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REVIEW ARTICLE

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International economic relations and energy security in the European Union: a systematic literature review

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ABSTRACT

Energy security has become a pressing issue in the European Union (EU), particularly due to geopolitical turbulence and supply chain disruptions. The continuous crises and the recent Russian invasion of Ukraine have highlighted the vulnerabilities of EU nations that rely on external energy sources, exposing them to potential price fluctuations and supply constraints. The aim of this study is to systematically review the EU's international economic relations through the prism of energy security. The review presents two topics of discussion that have been prevalent in the last decade: (i) the EU's economic and energy relations with other countries and (ii) the types of energy that are being traded. The review reaches the conclusion that the EU must reduce its reliance on Russian fossil fuels by developing new alliances and focusing on renewable energy sources.

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Energy security; international economic relations; energy relations; energy trade; European Union

1. Introduction

Energy plays a central role in the socio-economic structure of nations, significantly influencing their development (Brodny and Tutak 2023). In the European Union (EU), energy security has emerged as a critical concern amidst geopolitical upheavals and supply disruptions, notably exacerbated by the Russian invasion of Ukraine (Marhold 2023). This conflict has underscored the vulnerability of EU nations reliant on external energy sources, exposing them to price hikes and supply constraints wielded as political tools by energy suppliers (Mišík 2022). The recent crises, such as the COVID-19 pandemic and the energy crisis due to the war in Ukraine, have further underscored the precarious nature of energy security and its far-reaching implications for economic stability and social welfare (Zakeri et al. 2022). Despite concerted efforts by the EU to enhance energy security through initiatives like the Energy Union, challenges persist, with regulatory frameworks falling short of effectively safeguarding against disruptions in energy supply. The inadequacy of regulatory measures designed to guarantee transparency in energy agreements between member states and external suppliers, particularly with Russia, has underscored the necessity for more robust and unified energy policies within the EU (Brodny and Tutak 2023; Herranz-Surrallés 2018).

Furthermore, the Paris Agreement and the European Green Deal aim for climate neutrality by 2050. In the scenario proposed by IRENA (2024), significant alterations to the global energy mix are necessary to prevent a 1.5°C increase in the Earth's temperature. This entails a substantial reduction in the utilisation of fossil fuels, from 63% to 12%, by 2050. Additionally, the prominence of

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electricity as the primary energy carrier and the deployment of renewable energy sources capable of producing biomass and hydrogen are to be emphasised. In particular, it has outlined ambitious objectives for clean hydrogen as part of its 2020 Hydrogen Strategy (European Commission 2022a). The EU's REPowerEU package emphasised hydrogen's potential to enhance energy security and reduce dependence on Russian fossil fuels (European Commission 2022b). However, meeting the EU's targets for renewable hydrogen production presents challenges, leading to reliance on imports. In 2022, a huge reduction in Russian pipeline exports to the EU led to a gas crisis that highlighted the vulnerability of countries that depend on cross-border energy infrastructure. In light of this, policymakers must navigate the crisis's challenges to establish new energy links for scaling clean hydrogen production. In doing so, they must also learn from past crises in order to shape future hydrogen markets in an effective manner (Dejonghe, Van de Graaf, and Belmans 2023).

Although economic and energy relations are of paramount importance, particularly in the context of the ongoing socio-economic crises that the world has faced over the past decade (Pistikou et al. 2023), most studies focus on the relations between two parties. For instance, Sauvageot (2020) examines the economic and energy ties between the EU and Russia, while Dolata (2022) considers the above relationship between the EU and Canada. Therefore, the objective of this study is to provide a more comprehensive examination of the subject matter by conducting a systematic literature review of studies published over the past decade in order to answer the following research question:

- *What are the main issues discussed in the academic literature over the last decade on international economic relations and energy security in the EU?*

The following section presents a literature review on international economic relations and energy security in the EU. This is followed by a description of the methodology employed in our systematic review. Section 4 presents the main topics revealed by our analysis regarding the international economic relations and energy security in the EU. Section 5 discusses the results, while Section 6 offers concluding remarks and proposes directions for future research.

2. Literature review

Although the concept of energy security was first introduced in 1975 (Augutis et al. 2011), it has only gained prominence in the last approximately 20 years. Previous literature on energy security in the EU Member States has addressed the critical issue of the reliability of their gas supply, which is crucial for energy security (Proedrou 2022; Rodríguez-Fernández, Carvajal, and Ruiz-Gómez 2020). The importance of this issue lies in the fact that EU countries are highly dependent on gas imports, especially from Russia, which makes them vulnerable to geopolitical conflicts.

A conflict between Russia and Ukraine in 2021 is not unprecedented, given the relatively recent Russian-Ukrainian crises of 2006, 2009 and 2014. These crises highlighted the need for enhanced energy security, leading to a re-evaluation of the core priorities of the EU's energy strategy. This included the strengthening of trans-European energy infrastructure, the diversification of sources and import routes, and the establishment of a collective external energy policy. In essence, the crises have provided an opportunity to develop an integrated energy market and EU energy security, with the EU in a position to create and implement a new energy policy. Bocquillon and Maltby (2021) have examined the principal objectives of energy policy, which remain devoid of the requisite political will at the level of the Member States and the Council to take action.

Before the war, in 2021, the EU imported 155 billion cubic metres of Russian gas, or 45% of total imports. Russia was also the biggest supplier of oil and coal to the EU. Of the largest European economies, Germany was the most exposed, with Russia supplying around 30% of its oil, 50% of its coal and more than half of its gas. Conversely, France was less dependent due to its nuclear capacity and diversified supply strategies (Gonand et al. 2024). A few months into the war, three of the four Nord Stream pipelines were sabotaged and destroyed. Russia had already significantly reduced its gas

exports to the EU, making it impossible to resume the flow immediately. While analysts predicted a double-digit drop in EU GDP, rising unemployment and significant de-industrialisation, the EU managed to adapt by increasing alternative gas import routes, reducing demand by around 15% by taking advantage of a slightly warmer climate, changing the type of fuel and rapidly implementing liquefied natural gas (LNG) infrastructure projects (ACER 2024).

Nevertheless, in the forthcoming years, the EU will be confronted with a number of significant challenges. Firstly, competition for LNG imports is set to intensify, particularly during the winter months. The growth of the Indian economy and the potential for increased demand in China will intensify competition for gas, although the United States is expected to increase its LNG supply to the global market (Molnar 2022). The growth in gas supply from pipelines to the EU is constrained, with the flows from Algeria, Azerbaijan and Norway insufficient to meet demand (Gonand et al. 2024). In light of these circumstances, it is imperative to strike a balance between ensuring the short-term security of fossil fuel supply and pursuing a long-term energy transition that avoids catastrophic climate change.

In this regard, the EU has initiated the Energy Platform, which encompasses the aggregation of demand, the establishment of common gas markets, and the optimisation of LNG (and, subsequently, hydrogen) infrastructure (Dulian and Klochko 2023). This is consistent with the RepowerEU plan, which was adopted by the EU and funded by the RRF. The plan supports the ambitious green transition targets for 2030, including an increase in the share of renewable energy to 45%, the production of 350 TWh of biomethane, and the production and importation of 20 million tonnes of renewable hydrogen (European Commission 2022b). The EU is confronted with a dearth of domestic energy resources, which are required to satisfy its continuously growing energy demands. In this context, Renewable Energy Sources (RES) represent a promising avenue for achieving energy autonomy and stability (Francés, Marín-Quemada, and González 2013; Prontera 2021). Hydrogen has the potential to play an instrumental role in the green transition; however, its production remains a costly endeavour. Significant efforts are being made to produce hydrogen, as it is becoming less susceptible to geopolitical manipulation. The production of renewable hydrogen is feasible in regions where renewable energy and water sources are available, such as the United States and China. However, the European Union and Northeast Asia will likely rely on imports to meet their hydrogen needs (IRENA 2022). Furthermore, China has set an ambitious target for renewable energy by 2030, while the United States is providing support to the green energy sector through the Inflation Reduction Act (EPA 2023).

The functioning of the energy market and the security of energy supply are key objectives of the EU's energy policy. The aim is to ensure that the whole territory of the EU is supplied with affordable and secure energy, not only in terms of supply, but also in terms of respect and protection of the environment. In this regard, global technological advancement has created significant opportunities for countries lacking their own energy resources to enhance their autonomy (Brodny and Tutak 2023). While some steps have been taken, it is evident that the transition is still in its initial phase and will require a concerted effort from all stakeholders.

3. Methodology

In order to gain insight into international economic relations and energy security in the EU, a systematic literature review was conducted. To ensure the application of an academically acceptable review protocol (Gates 2002), the following three stages were followed: (1) planning the review, (2) conducting the review, (3) reporting the data; writing up the findings (Brereton et al. 2007).

As electronic databases are the source of academic publications (Petticrew and Roberts 2008), SCOPUS database was selected for this study as it is the largest database of abstracts (Marikyan, Papagiannidis, and Alamanos 2019) and provides a broad coverage in diverse disciplines (Bartol et al. 2014; Valderrama-Zurián et al. 2015). We did not include grey literature as it is usually considered to be of lower quality than peer-reviewed studies (Xiao and Watson 2019).

The principal objective of the study is to examine the international economic relations and energy security in the EU. To this end, the search string employed was:

('international econom*' OR 'global econom*' OR trade AND 'energy security' OR 'security of energy' AND Europ* OR EU)

As international economic relations are a very broad concept, we did not use the keyword 'relations' in our search string as the term many times is implied and not directly mentioned. In addition, we also used the keyword 'trade' as it is one crucial aspect of international economic relations. At this stage, we preferred to use broader keywords in order to have more exhaustive results than to miss some results that were of interest (Xiao and Watson 2019).

On 04/04/2024, the aforementioned string was used and had to be included within the title, abstract or keywords of the studies with no other restrictions. The initial result was 348 studies. As the latest studies are more likely to be relevant to the present context and thus offer more valuable insights (Xiao and Watson 2019), we then applied a restriction in our search criteria for studies published in the last decade between 2013 and March 2024. Therefore, the results were 237. Then, we only kept the English language studies, which resulted in 223 documents. Moreover, only journals were included in the process as the rest (e.g. book chapters, books, conference papers) may not have a strict peer review process (Jones, Coviello, and Tang 2011), resulting in 140 articles. Finally, irrelevant subject areas, such as mathematics, were excluded, thus bringing in 136 articles.

In accordance with the methodology proposed by Xiao and Watson (2019), all authors independently evaluated the studies based on the abstracts. Articles whose main topic was not international economic relations and energy security, that did not focus on the EU or that studied only a specific EU member state were excluded. For example, Bigerna et al. (2023) include the relevant keywords in their abstract, but their research primarily concerns the Italian case, which diverges from the primary focus of our study and was therefore excluded from further analysis. Following the screening procedure for abstracts, 58 articles were identified for full-text assessment. In that stage, two of the authors carefully read through the full texts of the 58 papers to assess their relevance with respect to the study. The articles that did not satisfy the aforementioned inclusion criteria were excluded. For instance, the study by Yakymchuk et al. (2022) was excluded at this stage because it primarily focuses on energy security in Ukraine. The full-text screening procedure resulted in the exclusion of 10 studies, leaving 48 studies for further analysis. (Figure 1).

The majority of studies on this topic was published in 2023, while the second highest number of studies was published in 2013 (Figure 2). It has to be noted that for 2024, we examined only papers published until the end of March.

4. Analysis and findings

A total of 48 articles were derived from the search protocol process, and two main topics were revealed. The first topic pertains to the countries with which the EU has economic relations regarding energy security topics (see Table 1). The second topic concerns the types of energy that these relations involve (see Table 2).

4.1. International economic relations for energy security

4.1.1. EU-Russia relations

Regarding the first topic, the majority of the articles discuss the economic relations for energy security issues between the EU and Russia. During the period analysed in this systematic review, a crisis in energy security exists between the two parties. The most recent papers of this analysis refer to the impact of the Russian invasion of Ukraine and Russia's 'energy weapon' – the restriction of gas flows to the EU (e.g. Hartvig et al. 2024; Rokicki, Bórawski, and Szeberényi 2023). On

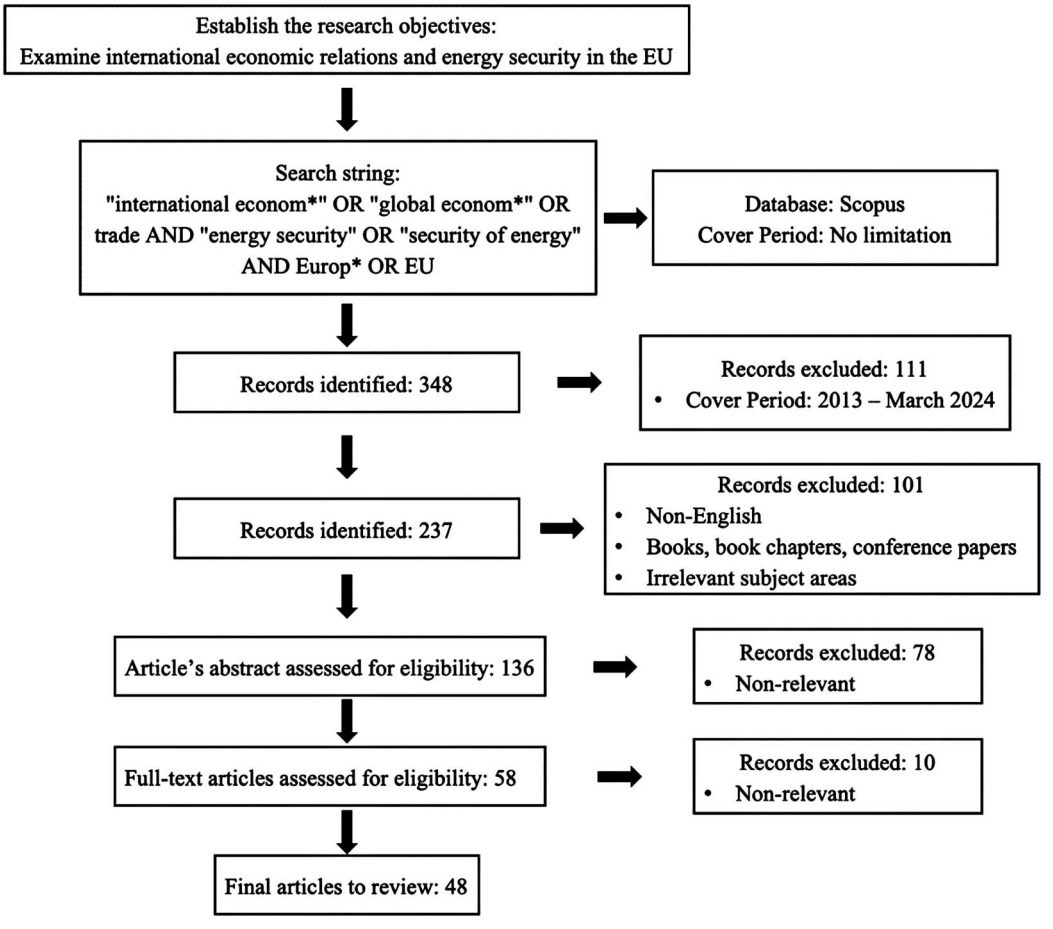


Figure 1. Search protocol for the systematic literature review. Source: Authors' creation.

the contrary, the first papers do not reflect Russia's threatening attitude towards European countries. For example, Sharples (2013) focuses on climate change and Russia's approach to this issue, concluding that Russia's energy security depends on the EU gas market. In addition, Brown (2014) questions whether Russia can be an environmental hero because, regardless of its motives, access to the Energy Charter Treaty results in benefits for international energy security and global sustainability.

Some of the problems in the relationship between Russia and the EU are presented in Laranova's study (2015). Liaranova outlines the impact of the Partnership for Modernization (P4M) between the two parties and concludes that this partnership did not meet the expectations. Furthermore, Siddi (2017) explains that although Russia has been a significant gas provider to the EU for more than forty years, gas transit through Ukraine is becoming problematic and can cause supply shocks. In the same vein, Sauvageot (2020) discusses the problems that the EU's energy interdependence with Russia raises and the role of Ukraine as a transit country. He concludes that the EU has not thoroughly examined transit aspects in its interdependence with respect to Russia. As outlined by Georgiou and Rocco (2017), the two powers need legislative and institutional reform.

The most recent paper before the Russo-Ukrainian war was by Pogoretskyy and Talus (2020), which focused on the World Trade Organization panel decision in the EU Energy Package controversy between the EU and Russia and its implications for the gas market.

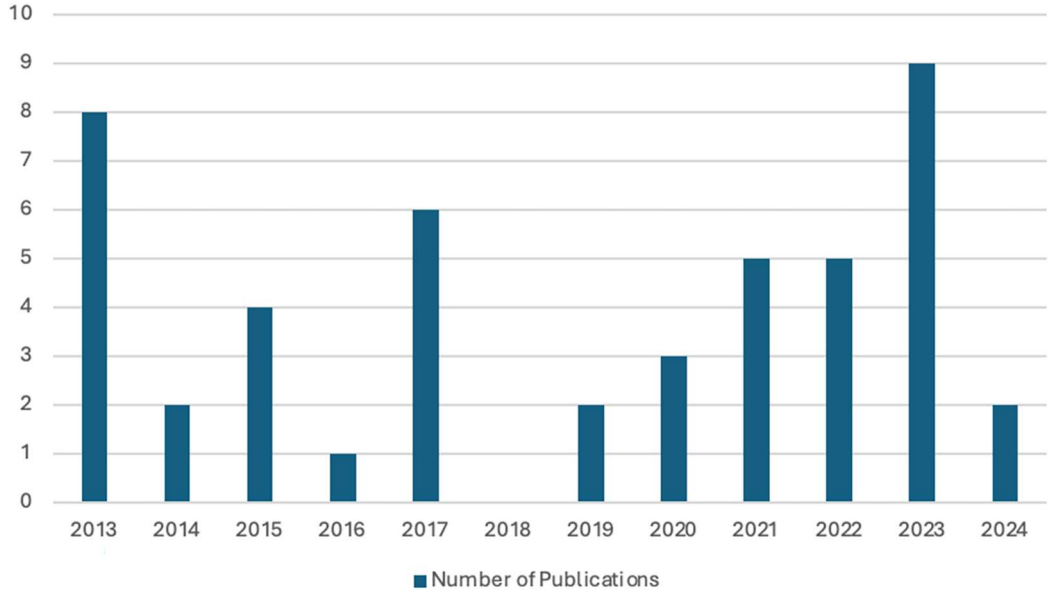


Figure 2. Publication distribution per year. Source: Authors' creation.

Table 1. International economic relations for energy security.

International economic relations for energy security		
EU and Russia	EU with other countries	Among EU countries
Hartvig et al. (2024)	Al-Saidi (2023) – Middle East	Zehir et al. (2023)
Rokicki, Bórawski, and Szeberényi (2023)	Dolata (2022) – Canada	Nuñez-Jimenez and De Blasio (2022)
LaBelle (2023)	Trollip, McCall, and Bataille (2022) – South Africa	Marhold (2019)
Vošta (2023)	Öge (2021) – Turkey	Azamatova, Shadova, and Shorova (2017)
Hosoe (2023)	Van der Zwaan, Lamboo, and Dalla Longa (2021) – North Africa	Hawker, Bell, and Gill (2017)
Shepard, van Ruijven, and Zakeri (2022)	Bocse (2020) – US	Leal-Arcas, Ríos, and Grasso (2015b)
Sturm (2022)	Siddi (2019) – Caspian region	Maltby (2013)
Pogoretskyy and Talus (2020)	Rabe, Kostka, and Stegen (2017) – China	
Sauvageot (2020)	Sánchez-Martín, Escribano Francés, and de Arce Borda (2015) – Turkey	
Georgiou and Rocco (2017)	Leal-Arcas, Ríos, and Grasso (2015a) – Eurasia	
Siddi (2017)	Amineh and Crijns-Graus (2014) – Eurasia	
Troulis (2017)	Froggatt (2013) – Asia	
Khrushcheva and Maltby (2016)	Kanudia et al. (2013) – GCC	
Locatelli (2015)	Özpek (2013) – Turkey	
Larionova (2015)		
Brown (2014)		
Sharples (2013)		

Source: Authors' creation

4.1.2. EU relations with other countries (except from Russia)

The literature on international economic relations and energy security in the EU is not limited to the nexus between the EU and Russia but also with other countries. The most recent study in this systematic literature review discusses the role of the Middle East, especially Qatar, as an energy partner of Europe due to the war in Ukraine (Al-Saidi 2023). Also, Kanudia et al. (2013) examine the Gulf Cooperation Council countries and their role in the EU's energy supply. Although the Middle East and the Caspian region concentrate large amounts of fossil fuels, their geopolitical instability

Table 2. Energy types.

Energy Types	
Fossil Fuels	Renewable energy
General: Rokicki, Bórawski, and Szeberényi (2023); Marhold (2019); Kanudia et al. (2013); Özpek (2013) **Coal**: Froggatt (2013) **Gas**: Hartvig et al. (2024); Cardinale, Cardinale, and Zupic (2024); Marhold (2023); LaBelle (2023); Öge (2021); Berdysheva and Ikonnikova (2021); Pogoretskyy and Talus (2020); Siddi (2019); Siddi (2017); Troulis (2017); Locatelli (2015); Brown (2014); Sharples (2013) **LNG**: Dolata (2022); Sauvageot (2020); Leal-Arcas, Ríos, and Grasso (2015a); Amineh and Crijns-Graus (2014) **Shale gas**: Bocse (2020)	**Hydrogen**: Dejonghe, Van de Graaf, and Belmans (2023); Dolata (2022); Nuñez-Jimenez and De Blasio (2022); Hancock and Wollersheim (2021); Van der Zwaan, Lamboo, and Dalla Longa (2021) **Solar and/or Wind**: Van der Zwaan, Lamboo, and Dalla Longa (2021); Rabe, Kostka, and Stegen (2017); Berberi et al. (2013) **Biofuels**: Pacini et al. (2013)

Source: Authors' creation

has a direct negative impact on EU countries that depend on these energy supplies (Amineh and Crijns-Graus 2014; Leal-Arcas, Ríos, and Grasso 2015a; Siddi 2019).

Much attention has been paid to Turkey's transit role in Eurasia for energy supplies (Öge 2021; Özpek 2013; Sánchez-Martín, Escribano Francés, and de Arce Borda 2015), as transit countries are vulnerable to changes but can guarantee energy security. Özpek (2013) concludes that Turkey's participation in the EU's energy security brings interdependence between the two parties.

The remaining papers discuss issues related to the EU's relations with Canada, the US, China, South Africa, and North Africa. Bocse (2020) examines the evolving dynamics of EU-US energy relations in the context of Russia's invasion of Crimea. He posits that, in light of strategic considerations, the United States has increasingly turned its attention to EU energy security concerns. Moreover, Dolata (2022) presents a historical overview of Canada–EU relations with regard to energy security. The author concludes that Canada encounters challenges in supplying energy promptly to the EU when required due to the geographical positioning of its energy infrastructure. In addition, Rabe, Kostka, and Stegen (2017) focus on the EU's dependence on Chinese supplies of raw materials for the solar and wind industries. Finally, two studies were identified for the African continent. Trollip, McCall, and Bataille (2022) explain that South Africa can export green primary iron to the EU market, while Van der Zwaan, Lamboo, and Dalla Longa (2021) shows that North Africa can be a producer and exporter of renewable energy to the EU.

4.1.3. Relations among EU countries

The last group of papers on this topic are studies that focus on the relationships among EU countries and what EU. Zehir et al. (2023) investigate the trade network within the EU and identify the Netherlands as the primary energy hub of Europe. They suggest that the number of hubs should be increased. Nuñez-Jimenez and De Blasio (2022) focus on the EU's hydrogen strategy, while Marhold (2019) discusses ways to create a more coherent EU energy policy. In addition, Azamatova, Shadova, and Shorova (2017) examine the impact of Brexit on the EU's economic and energy security proposing the introduction of new comprehensive policies; while Hawker, Bell, and Gill (2017) discuss the challenges of the European internal energy market with respect to electricity and suggest allowing cross-border involvement of generators in local capacity mechanisms. In the same vein, Leal-Arcas, Ríos, and Grasso (2015b) and Maltby (2013) point to the need for improvements in the EU internal energy market to ensure energy security.

4.2. Energy types

A second topic that emerges from the systematic literature review has to do with the types of energy that affect trade between nations. Although the gas markets (Amineh and Crijns-Graus 2014; Berdysheva and Ikonnikova 2021; Brown 2014; Cardinale, Cardinale, and Zupic 2024; Dolata 2022; Hartvig et al. 2024; LaBelle 2023; Leal-Arcas, Ríos, and Grasso 2015a; Locatelli 2015; Marhold 2023; Öge 2021; Pogoretskyy and Talus 2020; Sauvageot 2020; Siddi 2017, 2019; Troulis 2017; Sharples 2013), and generally fossil fuels (Bocse 2020; Froggatt 2013; Kanudia et al. 2013; Marhold 2019; Özpek 2013; Rokicki, Bórawski, and Szeberényi 2023), predominate throughout the review period, there have been several studies in recent years that focus on hydrogen (Dejonghe, Van de Graaf, and Belmans 2023; Dolata 2022; Hancock and Wollersheim 2021; Nuñez-Jimenez and De Blasio 2022; Van der Zwaan, Lamboo, and Dalla Longa 2021) and other types of renewable energy sources (Berberi et al. 2013; Pacini et al. 2013; Rabe, Kostka, and Stegen 2017; Van der Zwaan, Lamboo, and Dalla Longa 2021).

4.3. Results

The literature on the EU's international economic relations and energy security reveals an evolving narrative shaped by geopolitical shifts and strategic considerations. Initially, the literature focused on broader issues such as climate change and potential cooperative benefits (Brown 2014; Sharples 2013). However, over time, the literature shifted towards a focus on the growing tensions and problematic aspects of the EU-Russia energy relationship ((Larionova 2015; Siddi 2017). Finally, the more recent papers analysed in this review reflect a significant shift in the narrative, with a focus on the impact of Russia's geopolitical strategies, particularly the use of energy as a political weapon (Hartvig et al. 2024; Rokicki, Bórawski, and Szeberényi 2023).

Beyond the EU-Russia nexus, recent studies have expanded to examine the role of other regions, such as the Middle East and the Caspian region, in the EU's energy supply chain, noting both the opportunities and challenges posed by geopolitical instability (Al-Saidi 2023; Amineh and Crijns-Graus 2014; Kanudia et al. 2013; Leal-Arcas, Ríos, and Grasso 2015a; Siddi 2019). The strategic importance of transit countries such as Turkey has also been highlighted, recognising their vulnerability but also their crucial role in ensuring energy security (Öge 2021; Özpek 2013; Sánchez-Martín, Escribano Francés, and de Arce Borda 2015). Moreover, the EU's relations with other key energy partners, including Canada, the US, China, South Africa, and North Africa, have been explored, illustrating a diversified approach to energy security (Bocse 2020; Dolata 2022; Rabe, Kostka, and Stegen 2017; Trollip, McCall, and Bataille 2022; Van der Zwaan, Lamboo, and Dalla Longa 2021).

Within the EU itself, there is a focus on improving internal energy policies and market integration, with studies advocating for improved internal energy market mechanisms (Hawker, Bell, and Gill 2017; Leal-Arcas, Ríos, and Grasso 2015b; Maltby 2013) and energy policies (Azamatova, Shadova, and Shorova 2017; Marhold 2019).

Finally, a significant shift in recent years is the growing interest in sustainable and clean energy alternatives, particularly hydrogen and renewable energy sources, reflecting global trends toward decarbonisation and energy diversification (Dejonghe, Van de Graaf, and Belmans 2023; Dolata 2022; Hancock and Wollersheim 2021; Nuñez-Jimenez and De Blasio 2022; Van der Zwaan, Lamboo, and Dalla Longa 2021). This transition marks a pivotal period in the evolution of the global energy trade, as the traditional dominance of fossil fuels is increasingly challenged by innovative technologies and sustainable practices.

5. Discussion

The literature review discusses several aspects of the EU's international economic relations regarding energy security. The main issue that is raised concerns the EU's economic and energy relations

with Russia. Although the EU heavily relies on Russia as a significant supplier of natural gas, oil, and other energy resources for many decades (Siddi 2017), their relationship, especially in recent years after the 2014 invasion of Crimea (Georgiou and Rocco 2017) and the 2022 invasion of Ukraine (Hartvig et al. 2024), has reached its limits. Russia is using its energy resources and power to threaten EU states that support Ukraine, making it essential for the EU to find other ways to ensure its energy security.

Concerns have been raised that Russia's stance will hurt the EU economy by slowing economic development and depressing consumption. However, Hartvig et al. (2024), in a recent analysis, show that while there may be some strong initial negative economic effects, the EU will adapt to the new situation, and this will lead to positive results due to new investments in long-term energy security.

In order to diversify their energy supply and reduce their dependence on a single supplier, EU countries need to develop and expand their relations with other countries, such as Qatar (Al-Saidi 2023) and other Gulf Cooperation Council countries (Kanudia et al. 2013), China (Rabe, Kostka, and Stegen 2017), the United States (Bocse 2020), and Canada (Dolata 2022). In addition, the development of a single EU energy market has been highlighted as a potential source of benefits for EU countries (Leal-Arcas 2015b).

Finally, the systematic review revealed a growing interest in renewable energy sources, with the majority of recent articles addressing issues related to hydrogen (Dejonghe, Van de Graaf, and Belmans 2023; Dolata 2022; Hancock and Wollersheim 2021; Nuñez-Jimenez and De Blasio 2022; Van der Zwaan, Lamboo, and Dalla Longa 2021). The EU has established 2050 as the deadline for achieving climate neutrality, a goal that will be achieved partly through clean hydrogen (European Commission 2022a). Although the EU's Hydrogen Strategy has a significant reliance on imported resources, the hydrogen market may be less concentrated than other energy markets, which could mitigate the risk of supply chain disruptions (Dejonghe, Van de Graaf, and Belmans 2023). In the context of Russian invasion of Ukraine, the REPowerEU package highlighted the hydrogen's potential to enhance energy security and reduce the EU's reliance on Russian sources of energy (Dejonghe, Van de Graaf, and Belmans 2023). However, achieving the targeted volumes of renewable hydrogen domestically presents challenges; thus, extending its relations with other countries is of utmost importance.

6. Conclusion and future research

The systematic literature review on the subject of international economic relations and energy security in the EU reveals that two main topics are of interest for discussion: firstly, the EU's relations with other countries, in particular with Russia, and secondly, the types of energy being traded. It can be seen that the study has significant implications for policymakers and governments. The European gas crisis in 2022 underscored the dangers of excessive reliance on a single supplier or transit route, emphasising the necessity of diversification in energy imports. The exploitation of energy networks for political purposes has resulted in a lack of stability in the energy supply, necessitating the de-politicisation of energy supply. A diversification strategy must be implemented to source energy from multiple suppliers and employ varied transportation routes and carriers, such as pipelines, to enhance resilience against external supply disruptions. The renewable energy sources market, in particular, can be distinguished by a greater diversity in potential supply sources, which presents an opportunity to mitigate supply risks.

The EU's emphasis on reducing its reliance on Russian energy sources can facilitate a collaborative effort with the Middle East, the United States, Canada, Africa and China to diversify its energy portfolio and enhance its energy security. Heightened competition for Middle Eastern resources is anticipated among global and regional actors, prompting adjustments in energy strategies for countries like Turkey and Russia. This renewed interest in Middle Eastern energy is attracting new European players, promoting collaboration in renewable energy, energy efficiency, and low-

carbon technologies, which may potentially reshape regional dynamics. As energy cooperation expands to include clean electricity and renewable energy sources that can produce, among others, hydrogen, considering the Middle East's local impacts is essential. In order to ensure a sustainable energy transition, it is crucial to prioritise equitable partnerships and address social and environmental concerns.

Furthermore, the EU must emphasise the importance of effective management of import demand, which has emerged as a critical aspect. Governments must strike a delicate balance between stimulating demand for different types of energy and avoiding overreliance, which may expose their economies to vulnerabilities related to imports. Finally, building resilience to shocks is of paramount importance. Flexible strategies, such as fuel switching and demand reduction policies, play a crucial role in mitigating the impacts of potential supply shortages. Policymakers can navigate the installation of renewable energy sources and the complexities of hydrogen supply chains and safeguard energy security in an increasingly interconnected world by adopting a multifaceted approach that encompasses diversification, demand management, and resilience-building measures.

The European Union has sought to establish a competitive internal energy market that will operate freely and smoothly even in the event of a supply disruption. This has been achieved by integrating non-EU countries into its enlarged market, which operate under a common institutional framework. Although considerable progress has been made towards its completion, it is now necessary to intensify efforts to monitor the timely and correct implementation of its regulatory framework across the EU. Unfortunately, this is often impeded by the individual political, economic and business interests of stakeholders, which threaten to undermine it.

International economic relations and energy security in the EU warrant further research. As geopolitical trends, such as regional conflicts and strategic alliances, evolve rapidly, future research should focus on the implications of EU energy policies and their interactions with prominent global actors, including emerging powers and traditional energy suppliers. This area merits ongoing analysis to anticipate potential shifts in international economic relations and energy security dynamics. Moreover, future research may examine the evolving landscape of renewable energy technologies and their potential integration into the EU's energy mix. This integration could reshape energy security dynamics and mitigate geopolitical risks associated with fossil fuel dependence. In addition, an examination of the EU's responses to the emergence of global issues, such as climate change and the transition towards a low-carbon economy, may prove beneficial. Finally, since our systematic literature review was based only on papers from the Scopus database, future research may use other databases and grey literature to study this topic.

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No potential conflict of interest was reported by the author(s).

Data availability statement

This is a review study. The scientific papers used in our analysis can be found in the Scopus database at [https://www.scopus.com/home.uri].

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