

GEOPOLITICAL CONFLICT AND STRUCTURAL VULNERABILITIES IN EUROPEAN UNION ENERGY SECURITY

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ABSTRACT

Energy security has become a central strategic concern for the European Union as geopolitical conflicts increasingly disrupt global energy markets. The Russia Ukraine war in 2022 showed that the EU relied on external energy suppliers for its natural gas needs which caused major price fluctuations and delivery problems throughout European markets. Before the invasion Russia supplied approximately 45 percent of EU gas imports which demonstrated the danger created by their concentrated gas supply sources. Recent Middle Eastern geopolitical conflicts which impact energy transportation routes and oil extraction operations, have created new challenges for maintaining worldwide energy transportation systems. This article studies how geopolitical conflicts show the existing weaknesses in the European Union energy security framework. The research uses institutional analysis together with actual energy market data which comes from Eurostat and the International Energy Agency as well as European Commission reports to study European energy markets through three key factors which include import dependency and supply concentration and energy price fluctuations. The research results show that the EU faces increased risk from outside geopolitical events because its member states depend heavily on foreign energy sources and maintain limited relationships with particular suppliers and need multiple governing bodies to manage their operations. The European energy system still contains basic vulnerabilities despite the development of REPowerEU which enhanced its capacity to develop diversified energy sources and strengthen its infrastructure.

Keywords: European Union, Energy Security, Geopolitical Conflict, Energy Dependence, REPowerEU

INTRODUCTION

Energy security has re emerged as the primary concern for international political economy because geopolitical conflicts and market instability and infrastructure limitations disrupt global energy systems. Modern economies require

constant access to budget-friendly energy resources because they need these resources to power industrial operations and maintain economic growth and support technological innovation. Daniel Yergin demonstrates through historical

examples that energy supply disruptions create major economic and geopolitical impacts which make energy security a vital element for national success and global peace (Yergin, 2006, pp. 70–72). Current academic research defines energy security as a multidimensional concept which includes supply availability and supply accessibility and supply cost and environmental protection (Cherp & Jewell, 2014, pp. 417–418). The European Union functions as one of the top three global regions which depends on imported energy resources. The organization relies on external suppliers to meet most of its energy needs especially for oil and natural gas which results in permanent vulnerability to shifts in worldwide energy markets (Eurostat, 2024). The European Union relies on imported energy because research shows that renewable energy generation has increased but this dependency remains a core characteristic of its energy system (Bökkerink & Prontera, 2022, pp. 237–239).

The existing structural dependencies show how European energy governance systems developed through their historical progress. National regulatory frameworks governed energy policy during most of the post-war era because member states kept control over production activities and infrastructure development and market operations. The European integration process began to establish more coordinated energy operations through the implementation of the internal energy market and cross-border infrastructure development projects. National governments maintain considerable authority to decide their country-specific energy policies. EU energy governance has developed through incremental institutional expansion according to Tobias Maltby which created a system that allows European countries to work together while maintaining their right to formulate national energy policies (Maltby 2013 pp 437441). The Energy Union research determines that EU energy policy exists as a mixed institutional system which unites supranational regulatory frameworks with ongoing member state intergovernmental discussions (Bocquillon & Maltby 2020 pp 44 46). The geopolitical developments which occur in regions that supply external resources show the effects which result from this particular structural

arrangement. The energy supply chains of Europe depend on their extensive production facilities and transportation networks and their operational corridors which extend beyond their continental borders. The networks which support these operations experience disruptions which create immediate effects on the energy supply and price stability of regions that depend on those networks. The Eastern European geopolitical conflict showed how external supply disruptions create major fluctuations in European energy markets. The International Energy Agency reported that the 2022 energy crisis which reduced Russian gas exports led to European markets experiencing their highest price increases and supply disruptions (International Energy Agency, 2023, pp. 45–49). The EU natural gas market depended on Russian exports before the crisis occurred which created a supply risk for European countries that depended on this concentrated source (Kuzemko et al., 2022, pp. 2–4).

The global energy governance system creates additional challenges for these existing relationships. Energy markets function through decentralized institutional systems which include state authorities and multinational companies and global organizations. The European Union operates as a regulatory body in this system because it can establish market regulations yet remains vulnerable to international political events (Goldthau & Sitter, 2015, pp. 18–22). The interdependence between different institutional frameworks together with their overlapping systems creates two separate forces which determine how stable worldwide energy networks will operate (Van de Graaf & Colgan, 2016, pp. 3–6; Van de Graaf & Sovacool, 2020, pp. 24–26). The recent geopolitical conflicts have shown the fundamental dependencies which exist in European energy systems, leading to the development of REPowerEU initiatives which aim to build resilience and decrease external dependency (Jerzyniak, 2024, pp. 6–8; European Commission, 2022).

Research Problem

The European Union has introduced several policy initiatives that aim to improve energy security while decreasing dependence on external

energy sources. The Energy Union strategy together with the REPowerEU plan establishes frameworks which focus on two main objectives: increasing supply sources and developing renewable energy systems and creating unified European energy markets (European Commission, 2022). The current initiatives serve as part of a larger effort to build stronger resilience systems which began after recent geopolitical events disrupted global energy supply chains. The European energy system still has structural weaknesses which create permanent vulnerabilities. The EU maintains its reliance on imported fossil fuels despite policy initiatives that seek to speed up the energy transition process because this dependence makes its energy markets vulnerable to geopolitical threats originating from supplier countries and transit routes (Eurostat, 2024; Bökkerink & Prontera, 2022, pp. 238-239). Existing scholarship delivers essential knowledge about all aspects of the current problem. The research on European energy governance demonstrates how institutional coordination and regulatory integration together with policy entrepreneurship determine EU energy strategy development (Konopelko, 2023, pp. 4-6; Bocquillon & Maltby, 2020, pp. 44-46). The field of international political economy shows how countries that depend on imported energy resources face strategic risks because of their unequal energy interdependence (Goldthau & Sitter, 2015, pp. 87-92). Scholars conduct separate studies of these research areas. The existing research about European energy security has not achieved proper analysis of how geopolitical conflict interacts with fundamental elements of EU energy governance.

Research Question

To what extent do geopolitical conflicts in external energy-producing regions expose structural vulnerabilities in the European Union's energy security system?

Literature Review

Energy Security and European Integration

Energy policy has been closely linked to the broader trajectory of European integration since the post-war period. The initial partnerships which

focused on coal and nuclear resource development established the understanding that countries needed stable energy supplies to achieve economic recovery and industrial progress. European nations expanded their partnerships to include market integration and infrastructure linkages and the advancement of renewable energy technologies. The expansion of energy governance institutions in Europe demonstrates the shift from national energy regulation to a system that combines national and supranational elements.

European Union governance functions through a system that has developed through multiple historical periods. The energy policy framework operates through a system, which includes national governments, EU institutions, regulatory agencies, and private market actors, that functions at multiple institutional levels. Member states maintain their domestic energy strategy control because the European Commission supports both market liberalization and regulatory unification. Maltby (2013, pp. 440-441) points out that EU energy governance operates through a system that combines international coordination with national governments retaining their policy-making powers. Bocquillon and Maltby (2020, pp. 44-46) reach the same findings, which they describe as the Energy Union framework representing "embedded intergovernmentalism" because EU institutions manage policy development while member states maintain primary power over execution.

Earlier scholarship focused on studying the fundamental difficulties which arise from uniting energy systems that developed through historical periods of national fragmentation. Helm (2002, p. 175) explained that different national market systems together with their varying regulatory frameworks created major difficulties which prevented the development of a complete unified European energy market. The new policy changes which included market liberalization rules and cross-border infrastructure projects aimed to remove existing limitations by creating better competitive conditions which would enable member states to share their energy resources more easily. According to research about these reforms, market integration has led to better market performance together with increased

system flexibility, yet different countries still maintain their distinctive energy resource systems and infrastructural capabilities (Ringel & Knodt, 2018, pp. 211–213).

The current governance system has changed its approach to energy security which now includes more than just supply protection measures. Energy security today needs to be understood as a combination of three elements according to current research which includes both resource availability and system reliability and cost efficiency and environmental protection. Cherp and Jewell (2014, pp. 417–418) describe this broader understanding as a multidimensional framework which shows how markets and technologies and geopolitical dynamics form interrelated systems. Van de Graaf and Sovacool (2020, pp. 24–27) demonstrate that modern energy security needs to be understood through the interconnected global energy governance systems which include political and economic and technological elements that affect energy stability.

Geopolitical Dimensions of Energy Markets

International political relations of different countries depend on energy resources which have historically served as vital elements for their development. States can gain significant geopolitical power through their ability to control production centers and transportation systems and shipping routes. International political economy scholars analyze energy resources through two distinct lenses which view them as market products and strategic geopolitical assets. The European Union faces heightened geopolitical challenges because the region relies on imported goods to a large extent. Youngs (2009, pp. 12–15) explains that Europe has developed its external energy policy according to two main factors which include supply security and geopolitical rivalry between leading energy nations. European countries base their foreign policy on energy security because they depend on external resources which makes them vulnerable to political conflicts that occur in supplier countries and transit nations.

Researchers have conducted extensive research to investigate how the European Union handles this particular vulnerability. Goldthau and Sitter

(2015, pp. 103–108) describe the European Union as a regulatory entity which uses its unified market and comprehensive rules to control international energy markets. The European Union uses its power to establish regulations and control markets instead of managing energy resources through direct ownership according to this perspective. The power to regulate does not eliminate the fundamental weaknesses which arise from relying on foreign sources of supply. Energy-importing areas experience instant economic disruptions because their energy imports depend on only a few suppliers during times of geopolitical crisis.

Recent geopolitical crises have shown that energy supply networks are vulnerable to disruptions. The interruption of gas delivery systems which followed Russia's military invasion of Ukraine showed how much Europe depends on foreign energy sources and demonstrated how ineffective current methods of energy source diversification are. Kuzemko et al. (2022, pp. 3–5) assert that the crisis showed how political conflicts can turn economic interlinks into military weaknesses. European Union policy measures now focus on three key strategies which include supply diversification and infrastructure development plus rapid renewable energy implementation as methods to decrease their political vulnerability.

Global Energy Governance

Energy markets function in a complicated institutional environment that keeps growing more complex. Governance now extends beyond national governments to include international organizations and multinational companies and financial institutions and global regulatory networks. The multiple actors involved in international energy markets demonstrate how energy systems have become worldwide and how no single authority controls energy market operations.

Scholars have sought to conceptualize this complexity through several theoretical frameworks. Bulkeley (2012, pp. 15–17) describes contemporary climate and energy governance as a polycentric system composed of multiple overlapping centers of decision-making authority. Keohane and Nye (1977) introduce the concept of

complex interdependence which demonstrates how states develop mutual dependencies through their economic and political relationships. Van de Graaf and Colgan (2016, pp. 3–6) demonstrate that global energy governance functions through multiple institutional systems which operate independently instead of a single regulatory framework.

The institutional structures create two different effects because they provide advantages while making it difficult to establish coordination. The flexible governance system enables states and markets and international organizations to work together in different ways. The lack of a centralized authority creates difficulties during emergency situations and for long-term policy synchronization. The European Union must manage its complex governance system by executing its internal goals for market integration and decarbonization while considering its external geopolitical requirements. Regional actors such as the European Union now function within a multilayered governance system which connects domestic policy with international diplomacy and international market forces according to Van de Graaf and Sovacool (2020, p. 26).

Structural Vulnerabilities in EU Energy Security

The European energy system maintains multiple structural weaknesses because European countries depend on foreign energy sources for their energy needs. European countries consume more than half of their energy needs through imported fossil fuels, especially oil and natural gas, which connects European markets to international political events that occur in supplier countries and their transit routes (Eurostat, 2024). The European Union faces supply interruptions and price fluctuations that emerge from sources outside its territory because it depends on foreign energy imports. The research shows that different member states depend on energy imports differently, which results in different degrees of vulnerability for the European energy system. States that possess few domestic energy sources must deal with higher risks of supply interruption, while states that maintain diverse energy sources benefit from improved protection against such risks (Bökkerink & Prontera, 2022, pp. 238–240).

European energy policy has developed into a strategy that protects its vulnerabilities through three main approaches which include developing new energy sources and expanding renewable energy capacity and building better linkages among all member states. The European energy market measures aim to decrease geopolitical risk exposure while they enhance market operational flexibility. Jerzyniak (2024, pp. 6-8) states that external dependency reduction needs technological development institutional changes and ongoing funding for durable energy systems which the REPowerEU plan demonstrates through its policy goals.

The shift to low-carbon energy systems brings new geopolitical challenges. Renewable energy technologies need essential minerals which include lithium and cobalt and rare earth elements that have limited geographic distribution to operate. The transition to clean energy will create new strategic dependencies because it will transform existing global supply chain relationships. (Van de Graaf & Sovacool, 2020, pp. 87–89).

Research Gap

Existing research offers valuable understanding about European energy governance and international energy markets and the energy security aspects which involve geopolitical factors. The studies on EU energy policy research institutional coordination and regulatory integration and market governance matters which occur inside the European Union (Bocquillon & Maltby, 2020, pp. 44–46; Maltby, 2013, pp. 440–441). International political economy researchers investigate three elements which shape global energy markets: geopolitical competition, supply concentration, and strategic dependencies (Goldthau & Sitter, 2015, pp. 87–92; Van de Graaf & Sovacool, 2020, pp. 24–27). The two research areas provide important research findings, yet researchers mainly study them as separate fields.

The existing research fails to connect external geopolitical disruptions with the fundamental aspects of EU energy governance throughout its current analyses. The existing research studies separate energy crises and their corresponding

policy responses without investigating how geopolitical conflicts reveal hidden weaknesses that exist within the European energy system's institutional and structural framework. Researchers need to study the relationship between geopolitical instability in energy-producing regions and EU energy security governance systems in greater detail.

The current global energy market disruptions require assessment of how geopolitical shocks affect institutional structures because they have created new challenges for the European Union to develop energy resilience.

Theoretical Framework

European Union energy security can be understood through the application of international political economy theories and energy governance research findings. Three perspectives are particularly relevant for examining how geopolitical tensions influence the stability of European energy systems: interdependence theory, geopolitical approaches to energy security, and multilevel governance. The two perspectives explain how external supply disruptions impact institutional systems which the European Union employs to handle its energy security challenges.

Interdependence theory serves as an effective initial framework for studying the fundamental aspects that define global energy market structures. Economic relationships between producers and consumers create networks that establish reciprocal dependencies which enable parties to work together although these ties introduce risks of failure. Robert Keohane and Joseph Nye explain that economic interdependence creates relationships which give some parties greater risk exposure than others (Keohane & Nye, 1977, pp. 9-12). Energy markets serve as an important example which shows how power imbalances exist between different market participants. Energy-importing regions depend on dependable external resource access whereas exporting states use supply control to gain market power. The European Union depends on imported oil and natural gas which creates an energy security connection to political events

occurring in countries that supply energy and along transit routes.

Geopolitical methods of securing energy resources demonstrate to international relations specialists that energy resources and corresponding infrastructure systems hold strategic value for global political affairs. The essential components of global energy networks include energy production sites together with pipeline networks and maritime transport routes and liquefied natural gas infrastructure. Countries that possess these assets can use them to gain substantial geopolitical power especially during times of international conflict. The political economy of energy research demonstrates that energy-importing nations face increased vulnerability when they depend on specific supply sources and necessary transit routes (Goldthau & Sitter, 2015, pp. 103-105). Energy-producing areas and their transportation networks attract geopolitical conflicts because they reveal supply chain weaknesses and infrastructure protection deficiencies.

The multilevel governance theory explains European Union energy policy management through its institutional framework which governs the union. The European Union regulates energy through interactions between its member states and its international organizations and its various regulatory bodies and its private market participants who span different organizational levels. The authority in this system is distributed throughout multiple branches of power instead of being held by one main authority (Hooghe & Marks, 2007, pp. 58-59). European institutions enable regulatory coordination together with cross-border infrastructure development. However, member states maintain significant control over their national energy policies.

Taken together, The different theoretical perspectives create a unified framework which shows how geopolitical events affect the fundamental features of the European energy system. The concept of interdependence shows how energy producers and consumers maintain unequal power relations while geopolitical approaches demonstrate how energy infrastructure serves as an essential strategic asset. The European Union's ability to handle outside

threats receives explanation through multilevel governance, which explains its institutional capabilities.

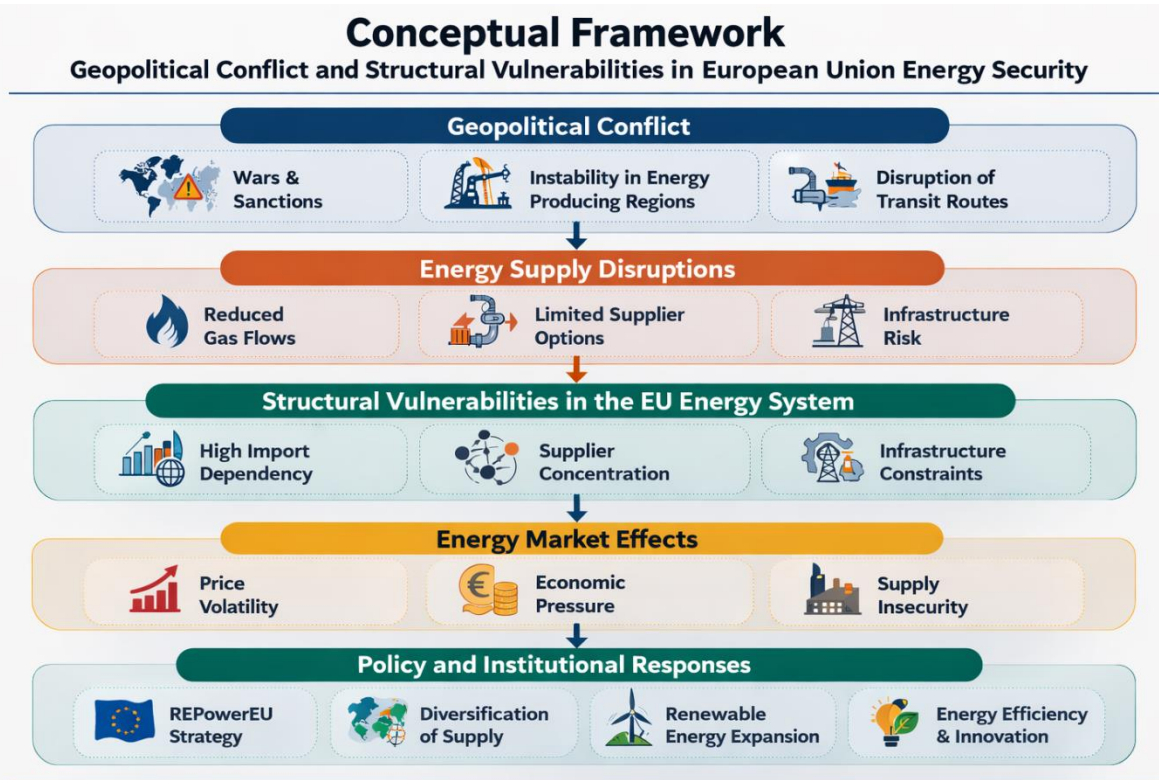


Figure 4. Conceptual Framework: Geopolitical Conflict and EU Energy Security Vulnerability

Figure 4. Theoretical framework that demonstrates how geopolitical confrontation reveals structural weaknesses on the European Union energy infrastructure and create market impacts that lead to institutional policy reaction.

Source: Author's conceptualization based on Cherp & Jewell (2014); Goldthau & Sitter (2015); Van de Graaf & Sovacool (2020).

The framework shows that geopolitical disruptions in energy-producing regions create supply constraints which reveal structural weaknesses of the EU energy system. These supply constraints lead to price fluctuations and economic challenges which result in policy measures that focus on supply diversification and renewable energy development.

Research Design and Methodology

The research uses a qualitative research design to analyze institutional policies and European energy market data through secondary data analysis. The

design enables researchers to study how geopolitical changes affect the operational frameworks of the European energy system. The concept of energy security includes both political and economic aspects which require researchers to combine institutional research with market data to study regional energy system vulnerabilities.

The analysis uses various empirical evidence which includes Eurostat statistical datasets and International Energy Agency market and policy reports and International Monetary Fund macroeconomic evaluations. The datasets supply comprehensive data about European energy

markets which includes energy import dependency and supply diversification and price changes and market structural patterns (Eurostat, 2024; International Energy Agency, 2023; IMF, 2024). The research evaluates institutional responses to changing geopolitical pressures by examining official European Union policy documents which include Energy Union and REPowerEU strategy documents.

The empirical investigation focuses on three analytical dimensions. The first dimension assesses European Union energy import dependency patterns to discover systemic features of the European energy framework. The second dimension studies how geopolitical changes impact key energy-producing areas and their associated supply routes. The third dimension evaluates European Union policies that seek to reduce energy-related vulnerabilities.

The analysis relies on secondary data and institutional reports as its main sources which restrict the researcher's capacity to study real-time market changes and country-specific policy differences.

Empirical Analysis

Structural Energy Dependency in the European Union

The European Union energy system depends on imported energy resources as its main structural element. European energy systems still depend

heavily on fossil fuel imports despite policies that aim to increase renewable energy production and enhance energy efficiency. The EU imported approximately 58 percent of its total energy consumption in 2022 according to statistical data which demonstrates that European energy markets continue to depend on foreign energy sources (Eurostat, 2024). The region's energy markets and economic stability experience immediate disruptions because supply interruptions from outside sources have existed as a fundamental weakness throughout history (Goldthau & Sitter, 2015, pp. 33–35).

Energy sources show different patterns of dependency on imported power sources. The European Union depends on oil imports to meet more than 90 percent of its total oil demand while member states import natural gas to satisfy about 90 percent of their total gas requirements because their domestic production capabilities are inadequate. Eurostat reports that coal imports supply approximately 70 percent of European Union energy needs in 2024. The European energy system depends on external supply networks for its structural connection to these networks. The EU energy system shows different dependency patterns among its member states which leads to varying levels of vulnerability against supply interruptions (Bökkerink & Prontera, 2022, pp. 238–240).

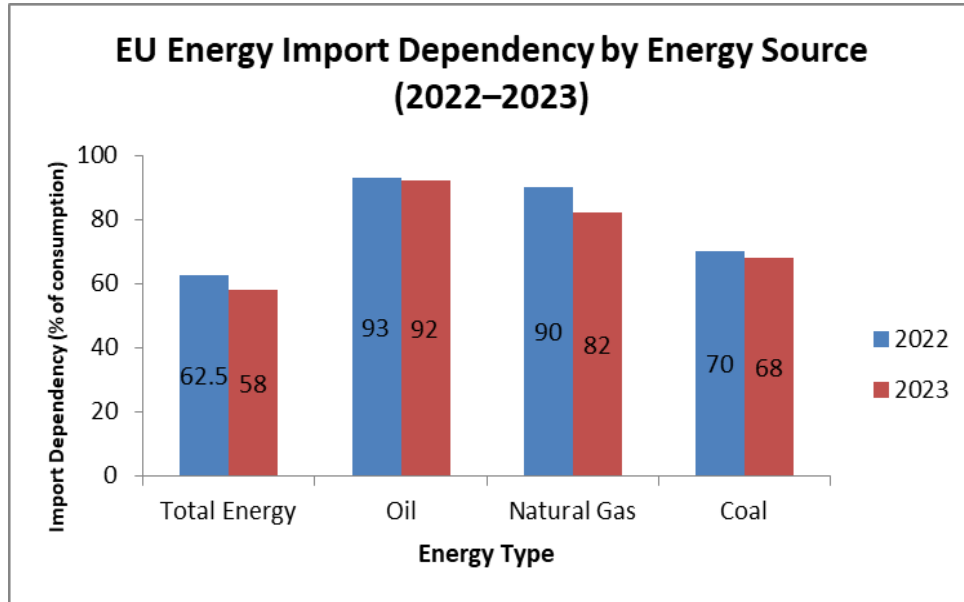


Figure 1. EU Energy Import Dependency by Energy Source, 2022–2023

Source: Eurostat (2025); International Energy Agency (2024).

Note: The percentages show how much of EU gross inland energy consumption comes from net imports.

As illustrate in Figure.1, the EU energy import dependency showed a decrease from about 62.5 percent in 2022 to 58 percent in 2023 because the EU implemented diversification measures and decreased its Russian gas imports. The European Union maintains high oil dependency at more than 90 percent which shows that external supplier dependence still impacts European energy security (Eurostat, 2025).

Supply Concentration and External Vulnerability

Energy security risks increase when imports are concentrated among a limited number of suppliers. Before Eastern European countries began experiencing geopolitical conflicts Russia supplied about 40 percent of EU natural gas to European markets which made it their leading outside supplier (International Energy Agency 2023 pp 45 47). Norway supplied the second largest portion of imports to Europe with nearly

23 percent while Algeria and international markets provided liquefied natural gas (LNG) shipments.

Geopolitical vulnerabilities increase when supply relationships become more focused. Market disruptions occur when one supplier controls most of import cargoes. The European energy crisis that followed Russia's invasion of Ukraine showed how geopolitical conflicts shift economic dependence into strategic weakness (Kuzemko et al 2022 pp 3 5). The developments show that supply concentration increases systemic risk in energy-importing regions according to global energy governance literature (Van de Graaf & Sovacool 2020 pp 24 27).

In response, European governments increased their LNG imports while establishing new energy partnerships with suppliers from the United States, Qatar, and Norway to achieve their goal of diversifying energy sources and decreasing their reliance on pipeline gas.

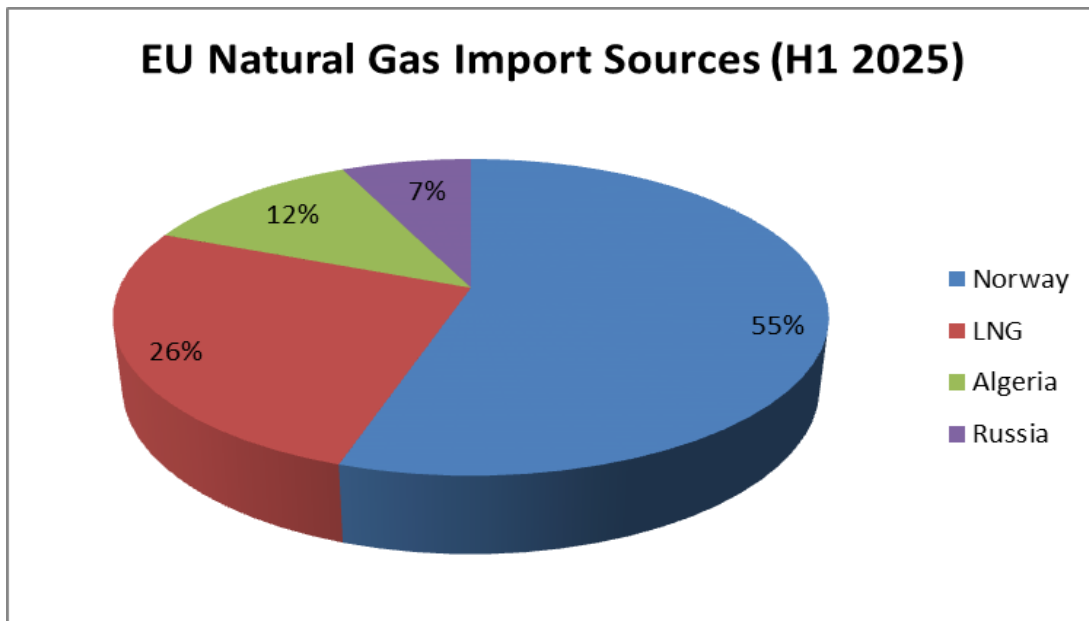


Figure 2. Composition of EU Natural Gas Imports, H1 2025

Source: IEEFA EU Gas Flows Tracker (2025); European Commission REPowerEU Report.

As illustrate in Figure 2, the EU natural gas import patterns have experienced major changes since the energy crisis that occurred in 2022. Russia now supplies about 7 percent of total European Union gas imports while Norway has become the main pipeline provider with 55 percent of EU gas imports. The supply of liquefied natural gas now represents approximately one quarter of total imports which demonstrates the success of REPowerEU framework diversification efforts. European energy markets still face geopolitical risks because a few exporters control most of the supply despite efforts to diversify their sources (IEEFA, 2025; European Commission, 2022).

Energy Price Volatility During Geopolitical Crisis

Energy markets experience rapid price fluctuations whenever geopolitical events disrupt energy-producing regions. The energy markets show immediate reactions to supply risk assessment

throughout regions that depend on imported fuels. The European energy crisis caused European natural gas benchmark prices to increase ten times their 2020 value because Russian pipeline gas deliveries dropped dramatically between 2020 and 2022 (International Energy Agency 2023, pp. 46-49).

The European economies experienced economic inflation and industrial interruptions because energy price hikes created their economic challenges during the crisis according to macroeconomic evaluations of the situation (IMF 2024). The energy price increases created higher production expenses for energy-intensive sectors including steel and chemicals and manufacturing while rising household energy costs produced major social and political demands for government action. The developments prove that geopolitical interruptions create economic disturbances which affect multiple energy markets that operate in a web of connections.

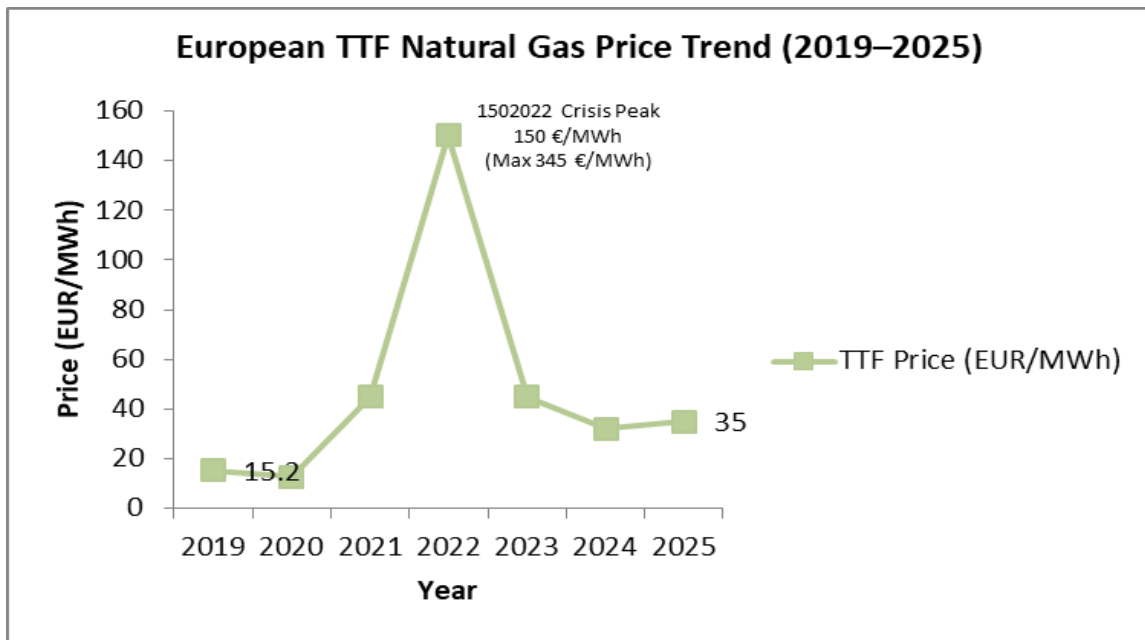


Figure 3. European TTF Natural Gas Prices (2019–2025)

Annual average prices illustrate the sharp increase during the 2022 European energy crisis following reductions in Russian gas supply.

Source: International Energy Agency Gas Market Report; Trading Economics database

Infrastructure and Energy System Resilience

Regional energy systems develop their resilience through their energy infrastructure systems. Energy systems use cross-border pipelines and electricity interconnections and LNG import terminals to redirect energy supplies during operational disruptions. European energy policy has increasingly emphasized infrastructure development as a method to enhance system flexibility while decreasing supply disruption risks. The REPowerEU strategy accelerated infrastructure expansion following the 2022 energy crisis. The European Commission (2022) report shows that multiple member states increased their LNG import capacity which helps European markets access global gas supplies more effectively. Infrastructure diversification enables organizations to develop stronger resilience capabilities through additional supply route options. The need for extensive infrastructure development requires organizations to commit long-term strategic planning and major capital

resources which restrict their ability to respond quickly during geopolitical emergencies.

Policy Responses and Institutional Adaptation

The European Union has implemented major policy changes because of the geopolitical disruptions which have occurred. The REPowerEU strategy which started in 2022 stands as the most extensive program which seeks to reduce external fossil fuel dependence while advancing the development of renewable energy systems (European Commission, 2022). The strategy demonstrates European energy governance efforts which aim to enhance resilience against geopolitical threats.

The REPowerEU initiative establishes three main goals which require interconnected policy actions to achieve its objectives: supply source diversification and renewable energy capacity expansion and energy efficiency improvements. The business diversification plan establishes two main components which will help the company extend its operations through increased LNG

import capacity and fresh energy agreements with different supply sources. Institutional adaptation at the organization level depends on infrastructure development as European energy markets gain flexibility through investments in LNG terminals and cross-border interconnections.

The existing structural limitations continue to exist. The European Union maintains its energy governance system through multiple institutional levels which give member states control over their national energy policies. The different national energy priorities which include nuclear power, fossil fuel consumption, and renewable energy development activities create challenges for countries which need to respond together during times of external supply disruptions. Research on EU energy governance therefore shows how supranational coordination conflicts with national policy control (Goldthau & Sitter, 2015, pp. 103-108).

European energy policy exists as a complete manifestation of strategic autonomy development efforts which exist together with actual international energy dependency situations.

Results and Discussion

The study demonstrates how specific structural aspects of the European Union energy system create its geopolitical conflict vulnerability.

First, The most critical structural weakness of the system exists because the system depends on imported materials. The EU continues to depend on foreign fossil fuel suppliers even after implementing policies for energy supply diversification and renewable technology expansion. Eurostat data indicate that the EU imports approximately 58% of its total energy consumption while import dependency exceeds 90% for oil and natural gas. European energy markets face risks from their dependence on energy sources which come from regions that experience geopolitical conflicts and transit routes. Goldthau and Sitter (2015, pp. 33-35) demonstrate that global energy interdependence leads to power imbalances which restrict energy-importing regions from making independent security decisions.

Second, the concentration of suppliers results in increased exposure to geopolitical risks. The

economy experiences severe impacts when major energy import sources depend on a small number of suppliers because supplier disruptions create high economic risks. Russia supplied about 40% of EU natural gas imports to European markets before Eastern European geopolitical tensions started to escalate (International Energy Agency 2023 pp. 45-47). The gas supply from pipelines decreased which showed how market stability can be lost when companies rely on one supplier. The European energy crisis demonstrated that natural gas prices increased because of geopolitical disturbances which affected energy systems that operate together with each other.

Third, the EU energy governance system faces challenges because its institutional structure prevents effective crisis management through joint operations. The European Union established regulatory frameworks to enhance energy cooperation between member states but these regulations permit each country to control its own energy policies. The national energy mixes and infrastructure capacities and domestic political priorities of each country create limitations on their ability to work together during supply disruptions. Maltby (2013, pp. 438-440) shows that EU energy governance functions through a multilevel institutional system which depends on national governments to maintain their central role. The energy crisis solutions developed by governments combine elements from both international organizations and national government programs.

Taken together, The findings demonstrate that energy security needs more than market supply and demand analysis to achieve complete understanding. Energy systems achieve their resilience through three factors which include the relationships between countries, the governance systems of institutions and the operational capabilities of their infrastructure. Energy supply networks connecting Europe to external producers extend across politically sensitive regions which allows geopolitical events to create direct economic impacts on European energy markets.

Energy governance systems face their most challenging tests through geopolitical conflicts which function as stress tests. Supply networks and regulatory coordination and market integration all

experience structural weaknesses which become evident during external shocks. Geopolitical crises do not create vulnerabilities within the European energy system because they operate as testing mechanisms which show existing dependencies that exist throughout the network.

At the same time, recent policy responses show that institutional awareness of structural challenges has increased. The REPowerEU strategy seeks to decrease dependence on foreign fossil fuel sources by implementing three key strategies which include supply diversification and faster renewable energy development and energy efficiency improvements (European Commission 2022). The European energy system gained additional operational capacity through infrastructure projects which included building liquefied natural gas terminals and establishing cross-border energy connections.

Nevertheless, The ongoing links between worldwide energy systems will drive political developments to affect European energy security. The European Union will create new energy dependencies because it is shifting to renewable energy sources. Renewable energy technologies depend on essential minerals which include lithium and cobalt and rare earth elements that exist in restricted quantities in particular countries. The shift to low-carbon energy systems will create new geopolitical risks which will replace existing energy supply chain vulnerabilities.

The changing patterns of energy security demonstrate how international energy security will emerge as a crucial requirement for the shifting energy supply landscape of the decarbonizing world economy. The European Union maintains its connection to worldwide resource networks because its current energy supply strategies depend on geopolitical conflicts and the strategic management of essential resources.

Policy Implications

Diversification of Energy Supply

Supply diversification has become a central priority in European energy strategy as policymakers seek to reduce exposure to geopolitical risks associated with concentrated energy imports. Prior to the 2022 energy crisis, Russia supplied approximately 40 percent of the

European Union's natural gas imports, illustrating how reliance on a single dominant supplier can create systemic vulnerability within interconnected energy markets (International Energy Agency, 2023, pp. 45-47). Efforts to diversify supply sources, particularly through expanded liquefied natural gas (LNG) imports and strengthened energy partnerships with countries such as Norway, Algeria, and Qatar, have helped reduce the immediate dependence on Russian pipeline gas. However, diversification does not automatically eliminate geopolitical risk. As scholars of global energy governance emphasize, energy interdependence often redistributes rather than removes strategic vulnerabilities, particularly when new supply chains remain geographically concentrated (Van de Graaf & Sovacool, 2020, pp. 24-27). Effective diversification therefore requires a broader strategy that considers the political stability, infrastructure capacity, and long-term reliability of supplier states.

Infrastructure and Market Integration

The energy infrastructure systems serve as essential components which enhance the regional energy systems ability to resist disruptions. The construction of LNG regasification terminals together with cross-border electricity interconnections and pipeline networks enables European energy markets to achieve greater operational flexibility because these systems allow energy distribution to be redirected during times of supply shortages. The Energy Union framework identifies infrastructure integration as the primary method which member states can use to enhance their market operations and improve security of their energy supply systems (European Commission, 2022). The interconnected infrastructure systems create two benefits because they enable both organizations to work together and they decrease the effects of local supply shortages. Infrastructure expansion projects by themselves cannot completely address the problems which exist in the organization. The energy systems of the future need large-scale infrastructure projects which must be planned over extended time periods and need considerable funding before they can achieve their capacity to

respond to rapidly changing geopolitical situations (Goldthau & Sitter, 2015, pp. 103–108).

Renewable Energy Transition

The development of renewable energy capacity serves as a permanent solution to decrease import dependence from foreign sources. Wind and solar power as renewable technologies create a dual benefit by decreasing fossil fuel needs which come from outside sources and helping to achieve climate change mitigation goals. The European Union obtained approximately 22 percent of its energy needs from renewable energy sources in 2022 which demonstrates the increasing importance of low-carbon energy sources in the European energy system (International Energy Agency, 2023). European energy systems can achieve better environmental results and improved strategic independence by increasing the percentage of renewable energy that comes from domestic production. The energy transition process moves forward at a speed which depends on three critical factors namely infrastructure development and technological innovation and regulatory coordination among member states (Bökkerink & Prontera, 2022, pp. 238–240).

Emerging Resource Dependencies

The expansion of renewable energy sources leads to decreased fossil fuel dependency. However, this development brings forth new geopolitical challenges because the supply chains for vital minerals and sustainable energy technologies must be examined. The manufacturing process of batteries and solar panels and wind turbines needs lithium and cobalt and rare earth elements which exist in only certain countries. The energy security situation has developed new geopolitical patterns which now exist alongside older energy security patterns. The research about changing energy geopolitical patterns shows that critical minerals dependence will bring new strategic risks which affect worldwide supply networks (Van de Graaf & Sovacool, 2020, pp. 87–89). European energy security policies will require supply chain resilience development through international partnerships and recycling technology implementation and mineral sourcing methods diversification.

Conclusion

The European Union considers energy security to be its main strategic challenge because global energy markets face disruption from rising geopolitical tensions. European energy systems show that their vulnerabilities arise from both supply shortages and the fundamental system design of EU energy systems. The European energy markets experience different levels of vulnerability to external geopolitical shocks because high import dependence and concentrated supplier ties and institutional fragmentation define their operational mechanisms.

The current situation demonstrates how geopolitical conflicts lead to swift economic and political impacts which affect interconnected energy systems. The supply chain interruptions which impacted major suppliers and transit routes showed that market interdependence becomes a strategic weakness when companies depend on one geographical area for their supply networks. The current situation requires organizations to work together while developing systems that can handle external energy threats.

The implementation of policy initiatives which seek to diversify supply routes and connect different energy systems and increase renewable energy capacity has strengthened the European energy governance system. The system still shows its structural links to international energy markets. The shift towards low-carbon energy systems will decrease reliance on fossil fuel suppliers but it will create additional geopolitical risks which stem from vital mineral supply chains and clean energy technology systems.

The European energy security evolution takes place in terms of various geopolitical power games and technologies development and institutional governing structures. The systems of energy in various parts of the world respond to shifts in interdependence patterns around the world based on diverse dynamic factors that scholars need to understand in order to examine such systems.

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