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Evolution of Gas Prices - From the Start of the War in Ukraine to Today

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Abstract. *This article scrutinises the volatility that has characterised European natural-gas prices in recent years, situating these fluctuations within the broader canvas of energy security and macroeconomic governance across the Union. Grounded in an exhaustive appraisal of specialised scholarship, the investigation interweaves qualitative interpretation with statistical examination of peer-reviewed data sets, thereby illuminating the constellation of geopolitical frictions, market imperfections and infrastructural rigidities that configure contemporary supply trajectories. The analysis reveals a pronounced synchronicity between price turbulence and diplomatic tensions affecting transit corridors from the Russian Federation, a dynamic that exposes latent systemic fragilities in member states whose import portfolios remain highly concentrated. Diversification initiatives—spanning liquefied-natural-gas terminals, interconnector upgrades and expanded strategic stockpiles—have softened short-term shocks yet have not yielded durable price convergence. A lasting recalibration appears contingent upon an accelerated incorporation of renewable sources, a shift expected to temper exposure to exogenous disturbances while sharpening the Union's competitive stance within an increasingly decarbonised global economy. By tracing the intricate interplay of regulatory design, market behaviour and geostrategic contention, the study enriches ongoing debates and furnishes a textured analytical template for policy architects and future empirical inquiry.*

Keywords: energy, gas-market instability, EU energy market, renewable energy transition, energy policies, decarbonisation, market resilience.

Introduction

Global energy provision remains anchored in the oil-and-gas sector, a foundation that underwrites both economic trajectories and the balance of geopolitical relations. In recent years the market environment has grown markedly turbulent, a tendency sharpened by the military confrontation unfolding in Ukraine.

This escalation has magnified the intrinsic variability of hydrocarbon prices and has obliged analysts to refine their grasp of the forces governing trade in crude and natural gas (Narayan 2007; Kang & Yoon 2009). Interruptions along pivotal transit corridors and contractual deliveries emerging from the conflict have exposed persistent structural weaknesses in the European Union's supply architecture, propelling natural-gas quotations to unprecedented heights. Empirical investigations by Zeitgespräch (2022) and Aliu et al. (2023) demonstrate that the episode laid bare a pronounced dependence on imports originating in the Russian Federation, a vulnerability intensified by the rigidity of long-term contracts and by the restricted latitude for diversification embedded in current infrastructure (Gedich 2017).

Although the COVID-19 pandemic unsettled commodity flows and altered demand profiles, its imprint on gas pricing pales beside the systemic reverberations triggered by the Russian-Ukrainian hostilities. Contemporary scholarship, exemplified by Umar et al. (2022), records an accelerated deployment of renewable capacity and stresses the necessity of more comprehensive strategies of energy governance. Against this backdrop, the present article scrutinises the repercussions of the war for intra-European price dynamics and supply security,

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situating the analysis at the confluence of geopolitical, economic and regulatory vectors while delineating pathways intended to curtail import reliance and reinforce long-term resilience.

Literature review

Energy has long served as a principal axis of geopolitical negotiation, and the sequence of shocks that began with the COVID-19 recession and intensified after Russia's incursion into Ukraine has placed European supply security at the forefront of policy deliberation.

The prevailing consensus in the literature holds that a durable response demands both diversification of external sources and a gradual retreat from household, industrial, and power-sector dependence on unabated fossil fuels. Within this debate, Jääskeläinen et al. (2018) trace Finland's historical reliance on Russian gas and, through scenario analysis to 2040, show that even apparently stable import relationships harbour latent vulnerabilities once social or political trajectories veer unexpectedly. Their findings resonate with the broader European experience, where decades of contractual lock-in have curbed the Union's capacity to shift volumes rapidly toward alternative suppliers.

The Nord Stream 2 project, conceived to move additional Russian gas directly to German markets, illustrates the tension between commercial opportunity and strategic exposure. Zhiznin and Timokhov (2019) argue that the pipeline once promised a dual dividend of price moderation and reduced military friction in the Baltic region; the war, however, ruptured that calculus and revealed the weight of geopolitical variables in infrastructure planning. Recent scholarship has therefore turned to the anatomy of risk itself. Zhu et al. (2022) construct a two-dimensional assessment that links supplier characteristics with the quality of importer–exporter interactions, demonstrating how mismatched contractual and logistical arrangements amplify supply-chain fragility when shocks arise. Historical studies illuminate the persistence of these dynamics. Lee (2017) attributes the 2009 gas dispute between Moscow and Kyiv to the compound effects of the 2008 financial contraction and a discernible shift in Ukrainian foreign policy, while Gedich (2017) shows that, even as late as 2015, Russian molecules retained a forty-two-percent share of European consumption despite intensifying competition and regulatory reform. Subsequent analyses explore the geographical logic of alternative corridors. Jafarzadeh et al. (2021) position Turkey as the indispensable hinge in the Southern Gas Corridor, yet Dubský et al. (2021) caution that economic metrics and political alignments narrow the universe of viable pipeline investments to a handful of projects that rarely satisfy every stakeholder.

The structural outcome is an oligopolistic marketplace embedded in an increasingly globalised trading system, where the European Union imports close to three-quarters of its gas and a significant share of its oil. Elustu (2021) links that dependence to long-run variations in growth, underscoring the premium that diversification commands in any strategy aimed at macroeconomic resilience. Viewed through the lens of the knowledge-based economy first articulated by Drucker (1993), contemporary energy policy cannot be disentangled from innovation systems: technological progress shapes both the efficiency with which resources are used and the pace at which renewables displace carbon-intensive fuels. Together, these lines of enquiry furnish a composite understanding of supply risk, geopolitical leverage, and the levers available to European decision-makers as they navigate a fluid and often turbulent energy landscape.

The role of the knowledge economy in the energy sector

Contemporary scholarship treats the knowledge-based economy as a paradigmatic realignment in which intellectual capital displaces material endowments as the prime engine of growth and innovation, recasting production and resource use through a lens that foregrounds learning, creativity and technological refinement (Dincă et al., 2010). Building on this perspective, Dincă (2013) shows that systematic practices of knowledge management and economic intelligence furnish firms with heightened adaptive capacity, since sophisticated analytic architectures permit rapid recalibration to shifting competitive conditions across an increasingly fluid world market. Under the combined pressure of global integration and accelerating technological breakthroughs, national systems confront a threefold task: generating relevant knowledge, assimilating external advances and circulating insights throughout the economy—a task that in turn requires institutional, infrastructural and educational transformation. Brătianu and Dincă (2010) conceptualise these adjustments as the economic and institutional regime, the skills base, the information-and-communications backbone and the innovation ecosystem; the World Bank Institute later operationalised this framework through the Knowledge Economy Index, a composite indicator that gauges a jurisdiction's readiness for such a transition.

Dincă (2013) characterises the underlying shift as a knowledge revolution, marking a departure from an industrial logic bounded by physical scarcity toward a domain in which ideas are reproducible at negligible marginal cost. Within this milieu, intellectual assets and human capital require deliberate stewardship, since they constitute renewable sources of value creation and durable competitive advantage. Educational policy emerges as a critical vector of adjustment. Evidence from Japan, where firms, universities and research institutes cooperate seamlessly, illustrates how curricula tuned to frontier technologies accelerate the circulation of expertise and foster an environment of continuous learning that matches the tempo of the global economy. A robust digital infrastructure reinforces these interactions by enabling high-bandwidth communication and distributed collaboration, thereby supporting the iterative refinement of products, processes and business models (Brătianu & Dincă, 2010).

Energy studies supply a concrete demonstration of these dynamics. Elustu (2021) links progress in research and development to the diversification of supply portfolios and the modernisation of grids; smart-network architectures now balance loads more efficiently and curtail technical losses, thereby strengthening both consumption optimisation and supply security. Concurrent improvements in wind-turbine design and photovoltaic manufacturing have driven steep cost reductions, hastening the displacement of carbon-intensive fuels. Zhu et al. (2022) argue that such advances, coupled with circular-economy principles embedded along supply chains, diminish external vulnerability and lay the groundwork for a resilient, low-carbon energy system..

The impact of knowledge on energy security

Jääskeläinen et al. (2018) emphasize that the use of prospective scenarios based on the analysis of historical and econometric data allows governments to develop more robust strategies to address risks. Similarly, Lee and Strazicich (2003) used advanced unit root testing methods to analyze long-term trends in energy prices, providing valuable insights into market developments. In a context marked by crises such as the COVID-19 pandemic and the war in Ukraine, the knowledge-based economy allows for quicker adaptation to changes. Kang and Yoon's study (2009) demonstrates that advanced forecasting models, such as GARCH, can be used to anticipate price volatility and plan mitigation measures.

Diversification and transition to renewables

Technological advances in gas liquefaction and seaborne logistics have altered the competitive geometry of Europe's market by loosening the grip of fixed-route pipelines and widening the spectrum of potential suppliers (Gedich 2017). Analyses grounded in game-theoretic reasoning reveal an emergent strategic calculus in which regional coalitions exploit shared knowledge to refine routing choices and strengthen their leverage during price formation (Jafarzadeh et al. 2021). Predictive models that weave macro-economic signals with geopolitical mapping extend this insight, demonstrating how anticipatory analytics sharpen the framing of regulatory initiatives and investment priorities (Narayan 2007).

Even so, the present architecture retains significant blind spots. Heavy reliance on retrospective data sets, alongside modelling routines ill-suited to low-probability upheavals, constrains the capacity to detect sudden market inflections. Political veto points and fiscal asymmetries within the Union further inhibit the rollout of alternative infrastructure, a limitation that Dubský et al. (2021) trace to divergent national incentives. Methodological renewal that embeds machine-learning algorithms and heterogeneous, real-time data streams into existing toolkits promises a deeper grasp of the interdependencies linking price trajectories, supply security and decarbonisation goals. Realising that promise depends on dense partnerships among research institutions, private operators and public authorities, so that emergent technical insights mature into policy instruments capable of steering an increasingly intricate energy landscape..

Methodology

This investigation employs a systematic design to trace the repercussions of successive energy shocks on Europe's security of supply.

The evidence base was assembled in accordance with the PRISMA protocol, which structures every phase of identification, eligibility appraisal and inclusion; throughout that process, topical relevance, methodological integrity and temporal proximity served as principal admission touchstones. Within the resulting corpus, close textual scrutiny elucidates recurring motifs of import-dependence, supply robustness and diversification capacity, while complementary statistical synthesis illuminates the geopolitical and macro-economic reverberations that recent crises have imprinted upon continental markets. A narrative reconstruction of the PRISMA flow clarifies the logic governing each filtration step, thereby ensuring full transparency in the formation of the analytical foundation.

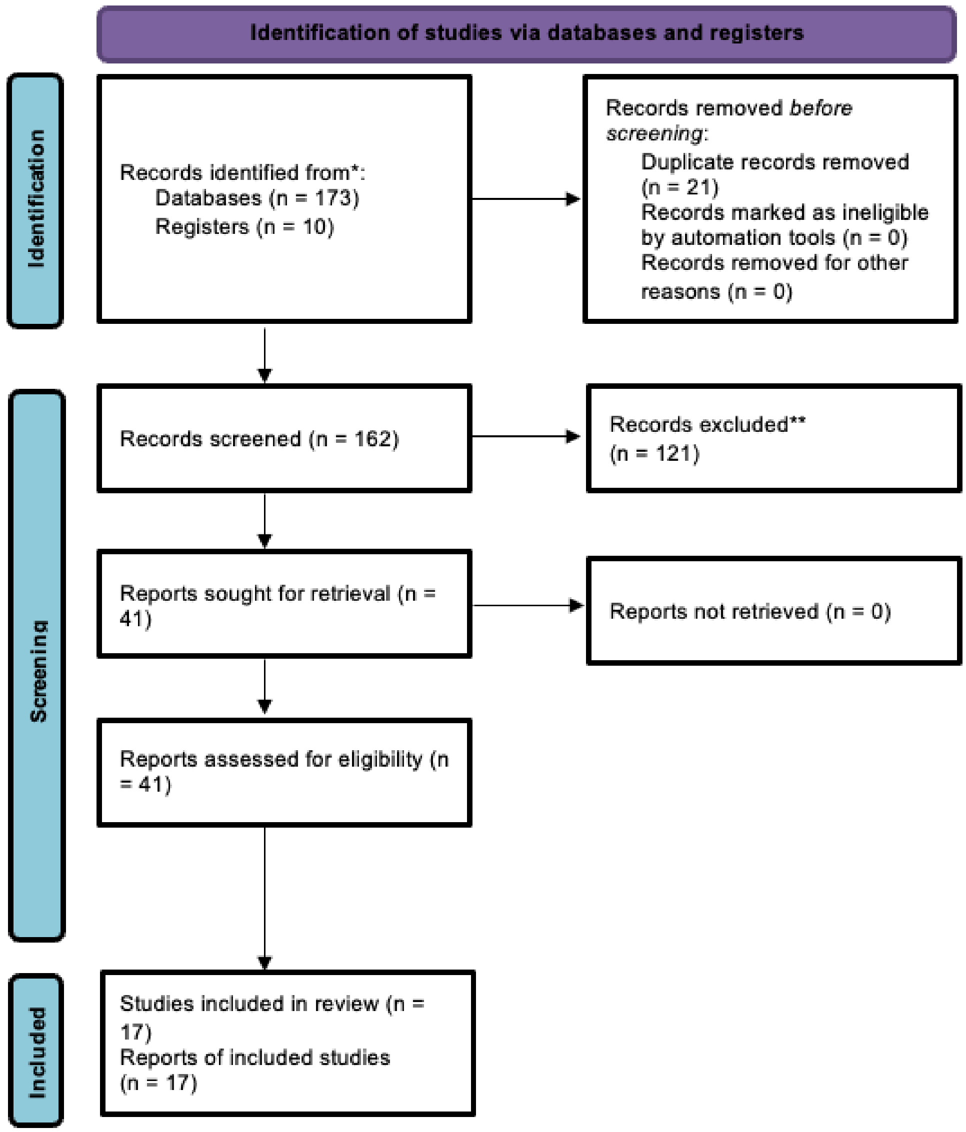

Figure 1. **PRISMA flowchart**

Results and discussion

A thorough review of recent studies, reinforced by current market data, reveals the manner in which successive shocks—the pandemic followed by Russia's incursion into Ukraine—have reshaped Europe's natural-gas landscape, with far-reaching consequences for security of supply and macroeconomic governance. Analyses by Aliu et al. (2023) and Di Bella et al. (2022) trace the steep ascent of spot and contract prices during 2022, showing how abrupt interruptions along eastern transit corridors magnified existing tightness and pushed quotations far beyond levels observed before 2020. Earlier work by Jääskeläinen et al. (2018) had already signalled the strategic fragility embedded in concentrated import portfolios; the conflict simply converted that latent exposure into an acute market reality. Gedich (2017) helps explain the rigidity that hampered adjustment, documenting the prevalence of long-term, oil-indexed contracts that slowed the redirection of flows when pipeline deliveries faltered.

The literature converges on the view that dependence on Russian molecules represents a structural vulnerability rather than a straightforward commercial arrangement. Case studies centred on Finland underscore the asymmetry in bargaining power that such reliance creates, while Zhiznin and Timokhov (2019) demonstrate how infrastructure intended to enhance reliability—Nord Stream 2 most conspicuously—ultimately deepened exposure once geopolitical conditions deteriorated. Attempts to broaden the supplier base face material obstacles. Research by Dubský et al. (2021) shows that financing, regulatory approval and divergent national interests have delayed alternative trunk lines, and game-theoretic simulations by Jafarzadeh et al. (2021) point to Ankara's pivotal position in any southern corridor, making regional stability in the eastern Mediterranean and Caucasus a precondition for durable risk mitigation. Policy interventions introduced after the first price spike illustrate both what can and cannot be achieved through market design. Measures such as price ceilings and enlarged strategic reserves, discussed by Marriott (2022) and Elustu (2021), tempered the most extreme quotations but produced uneven results across the Union, since exposure profiles differ markedly among member economies. States with diversified portfolios absorbed the shock more readily; those whose industrial models depend on pipeline gas from Russia experienced the sharpest cost pass-through. Empirical work by Sadorsky (2006) and Kang & Yoon (2009) establishes the link between such price turbulence and consumer-price inflation, a relationship confirmed when the 2022 surge in wholesale gas translated into record retail-energy bills and broader price-level acceleration. Subsequent stabilisation in 2023, facilitated by emergency procurement and demand-side adjustments, moderated inflationary pressure but left average quotes well above the pre-pandemic baseline.

Longer-term considerations dominate the forward-looking literature. Lee (2017) argues that recurrent disputes along the Ukrainian transit route underscore the strategic logic of diversification, while Zhu et al. (2022) propose a framework that embeds supply-chain risk within broader sustainability metrics. Empirical evidence now associates accelerated deployment of renewables and efficiency gains with incremental erosion of external dependence, yet the transition remains uneven and capital-intensive. Across these studies, the trajectory of the mean import price functions as a barometer of progress: its decline from the 2022 peak signals initial success in crisis management, though its persistence above historical norms reminds policymakers that structural remedies—new infrastructure, revised contract architecture and low-carbon substitution—must advance in parallel if durable resilience is to emerge.

Table 1. Natural gas price - evolution (€/MWh)

Year	Prices including taxes (€ per MWh)	Prices excluding taxes (€ per MWh)	Total taxes and duties (€ per MWh)	Annual price increase incl. taxes (%)	Annual price increase excl. taxes (%)	Annual tax increase (%)
2018	60.0	40.0	20.0	0.0	0.0	0.0
2019	60.0	40.0	20.0	0.0	0.0	0.0
2020	80.0	60.0	20.0	33.3	50.0	0.0
2021	120.0	80.0	40.0	50.0	33.3	100.0
2022	130.0	85.0	45.0	8.3	6.3	12.5
2023	120.0	80.0	40.0	-7.7	-5.9	-11.1
2024	120.0	80.0	40.0	0.0	0.0	0.0

Source: Author. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Natural_gas_price_statistics

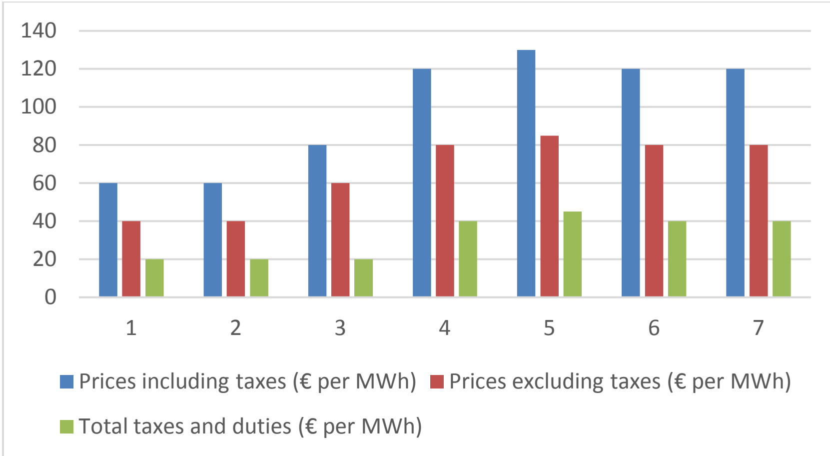

Figure 2. Natural gas price evolution 2018-2024

Source: Author.

Figure 3. Percentage growth (%)

Source: Author.

Price stability, broadly preserved up to 2019, unravelled once the pandemic froze industrial output and clipped global energy appetites. As restrictions eased and factories surged back to life, demand for natural gas rebounded faster than logistics networks could accommodate, revealing strain points in pipelines, storage parks and shipping schedules. That rebound gathered pace throughout 2021; mounting inflation and lingering doubts over future supply then propelled quotations to new peaks during 2022. Russia's assault on Ukraine deepened the turmoil, severing well-worn transit corridors and exposing the extent of Europe's dependency on eastern inflows. In reply, governments hastened portfolio-diversification schemes and accelerated investment in non-fossil technologies. These steps trimmed the crest of the price curve in 2023, yet market tension persists and remains vulnerable to fresh geopolitical or macro-financial shocks. Enhanced storage capacity and a quicker roll-out of renewable infrastructure can soften volatility, but until consumption and deliverability settle into durable alignment, natural-gas pricing will continue to serve as a sensitive gauge of both economic momentum and geopolitical risk.

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Table 2. EU gas supply and demand (bcm)

Year	Demand (bcm)	Supply (bcm)	Demand-Supply Difference (bcm)
2018	480	510	30
2019	490	520	30
2020	460	480	20
2021	500	510	10
2022	450	460	10
2023	430	440	10

Source: Author. https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Gas_Key_Developments_Q1_Q2.pdf

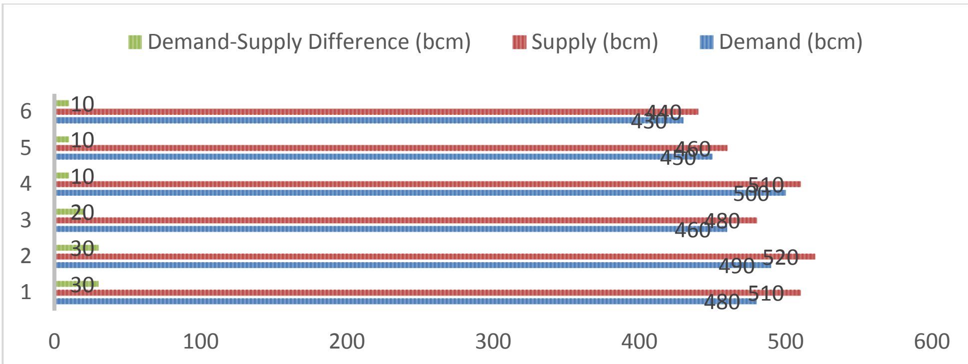

Figure 4. EU gas supply and demand

Source: Author.

Mounting procurement costs during 2022 and 2023—amplified by deliberate efficiency programmes across industry and households—dampened European appetite for natural gas, and producers responded in kind, tapering output to suit the slimmer order book. The gap between purchases and deliveries thus narrowed, signalling a tenuous equilibrium reached at markedly lower throughput. Yet this fragile balance remains shadowed by a strategic reality: the Union's heavy historical reliance on Russian flows still shapes every policy decision on storage, procurement, and long-term infrastructure finance, reminding planners that any resurgence in geopolitical friction could again unsettle a market only recently steadied.

Table 3. Share in value of extra-EU imports of natural gas from Russia

Year	Percentage of imports from outside the EU
2018	40.2%
2019	45.5%
2020	42%
2021	39.7%
2022 (Q1)	30.5%
2022 (Q2)	29%
2023 (Q1)	14.8%
2023 (Q2)	12%
2024 (Q1)	16.2%
2024 (Q2)	18%

Source: Author. https://www.statista.com/statistics/1021735/share-russian-gas-imports-eu/

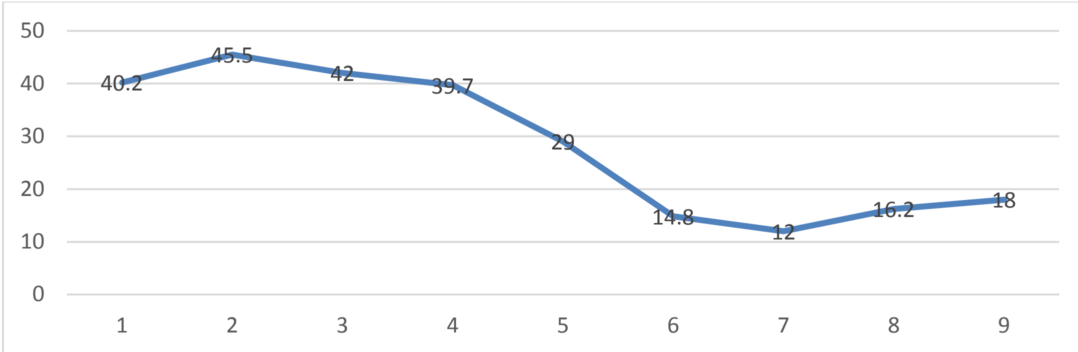

Figure 5. Share in value of extra-EU imports of natural gas from Russia

Source: Author.

In the pre-pandemic period, between 2018 and 2019, imports of natural gas from outside the EU increased significantly, rising from 40.2% in 2018 to 45.5% in 2019. This trend was mainly driven by increased energy demand, fueled by a general economic recovery and a continued dependence on external gas sources, especially from Russia. In this context, there was a steady reduction in domestic production, particularly in the Netherlands, but also a diversification of external sources, which ensured the supply of natural gas.

However, with the onset of the pandemic in 2020, energy demand was severely affected by the global imposition of restrictions, and natural gas imports from outside the EU fell to 42%. This was a moment of stagnation for the natural gas market, during which many European economies experienced a significant decrease in demand. In 2021, as the economy began to recover, imports slightly increased to 39.7%, but did not reach the peak level of 2019. This reflects a certain attempt by the European Union to improve source diversification and develop internal infrastructure to reduce dependence on imported natural gas. The year 2022 marked a radical change due to the war in Ukraine. The conflict had a major impact on the European energy market, prompting member states to quickly reduce their dependence on Russian gas. In this context, imports of natural gas from outside the EU decreased significantly, reaching 30.5% in the first quarter of the year and 29% in the second. These declines clearly reflect the EU's efforts to diversify supply sources, focusing on increasing imports of LNG from the United States and Middle Eastern states. Additionally, in 2023, imports continued to decline to a historic low of 12% in the second quarter, highlighting the EU's transition towards more diversified energy sources and a significant reduction in imports from Russia. These changes were supported by investments in renewable energy sources and the necessary infrastructure for their storage and distribution.

In 2024, imports began to rise again, reaching 16.2% in the first quarter and 18% in the second quarter. This rebound can be explained by increased seasonal demand, but also by the need to supplement natural gas stocks, against the backdrop of an expanding industrial sector and higher energy demand. However, even with these increases, imports remain much lower compared to the pre-pandemic period, reflecting a significant change in the European energy landscape.

Another significant aspect is the relationship between natural gas prices and the inflation rate.

Table 4. Gas prices vs inflation in the EU

Year	Average Natural Gas Price (€/MWh)	Inflation Rate in the EU (%)
2018	20.5	1.7
2019	22.3	1.4
2020	18.7	0.3

Year	Average Natural Gas Price (€/MWh)	Inflation Rate in the EU (%)
2021	24.6	2.6
2022	88.5	9.2
2023	75.4	7.0

Source: Author - https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2968~e514c92723.en.pdf.

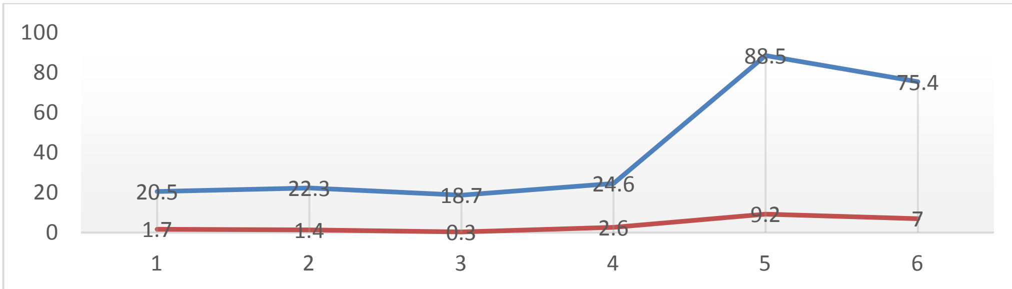

Figure 6. Gas prices vs inflation in the EU

Source: Author.

The gas prices soared during 2022, pushing household energy bills higher and lifting the wider consumer-price index across the European Union. As spot quotations retreated in 2023, headline inflation moved down in parallel, underscoring the powerful pass-through from energy costs to the general price level. Targeted fiscal and regulatory actions—among them temporary tariff ceilings and enlarged strategic storage—smoothed the adjustment, though underlying pressures remain vulnerable to renewed supply shocks.

Tabel 5. Policy impact on gas prices

Year	Policy Measure	Impact on Price (€/MWh)	Total Gas Price (€/MWh)
2020	Introduction of a price cap	-5.0	18.7
2021	Strategic gas reserves	-7.5	24.6
2022	Subsidies for households	-10.0	88.5
2023	Diversification of supply	-15.0	75.4

Source: Author. https://www.sciencedirect.com/science/article/pii/S0301421522005316

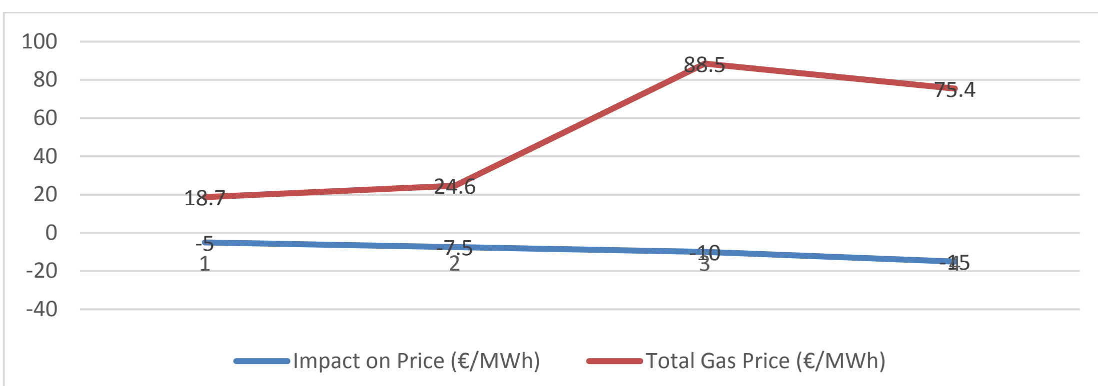

Figure 7. Policy impact on gas prices

Source: Author.

Policy measures such as price caps, the creation of strategic reserves, and the diversification of supply sources have had a significant impact on stabilizing natural gas prices. These interventions have helped reduce the burden on consumers but were insufficient to fully offset the increases in 2022.

Conclusions

Successive disruptions—the pandemic and the conflict that erupted on the Union's eastern frontier—have combined with existing market rigidities to create a volatile setting for European natural gas. Sharp price swings revealed how heavily the region still leans on Russian supply, yet the same turmoil spurred a sustained drive to diversify import routes and advance low-carbon generation. Emergency steps such as capped tariffs, enlarged strategic inventories and rapid LNG procurement cushioned households and industry but did not fully extinguish the inflationary momentum, showing that durable stability requires coordinated action across the Union rather than a patchwork of national remedies. The inquiry also brings out the close link between wholesale volatility and the macro-economic exposure of individual member states. Economies that had already invested in efficiency programmes and renewable capacity weathered the shock with less strain, underscoring the strategic value of demand-side management in any energy-security blueprint. Extending the research to include lessons drawn from non-European markets would help refine these insights for the Union's varied institutional contexts.

Finally, digital tools rooted in the knowledge economy are set to shape the sector's next phase. High-resolution telemetry, predictive modelling and advanced optimisation routines are beginning to guide dispatch and storage operations; wider adoption promises quicker responses to supply surprises and lower system costs. Coupling such analytics with transparent knowledge-sharing platforms can accelerate Europe's shift toward a more resilient, low-carbon energy architecture.

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