full capacity (Czerny, 2023; Schreurs, 2023).

The mentioned details of the precarious structure before the crisis state Gazprom-controlled European gas storage that approached historic lows, about 25 % of total capacity continent-wide in March 2022; some Russian-owned facilities were as low as 13 %. This was not by accident; analysts had generally interpreted it as leverage whereby Europe would be in a weak position come winter time as the prices of the product were on the rise (Papaioannou et al., 2024).

In summer of 2022, the situation escalated. In June, the Russian government cut Nord Stream 1 throughput of the gas to 40% of its capacity due to maintenance reasons, this maintenance pressure exacerbated by a component under Canadian sanctions awaiting clearance. By July, it had grown down to 20%. This was preceded by an interim closure in the month of August under the pretext of carrying out maintenance works, then the temporary discontinuation of the pipeline in the month of September which was pretextively attributed to issues of leakage but which was generally perceived as a way of reciprocating the Western sanctions. The crisis reached its height on 26 September 2022 with underwater explosions destroying the other 3 out of 4 lines on Nord Stream 1 and 2 in the Baltic Sea. It was based on investigations that the incidents were caused by sabotage, although attribution has been debated; the ensuing functionality loss made the pipelines useless and reflected a resounding attack on energy security (Jong, 2023; Sanderson et al., 2023).

The consequences of this went beyond the Nord Stream system. The transit through Ukraine, which is a loss point, together with the Yamal Kazan grouping management, which travels through Belarus and Poland, slowed down as part of the wider disruption approach and sanctions framework of the war. By late 2022 Russian pipeline gas destined to Europe had plummeted to several times less than the estimated 150 billion cubic metres per annum of export before the war.

Geopolitically, the interference changed the face of Europe. The Eastern neighbours Poland and the Baltic states who have been long worried about the power of Russia felt reaffirmed to their position. The invasion seen a concerted EU sanction regime, but the relationship in energy areas created rifts. Hungary and other nationalities refused overall embargoes. In the case of Germany, the shock triggered the iconic zeitenwende speech of the chancellor, Olaf Scholz, on 27 February 2022, a turning-point speech, which was used to describe the defence, energy policy, and leadership with Ukraine. This speech marked the end of passive dependence on cheap Russian gas which was the basis of not only industrial activity but also a miscalculated foreign-policy (Mihr & Pierobon, 2023; Spohr, 2023).

The 2025-2026 time perspective provides the strategic disuse of pipeline disruption, which was effective in the short term but counter-productive on a long-term basis. By the end of 2024, Russian pipeline exports to Europe had failed and Ukraine transit lost its flow by 1 January 2025 which cemented almost zero direct flows to 2026. Limited supplies of residual TurkStream operations keep supplying some volumes to southeastern Europe though German imports effectively stop. The crisis caused such a quick adjustment, however, at the cost of short-term havoc: economic blocks tightened their belts, households got ready to voltage irregularities, and the continent coped with the inequality of its previously assumed energy interdependence (Güntner et al., 2024; Zhou & Månberger, 2024).

Overall, it was not just a supply shock of 2022, but this marked the beginning of the collapse of the Europeans post-cold War energy order, which revealed that natural gas is now a hybrid warfare tool.

Immediate Response: Crisis Management and Infrastructure Pivot

With the sudden weaponization of the gas supplies in 2022 confronted, Germany staged its own response that was more than remarkable, a mixture of emergency firefighting and huge spending by the state as well as hastened constructs of infrastructure that had averted worst case scenarios of blackouts and industrial collapse. It was not classy, there were politically harsh choices like the re-opening of coal plants and the lengthening of nuclear plants. However, it was successful, which allowed it to have more time to make systemic changes and was very flexible in crises (Co et al., 2020; Jirušek, 2023).

Crisis playbook was implemented almost instantly. When flows became low in March 2022, and storage levels were low, Germany turned on its national gas emergency mechanism, which peaked to alert and reached the emergency level in June. This prompted concerted action: compulsory fill-up quotas on storage (to 90-95% in November), demand-rationing priorities (saving households in terms of industry where needed), and conservation propaganda. Lights turned off in the public, water was cooled in swimming pools, and the industries were encouraged or required to reduce their use (Rickert et al., 2022).

One of the notable accomplishments was the fast replacement of the storage. Still, facilities were filled at more than 95 % to the first crisis winter, from dangerously low levels in spring 2022. Conservation also achieved much: Germany cut gas use by 19.4 00:100 of August 2022 through January 2023 which exceeds the voluntary 15 00:100 goal in the EU. This was the result of a combination of voluntary efficiency policies (e.g., better insulation, reduced thermostats) and the structural changes, i.e. fuel switching in generation. The economic rescue was enormous and rapid. The government unleashed subsidies, price caps as well as tax relief amount of a hundred billion plus. About 10 billion euros alone rescued troubled importers like

Uniper that was nationalised when Gazprom pulled out of Gazprom Germania. Price caps allowed households and small enterprises to enjoy the full benefits of spikes, and the energy-intensive sectors obtained individual relief to avoid offshoring (Grubb et al., 2022; Weber et al., 2023).

Diversification came to be the mantra on the supply side. Norway also increased its speed in pipeline deliveries, and became the leading supplier in Germany in a matter of days. LNG resulted in United States being a savior through exports driving up to Europe. Nonetheless, Germany had no sufficient import capacity because there are no onshore LNG terminals until 2022. The remedy was to have floating storage and regasification units (FSRUs) i.e. marine platforms that liquefy and regasify gas. The turnaround was also astoundingly fast. Wilhelmshaven docked the first FSRU in December 2022 and it came into operation in a few months. This was succeeding by units at Lubmin, Brunsbuettel and a second unit at Wilhelmshaven. Four had gone online by mid-2023; it was planned to scale to commercial operation by the second half of 2025 and Wilhelmshaven 2 opened anti-in-the-second with the the increase of capacity (Durakovic et al., 2022). By 2025, Germany had five such terminals (mostly FSRU) and the overall regasification was estimated to be about 20-25 bcm per year- enough to supply a large part of diminished demand. Other projects, including Stade onshore, were pushed to 2026 but the fleet was found sufficient. Temporary bridges were used to fill the gaps: coal plants (to be phased out) were turned on or put on stand-by to increase output. The remaining three nuclear plants, which are to be closed in 2022, were extended to 2023. These actions attracted criticism due to emission increments but were a priority to guarantee security (Cachorro et al., 2019; Glynos & Scharf, 2024).

These reactions entrenched resilience since the beginning of 2026. The last loss of significant Russian pipeline routes took place at the end of Ukraine transit on January 1, 2025, but Germany began the 2025/2026 heating season calmly even at lower storage levels (75-80% in November 2025) on normalized markets without the effect of scarcity. Now, LNG terminals are operating with diversification of the imports of U.S., Qatar, and Norway. There were also no significant deficits, although the situation in the world remained tight (Güntner et al., 2024). The work was not cheap, infrastructure costs billions of dollars alone and is a creation of Government subsidies. However, it changed Germany to become the weakest member of Europe to a more balanced importer and the flexibility of LNG acted as a buffer. It was not a sustainability-oriented phase but a survival mode that took a pragmatic approach to having the legacy and new solutions to survive the storm.

Short Term Consequences: Economics Pain and Geopolitical fallout

The short-term effect of the gas disruptions of 2022 affected Germany the way a slow-motion economic earthquake produces its ripples, triggering perturbations which initially caused price instability and then flowed into the sphere of inflation, industrial stress, and the social anxieties, on the whole. Although the crisis-management solutions helped to prevent disastrous shortages, the short-term expenses were very high, thus, showing how deeply energy prices have become entangled into the sea of a modern industrial society. In the perspective of early 2026, when markets have stabilised to a large degree and Russian supplies have moved to the background of history, any leftover discomfort would be manifested in the form of stunted growth pathways and the competitiveness debate, despite the absence of an actual recession ("Global Economic Prospects, January 2025," 2025; Hourcade et al., 2018; Zhou & Månberger, 2024).

Price dynamics were affected the most viscously. Before the conflict, the European benchmark TTF gas was trading at about 2030 EUR /MWh. The escalation of hostilities caused a drastic spiral: max prices had topped 300 EUR / MWh in summer 2022, and the average had doubled (or in many months more) compared to 2021 levels. Extreme scenarios were included into forecast models, which stated that a price spike of 200 to 700 %would happen in the event that there were full supply disruptions. Even though a total embargo was not realized instantly, the restricted supply, i.e. throttling, generated similar havoc. The trends were

reflected in wholesale electricity prices, with marginal prices that were accounted by gas consuming about 30% in the time preceding the crisis (Zhou et al., 2025).

Table 3: ***Approximate TTF Natural Gas Prices (EUR/MWh, Monthly Averages 2021-2025)***

Year/Month Range	Avg Price (EUR/MWh)	Notes
2021 (pre-war)	~20-50	Stable baseline
2022 Peak (Aug)	~200-300	Crisis highs
2023 Aug	~40-80	Volatile decline
2024 Aug	~30-40	Normalization
2025 Aug (to Dec)	~27-31	Lingering elevation

The resulting spikes went on to multiply household spending which rose to over twice or even three times at the outset but this was later put in check by subsidies, small and medium-sized businesses faced higher prices, 27 % or higher, right at the beginning. The inflationary pressure escalated, and the main situation on this is created, in large part, by a stark increase in energy prices, which helped in causing the high levels of inflation in Germany in 2022, which was more than 8. Such dynamics had the greatest negative impacts on energy-intensive sectors including the chemical sector, as an example of BASF reducing its production due to them, metallurgy, glass manufacture, and fertilizer production. As a result, there was idling of several of the plants, reduction in shifts, and media was awash with the idea of deindustrialisation. The modeled thesis showed a scenario of 0.9 to 6 contraction of GDP in extreme cases; the actual economic drag was much keener, around 23% in 2022-2023, due to lower output and the need to operate in an uncertain environment. However, the German industries chose to base investments in other countries, which undermined their competitiveness in exports.

Geopolitically, the crisis challenged the union of the European Union. The phenomenon of energy poverty has presented families with the impossible high price of heating their homes, which triggered massive demonstrations and opposition among the population, with wins by right-wing groups in certain areas. Solidarity was a tense relationship: the either end of the process was the provision of vast subsidies by wealthier member states, especially Germany, the eastern member states sought more strict embargoes. It was the REPowerEU initiative which aimed to unify energy diversification strategies but disagreements over the prolongation of nuclear and coal energy utilization threw light on intra-EU faults. Globally, the rivalry of liquefied natural gas (LNG) made alliances complicated; the outbidding of the Asian markets by Europe caused some ethical issues.

As the crisis recession near its end, there are still residual effects of the crisis, despite no acute shortages that have marred winters between 2023 and 2025. Storage capabilities have been consistently applied and demand has been about 20% lower than in 2021, both of which have been ascribed to efficiency gains in structures and relatively gentle weather conditions. The market price stabilised at an approximate of 28-31 EUR per megawatt hour by the end of 2025 but is still high in comparison to before the year 2021, and this will squeeze the profit margins of companies. By 2025, the economy can be characterized as stagnant, with its growth forecasted to be almost zero; lack of energy affordability is reported as one of the main reasons supporting poor industrial production and tendency to outsource manufacturing facilities. However, resiliency came to pass: no massive blackouts were observed, the inflation rates dropped to about 21% in 2025, and the European Union diversified the sources of energy imports.

Table 4: Germany's Natural Gas Import Sources (Approximate Shares)

Source	2021 (%)	2025 (%)
Russia	~55	~0 (pipeline; minimal indirect LNG)
Norway	~20-25	~45-50
US (LNG)	<10	~25-30
Qatar/Other LNG	<10	~20-25
Netherlands	~15	~5-10

Considering the development, the short-term effects were combined with unavoidable shrinkage of economies and social tension but these alas were partly alleviated with prompt interventions. The crisis amplified existing inequalities and, at the same time, created a driving force, which, in turn, formed a prototype and a warning example of energy processes in controversial geo-political space.

Unintended Positives: Acceleration towards Resilience

With the 2022 energy crisis undisputed adversities, a fortuitous note was found on a forced acceleration toward increased efficiency and renewable integration which would not have become as prevalent as it became without those perturbations. The sudden shock cuts acted as hypothetical shock therapy, driving behavioural reactions, industrial responses, and policy desperation which happened conveniently in line with Germany's long-term Energiewende plans. Despite the transition causing much suffering, these beneficial effects have shown to be exceptionally long-lasting to the year 2026, turning a geopolitical weakness into a force of resilience (Beck et al., 2025).

The most important of these changes was a structural decrease in the demand of natural gas. Pre-crisis consumption remained at a baseline of about 90-100 bn cubic metres per year (the maximum is 2021). This is because the invasion led to immediate cuts of 19.4% in the crucial 2022-2023 as an isolated effect, exceeding EU targets. But instead of recovering to its full extent as prices fell, demand remained at continually low levels of around 18-21% below 2021 levels in 2024 and 2025, stimulated by efficiency gains, fuel replacement and dampened industrial activity (Ziółkowski & Gański, 2023). The households used more intensive insulation, industries streamlined operations (e.g. heat recovery in chemical production), and power generation shifted in favour of no longer using gas. This new normal will be sustained by the late 2025s when gas forms less than 20% of primary energy the shift in terms of import demand and insensitivity to international dysfunction is irreversible (Sørensen & Cappelletti, 2023; Zhou et al., 2025).

The sudden downward trend left an opportunity to the growing of renewable energy significantly. It was ambitious and prescriptive because Germany had a pre-crisis goal of 80% of renewable electricity by 2030. This emergency increased development; overall electricity generation in 2021 was about 40-45% of renewable power, and in 2025 it was almost 56%. It was the result of a strong growth of solar capacity - record additions - and a strong and stable wind sector that reduced weather variability. There was initial data on 2025 which shows that during the third quarter renewables contributed approximately two-thirds of the governmental electricity generation. This change, in turn, was mainly fueled by expedited permitting in the framework of the so-called Easter Package-related reforms, specific subsidies on rooftop photovoltaics, and crisis-related investments in the grid system and storage (Kou et al., 2025; Vasylieva et al., 2025).

Greenhouse gas emissions also enjoyed the gains. Compared to 1990 levels (~1,252 Mt CO 2eq), the targets were 48% less in the year 2024 (approximately 649 Mt). Predicting, it is expected that further downfalls

will happen by early 2025, and this will be associated with the lesser dependence on fossil fuels. Emission peaks in the short-term due to a temporary increase in coal and nuclear power use following the crisis, but the overall impact was to push the decarbonisation agenda further than had been predicted prior to the crisis (Glynos & Scharf, 2024). The capture of the witnessed dynamics as conceptualisation of the crisis as shock therapy captures the dynamics of abrupt price rise and scarcity resulting in sudden innovations that could otherwise have been slow among market forces. Industrial participants enhanced electrification of their operations and early-stage hydrogen demonstrations and the general idea of energy efficiency became popularized. On the European level, this momentum was further accelerated through the REPowerEU initiative but the scale of Germany put the initiative in an authoritative proving ground in large-scale deployment (Schiffer et al., 2022). However, the advantages were not equally shared and energy-consuming companies suffered the greatest losses and not every cost reduction was the outcome of voluntary decisions. Considering the viewpoint of 2026, the crisis unintentionally bridged the gaps in the Energiewende, proving that the need can lead to the energy transition innovation. This case highlights a larger thesis in the sense that, policy disturbances have two-fold results, with short-term negative impacts that can eventually precipitate sustainability of benefits in the long term (Regenfelder et al., 2025; Yang, 2022).

CONCLUSION

The history of Germany which includes reliance on Russian energy: a decade after decade of pragmatic alliances is a typical example of the vulnerability of international relationships: excessive dependence on one, geo-politically uncertain supplier. The present analysis indicates that, as of 2021, Russia was supplying over 55% of natural gas in Germany, along with overwhelming quotas of oil and coal, thus contributing to the impact of the 2022 Ukranian invasion. Weaponization of supplies involved in the invasion crippled flows, controlled storage, and the sensational sabotage of the Nord cluster pipeline brought these dependencies to the forefront and interfered with supply and prices on the scale to cause economic instability (Bargujara et al., 2024).

The key question of the research is the following one: How did Germany become historically energy dependent on Russia and revealed its vulnerabilities, which were revealed during the war in Ukraine and what were the short-term economic and geopolitical implications of the consequent gas cut-offs? The results can be classified into two major categories (Moll et al., 2023). To begin with, these interdependencies increased susceptibility by giving preference to short term economic benefits in terms of obtaining cheap industrial fuel at the cost of diversification alongside the infrastructural biases and the post-Fukushima nuclear phase-out. Second, when cut-offs were realized, the short-term impacts were acute, in the form of price hikes of up to 200Ps, strong inflationary forces, shrinkage of industrial production in major industries like chemicals and metallurgy, and a real GDP decline of between 1 and 3%, which is much less than the doom-mongering 6% opinion. On a geopolitical level, the crisis weakened the unity of the European Union, increased the possibilities of energy poverty, and changed the setups of the alliance, eventually leading to the designation of the era as a Zeitenwende by the Scholz administration (Bunde, 2025).

However, the short-term aftermath was containable, as timely responses, fast LNG constructions, over-and-above set-ups and diversification going to both Norway and the United States brewed up blackouts and recession in its entirety. These measures won important breathing room as of January 2026, when Russian pipeline imports will be at zero and winter seasons will be calm of crisis. Some silver linings appeared: a sustained decrease in demand of about 20% that compared to 2021 rates, an increase in the renewable output to about 56% of the electric power generation in 2025, and emissions cuts of about 50% compared to 1990 levels. The crisis provided some kind of a shock therapy forcing efficiency and investments that moved Energiewende faster than the pre-war speeds (Beck et al., 2025; Schill et al., 2025).

Consistent with the Energy Security Theory, by resulting in interdependence of four pillars, the episode anticipates the resilience as a dynamic fifth dimension: not static availability, but the ability to adapt to the shocks. It criticizes the lay beliefs of interdependence, showing how economic relationships can encourage dominance instead of stopping it (Chen & Ryoo, 2026).

The existing gaps in future research reflect the hypothesis: subtle analyses on long-term effects of LNG on methane emissions, disparities in socio-economic factors witnessed in different regions because of the change, and how policy attitudes change and become policy acceptance. These insights could be deepened by comparing them with the experience of less-dependent EU states or other countries of the world, including the post Fukushima direction of Japan. Looking back almost four years, the crisis revealed structural weaknesses in the energy policy of Germany (and therefore, the European Union, via Germany) which is based on complacency created over decades of seemingly stable Russian imports. It also showed great flexibility: the country that was most susceptible previously becomes more resilient, with the diversified sources and green bases. In a geopolitical age of volatility, this epic serves as a reminder that nothing is really secure in the world other than a pretension of reliance in the guise of cooperation but rather malleable, self-sustaining self-sufficiency. The shock of the wake-up call came with a high price, but it can possibly become a revolutionary spark.

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