https://asce-uok.edu.pk/journal
DOI: https://doi.org/10.56384/jes.v42i1.425

Powering the EU through Nuclear Energy: A Reassessment of the EU's Energy Strategy in the Current Scenario

Asra Pasha*

Abstract

The changing landscape of global geopolitics with the Russia-Ukraine war in the backdrop has hit Europe hard in many ways. Europe is being pushed into believing that if it fails to review its energy trade policies with Russia in particular and economic diplomacy with the world at large, it will continue to sponsor the war upon itself that it earnestly wishes to end. To achieve the expectation of not being a party in this war and ward off military conflict from seeping westward from Ukraine, the European Union has been compelled to undertake some decisions that it does not wishfully welcome, and more are coming its way every few days. A grave issue facing Europe is its energy reliance on fossil fuel and natural gas from Russia to keep its wheels moving. Long-term contracts by many European countries with Russia and the constant pressure from the US administration to impose severe sanctions on Russian imports, heavy tariffs on third countries that are Russia's active trading partners, and finding new avenues to energy are taxing challenges for the European Commission.

A parallel challenge is the US's directive to increase the defense spending or find itself alone in the face of military tyranny. This article studies how the global powers are safeguarding their economic interests, throwing the European Union into self-pity and responsibility for a war that the EU did not start to begin with and that has resulted from serious miscalculations concerning NATO and its expansion. It is also an attempt to examine, while containing the current energy picture of Europe in the background, how using nuclear power for energy production responsibly could salvage Europe from its current financial predicaments.

* Ms. Asra Pasha is a Freelance Writer and M.Phil student at the Area Study Centre for Europe, University of Karachi. Email: asrapashais@gmail.com.

Keywords: EU's Energy Strategy, Nuclear power, Russia, European security, NATO

Introduction

The Russia-Ukraine military conflict is now more than three years old. It is clear that Russia firmly stands its ground against NATO's security ambitions. As a strong global economic and largest nuclear power, the legitimacy of Russia's gumption to guard and enhance its redline zone towards west seems logically unfair. Especially, when it has never given the pretense of being ignorant of similar western endeavors. In his analysis of the war, political analyst John J. Mearsheimer is of the view the US and its NATO allies had a crucial role in starting the war and are central to the conduct of this war. He has emphasized that the West's responsibility in this event must be evaluated to understand it better. According to Mearsheimer, there is no need to pay attention to the causes of a successful war. But he insists that the war in Ukraine is a 'multidimensional disaster' and it becomes paramount to understand how the world arrived at this terrible situation[1]. It is not hard to agree that an expansionist approach in today's global geopolitics and multilateralism in economies could easily be miscalculated and go south owing to the nature of inter-regional economic, social, and political relations among countries.

The Russia-Ukraine conflict could be studied in the context of all the classic ripple effects of war as a consequence of it being three-year old: direct human and material destructions, human capabilities, economies, values and attitudes, policy and governance, and domestic and international power relations[2]. However, the one in question here is the economic costs of this war for the European community and how it can prepare itself to avoid suffering from a similar economic trail in future.

In present day's interconnected global structure, some of these impacts have shaken regions as far as South Asia. Yet, the price that Europe is being made to pay is visibly greater. The energy supply chain disruption due to

[1] John J. Mearsheimer Lecture at the Robert Schuman Centre of the European University Institute Florence, Italy, June 16, 2022. https://www.cirsd.org/en/horizons/horizons-summer-2022-issue-no.21/the-causes-and-consequences-of-the-ukraine-war.

[2] P. Bocquillon, S. Doyle, S. James, *et al*. "The Effects of Wars: Lessons from the War in Ukraine. *Policy Studies* 45, Nos. 3 - 4 (2024): 261-281. https://doi.org/10.1080/01442872.2024.2334458.

third party influence, drastic implications of abrupt policy transitions, and infrastructural sabotage among other factors have pushed Europe into the worst energy crisis of its history. The second Trump administration has adopted the policy of third-party sanctions and economic embargoes on Russian trade under its "America First" agenda[3]. The burden of this agenda is heavily weighing down on the European community and especially on its NATO allies. President Trump has directly accused them of fueling the war. One the one hand, Europe is struggling to stabilize its energy supply and demand. On the other hand, the US is pressurizing the European countries to devise sanction packages and sever trade ties with an important global trading partner like China. While Trump points finger at NATO allies for their continuing oil trade with Russia[4], the strategic disregard of the US is harmful for Europe's long term political and economic relations with its global partners.

This article attempts to study the impacts of this strictly regional conflict in terms of economy and peace for the global political and diplomatic community and how disparaging the long-term effects of abrupt policy shifts for Europe can be. Europe needs to revisit its political, diplomatic, and economic goals to have a sustainable future. It has to prioritize its economic and diplomatic interests without being held hostage to third party economic warfare. It is important to see the impacts of this war on Europe in the full context of its 'exogenous shocks'[5] and the eventual consequences of 'punctuated equilibrium'[6] that this scenario holds for the global economy and peace.

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[3] AFPI, America First Agenda. See https://www.americafirstpolicy.com/assets/uploads/AFPI_Biblical_Pillars_2022_Final_(1).pdf.

[4] Hanna Duggal. "How much of Europe's Oil and Gas still comes from Russia", *Al Jazeera*, 3 Oct 2025. https://www.aljazeera. com/news/2025/10/3/how-much-of-europes-oil-and-gas-still-comes-from-russia.

[5] **Exogenous shocks** are unexpected or unpredictable events that occur outside an industry or country, but can have a dramatic effect on the performance or markets within an industry or country. https://archive.unescwa.org/exogenous-shocks.

[6] **Punctuated equilibrium** is "the idea that evolution occurs in spurts instead of following the slow, but steady path that Darwin suggested. Long periods of stasis with little activity in terms of extinctions or emergence of new species are interrupted by intermittent bursts of activity." https://www.sciencedirect.com/topics/earth-and-planetary-sciences/punctuated-equilibrium#:~:text=%E2%80%9CPunctuated%20equilibrium%20is%20the%20idea,by%20intermittent%20bursts%20of%20activity.%E2%80%9D.

Europe's economic predicament

Europe's regional proximity to the Arctic ascribes to it a high demand of energy primarily for heating purposes owing to its peculiar low temperatures annually and a challenging terrain. This demand is spread over industry and households. Most of the Russian territory has a similar climate. Therefore, a mutual need for energy is best met by a regional cooperation in meeting supply and demand situation within the region. Ideally, this has better economic prospects for the region in terms of economy of scales and climate goals. Longer supply chains are not only unfeasible for the financial interests in such transactions but also pose a hazard to the global climate goals of the trading parties by creating a higher carbon footprint at the end. Between the first and 19th sanction package of the EU against Russia since 2022, the energy situation has deteriorated beyond expectations, whereas, the rationale behind these sanctions remains unfulfilled. The war has expanded. Russia has found new trading partners as the EU has receded its commercial footprint at the behest of Washington[7]. The EU is circumstantially compelled to accuse Russia of 'waging a deliberate grey zone campaign against Europe'[8] when consecutive sanction packages are playing havoc with its regional trading activity. Yet, the trade outlook of the US with Russia present surprises in the form of high import bills year after year.

Russia's major exports are minerals, fossil fuel, and natural gas. According to the OEC data, Russia ranked as the 17th largest exporter in 2023 in global trade with crude petroleum exports of $122bn, refined petroleum worth $52.1bn, petroleum gas worth $39bn, and gold worth $13.6bn. The trade between China and Russia stood at $129bn; with India at $66.1bn; with Turkey at $31bn; with Kazakhstan at $16.1bn., and with Brazil at $11.1bn.[9] The EU is the top importer of Russian LNG through pipeline and among the top five importers of crude oil in 2025.

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[7] Consilium, Timeline - EU sanctions against Russia, (2025). https://www.consilium.europa.eu/en/policies/sanctions-against-russia/timeline-sanctions-against-russia/

[8] Jorge Liboreiro. "Russia is waging a 'grey zone campaign' against Europe", 8 Oct 2025. https://www.euronews.com/my-europe/2025/10/08/russia-is-waging-a-grey-zone-campaign-against-europe-warns-von-der-leyen.

[9] The Observatory of Economic Complexity (OEC), Profile: Russia. Visit at https://oec.world/en/profile/country/rus.

The trade between the US and Russia includes fuel, minerals, pharmaceutical raw materials, sensitive medical imaging equipment, and radioactive materials. The US exports to Russia were worth $595mn while Russia's exports to the US were worth $4.87bn in 2023.[10]

While the US's shift in its global trade policy with Russia after Trump's election has caused a disturbance among its strategic partners who have found it difficult to continue their trade policies with Russia, the trade outlook between the two nuclear powers is still quite astounding in 2025. Their economic transactions provide a paradoxical picture especially when the US is urging its strategic partners to abruptly sever trade ties with Russia or face sanctions. The US exported goods worth $52.6mn to Russia while its imports stand at $356mn in July of this year leading to a negative trade balance of 303mn for the US.[11]

Although the top trading partners of Russia have changed especially after its conflict with Ukraine started in February 2022, Europe is the visibly at the losing end.[12] The EU is largely dependent on its energy imports from Russia. Under the 19th sanction package by the EU, the European Commission has drafted new rules under which new contracts with Russia for natural gas will be banned from January 2026, while certain landlocked countries within the union may continue to honor their short- and long-term contracts until the end of 2027. This has evidently hurt Russia's trade outlook with the EU as the EU's dependence on Russian gas has dropped from 45% in 2021 to 18% after 3.5 years of war.[13]

The states engaging in trade with their opponents amid a military conflict is not new according to an MIT political scientist Mariya Grinberg.[14] She states that trade between warring parties comes in variations and is a determinant of boosting one's economy during conflict while capitalizing on the economic dependency of the opponent by not providing a

[10] https://oec.world/en/profile/bilateral-country/usa/partner/rus.

[11] Ibid.

[12] Visit at https://www.euronews.com/business/2025/08/30/what-is-the-current-state-of-eurussia-trade-main-export-and-import-flows-in-2025

[13] https://www.epc.eu/publication/sanctions-190-the-eu-moves-on-lng-circumvention-under-transatlantic-pressures/.

[14] Peter Dizikes review Mariya Grinberg, *Trade in War: Economic across Enemy Lines, MIT News* (28 August 2025). https://news.mit.edu/2025/why-countries-trade-each-other-while-fighting-mariya-grinberg-book-0828.

commodity of equal value in return. However, the trade between Russia and the EU is rather tricky as the EU is largely dependent on energy imports from Russia due to financial factors and the geographical proximity of both complements the EU's climate targets.

EU's energy mix

The EU's energy survival depends on the energy produced within the region and that which it imports from the EU and non-EU members. Therefore, to understand the EU's energy picture clearly, it is important to remember that its total energy mix comprises locally produced energy combined with its energy imports. According to data presented by Europa, the EU produced 42% of its own energy while imported 58% of its total requirement in 2023. The main energy sources of the region include crude oil and petroleum products (37.7%), natural gas (20.4%), renewable energy (19.5%), solid fuels (10.6%), and nuclear energy (11.8%).[15]

The share of the EU member states that contribute in this energy mix according to the above-mentioned sources in 2023 is:

- Petroleum products: Cyprus (86.3%), Malta (85.6%) and Luxembourg (61.1%)
- Natural gas: Italy (34.8%), the Netherlands (29.5%), Hungary (29.1%) and Ireland (28.5%)
- Renewables: Sweden (50.2%) and Latvia (44.7%)
- Nuclear: 39.1% of which is available in France and 28.8% in Slovakia
- Solid fuels: Estonia (53.4%) and Poland (35.5%).[16]

Among this range of energy sources within the EU, renewable energy (hydro, wind, and solar) remained the largest energy source at 46% followed by nuclear energy which was 29%, solid fuels at 17%, natural gas at 5%, and crude oil at 3%[17]. However, the limitation lies in the fact that not all contributors in the EU can produce all kinds of energy and, yet, their consumption and utilization demand other types of energy for production, household, transportation, etc. Therefore, the EU is compelled to import major energy supplies in the form of crude oil and natural gas to continue

[15] Shedding light on energy in Europe – 2025 edition, eurostat. https://ec.europa.eu/eurostat/web/interactive-publications/energy-2025

[16] Ibid.

[17] Ibid.

functioning. For instance, until 2023, Malta could not produce any other form of energy except renewable energy. France produced a significant 72% of total nuclear energy production while Poland, Estonia, and Czechoslovakia's main energy production source was solid fuels like coal, biomass, and firewood. The Netherlands produced the largest share of natural gas at 41% and Denmark topped in contributing crude oil at 30%. Despite looking good in numbers so far, it is the percentage data only representing the total share in capability of production through these respective sources and the energy consumption figures are a completely different story[18].

According to the Center for Research on Energy and Clean Air, the EU has paid around €210bn to Russia in exchange for oil and gas supplies[19]. Russia was exporting 45% of oil and 27% of natural gas requirement of the EU before 2022, which fell to 19% for gas and 3% for oil in 2024[20]. The EU pays around €1.35bn euros to Russia in exchange for oil supplies despite months of iteration, contemplation, and agreements on imposing all out ban on Russian energy imports. The US President while addressing the UN in October 2025 said that he was surprised at how the EU was funding a war against themselves.[21] In the same financial year, the US had paid $356mn to Russia in exchange for various high value commodities.

The future NATO and Europe's strategic freedom

The second Trump administration has constantly urged Europe to enhance their defense contribution in NATO or expect no support from the US in the event of a military conflict. Europe's biggest priority at the moment is to stop this military conflict in the east from penetrating further westwards while also continuously sustain through rising strategic and political temperature.

NATO's birth was a result of the European paranoia of multiple internal and external threats to its security and political principles. We are focused on the purpose of NATO for the European Union as a whole at the moment; therefore, this article studies the external threat of communism vs

[18] Ibid.

[19] "Trump 'Ready' to Sanction Russia if Nato Nations Stop Buying its Oil", *BBC News*, 14 September 2025. https://www.bbc.com/ news/articles/c62zxp1y5lwo.

[20] Duggal. "How much of Europe's Oil and Gas still comes from Russia.

[21] Ibid.

democracy as a context. The ever-present fear of Russia has been fundamental to the existence of an integrated Europe and is considered the biggest threat to its remaining as a democratic, economic, and political community. How this fear serves the actual European purpose is a different debate. Nevertheless, the European Union, despite its unsurmountable fear of the communist threat, could not survive without leaning on Russia for crucial strategic matters that affect its existence and were fundamental to the survival of its people, for example, trade and economy.

The NATO, established in April 1949, is a multilateral transatlantic military and defense agreement whereby the US guaranteed the defense of the European region that entered its cooperation nexus[22]. It functions through direct and indirect contributions of its members. The European allies of NATO agreed in 2006 to contribute 2% of their GDP to the collective defense. Many countries that gradually joined the alliance didn't have strong national defense structures. And, as a matter of fact, while NATO is a blessing for the European region, it has also been regretted in many phases and instances. For example, when Iceland signed up for NATO in 1949, it did not have an army and still does not. In 1966, France, one of the pioneering members of the alliance, chose to withdraw itself. This was perceived as a desire to achieve military independence since France also had achieved the capability to produce nuclear weapons. However, in 2009, France officially returned to NATO's integrated military command under Sarkozy period.[23] During this period, a short-lived European Defense Community was established in 1952 that welcomed with keen interest by several western states to counter the ideological and military penetration of the USSR, but soon it was felt to be redundant and was abandoned[24]. Several non-NATO European countries including France were optimistic about the establishment of the EDC, but, unfortunately, Europe's freedom to have its own defense strategy seemed a fanciful idea[25].

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[22] What is NATO? at https://www.nato.int/en.

[23] "France to Rejoin NATO Command," 15 March 2009. Visit at https://journals.law.harvard .edu/ilj/2009/03/france-rejoins-nato-full-time/.

[24] "When It Comes to Building Its Own Defense, Europe Has Blinked" *The New York Times*, 4 Feb 2023. https://www.nytimes.com/2023/02/04/world/europe/europe-defense-ukraine -war.html.

[25] G. A. Bonifacio. "The Failure of the Proposed European Defense Community and Its Implications on the European Union's Pursuit of Strategic Autonomy", (MA Thesis, Feb 2022). https://vtechworks.lib.vt.edu/server/api/core/bitstreams/11b62af4-a364-4ed9-8574-0096b78631c6/content.

The new challenge to the European NATO allies is posed by the second Trump administration as the President finds that shouldering the weight of European membership costs does not sit well with his "America First" agenda. The US is now insisting NATO members on increasing their annual contribution for the alliance up to 5% of their GDP. This condition has been accepted by NATO allies at the Hague Summit in 2025 and, as the first phase, have committed to up their contribution from 2 % to 3.5% of their GDP by the year 2035[26]. The effects of this raise in defense expenditure will likely trickle down to their economies which are already in frail position due to rising costs of basic commodities and high import bills. The decision to include stable economies like Finland and Sweden into the NATO seems an attempt to assist the idea of improved funding for NATO apart from its eastward expansion. However, it is not only that. One of the major concerns of the European economies is the high energy prices which are further exacerbated at the moment due to heavy sanctions that the EU has been forced to impose on their top trading partner, Russia, which exports phenomenal quantities of energy supplies to the western European block.

The need for Europe to sustain its NATO membership comes at a cost of their freedom to exercise economic decision-making, defense independence, and political sovereignty. Earlier, Canada also showed its distress to remain in NATO[27]. Yet, NATO is undeniably a necessity for countries that have not prioritized on developing their own defense strategy and mechanism. Due to an absence of or a weak defense strategy, NATO's support becomes indispensable for them. Yet, the growing frustration among members is ironically the rising spending that the US demands from them to stay in the alliance. It appears that as difficult it is to become eligible to become a NATO member, it is as impossible to part ways. And, therefore, despite the commitment and will to defend their territory, non-US NATO allies agree to remain susceptible to US's political whims and dominance[28].

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[26] "NATO allies agree to boost defense spending to 5% at The Hague summit", Defence Newa, June 2025. https://www.defensenews.com/global/europe/2025/06/25/nato-allies-agree-to-boost-defense-spending-to-5-at-the-hague-summit/.

[27] Paul McLeary. "NATO is losing patience with one of its own members - and it's not who you think," 7 August 2024. https://www.politico.com/ news/2024/07/08/nato-summit-canada-commitment-00166648.

[28] D. Dunn and M. Webber. "Looking Ahead: Imbalance, Dependency and NATO's Uncertain Future", *Defence Studies* 25, No. 3 (2025). https://doi.org/10.1080/14702436.2025.2474057.

In a scenario where Europe finds itself between a rock and a hard place economically and militarily, it is essential for the European countries to prioritise their independent security strategy and capability and set itself loose from the fraying transatlantic paradigm.

Pressures and loopholes EU's energy strategy

The limitations of engaging in crucial imports from Russia exclusively has thrown the EU into a directionless political and economic perplexity. The EU is braving huge transatlantic pressure to impose sanctions and tariffs on various third-party countries, and a clear economic policy from the EU fails to take shape in the presence of deep loopholes in its energy policy. First, long term import contracts with Russia were geographically logical. The supply time and frequency could be managed easily. Second, dependence on a source in proximity made the products for end users less costly as compared to importing it from a remote source. Third, there was a lower requirement for storage and contingency owing to the presence of infrastructure for suitable supply. And fourth, the price negotiations were much easier prior to Russia's full-fledged invasion of Ukraine. The volatility in the energy policy of the EU being tied to the shift in the US's rhetoric on Kremlin also became heightened by its exemption in supply of pipeline oil and gas for certain countries despite an anti-trade sentiment with a series of sanctions packages since 2022[29].

The pricing disagreements on energy commodities has further precipitated the situation for the region. Hungary and Slovakia have refused to dishonor their long-term supply contracts with Russia. The new cap on Russian oil is non-negotiable for Russia which is a drastic $47.60 per barrel down from $60 before 2022. The US administration continues to accuse Europe of providing a financial edge to Russia in this way.

Trade during war and grey zone campaign

Trade during war holds a significance equivalent to lock and key mechanism. If a country denies the enemy its commodity in exchange for their finance, it tends to give the latter a financial edge against the former[30].

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[29] "Sanctions 19.0: The EU Moves on LNG, Circumvention under Transatlantic Pressures", 3 October 2025. https://www.epc.eu/publication/sanctions-190-the-eu-moves-on-lng-circumvention-under-transatlantic-pressures/.

[30] Mariya Grinberg. *Trade in War: Economic across Enemy Lines,* Review in *MIT News.*

Sanctions in modern statecraft are a critical political tool to establish dominance and global influence, reinforce foreign policy goals, and curtail a culture of violations of global laws to suit one's goals[31].

They can be applied to people falling within a state's jurisdiction or corporations and organizations in a foreign jurisdiction who are engaged in transactions with entities that are sanctioned. Sanctions are classified into two main categories namely, primary and secondary. In a political scenario, sanctions mostly involve economic fencing of interests of foreign entities like a foreign regime or organization, a person or a corporation that behaves in a manner conflicting with a government's global political and economic goals.

However, it is imperative to employ sanctions in a judicious manner to reap long term benefits. There are limitations involved in sanctions for both parties, i.e. the one imposing them and one they are being imposed on. For states to truly receive the benefits of sanctions, there need to be a certain level of economic relations between them and, yet, they come with an economic cost for all stakeholders involved. For instance, the US has established its transatlantic relations with the entire European region on the basis of either imposition or lifting of certain economic, political, and diplomatic sanctions.

According to Rawi Abdelal and Aurélie Bros of the Davis Center for Russian and Eurasian Studies at the Harvard University[32], the "over-use of unilateral economic sanctions as a tool of statecraft, especially in the energy sector, has significantly undermined trans-Atlanticism."

While the US has a phenomenal role in establishing the European Union as it is today, its overuse of sanctions has caused the fraying of trans-Atlantic ties.

Nuclear energy – A permanent solution for Europe?

The adoption of nuclear energy as a national energy source for public use divides the world opinion. The first nuclear plant became operational in

[31] https://www.sanctions.io/blog/primary-and-secondary-sanctions-explained.

[32] R. Abdelal and A. Bros. "Sanctions and the End of Trans-Atlanticism" IFRI (January 2020). https://www.ifri.org/sites/default/files/migrated_files/documents/atoms/files/abdelal_bros_sanctions_trans-atlanticism_2020.pdf.

1954 in Obninsk, Soviet Union. It was constructed purely to generate electricity for public use using enriched uranium and making up to 5000kW of electricity. Following its success, the Soviet Union began to expand their nuclear capability. The second and third nuclear power facilities were opened four years later in Novosibirsk in 1958 with a 100 times greater capacity than the previous and another in Leningrad, with a capacity to generate 2mn kW of electricity. However, this was a time when obtaining nuclear power was globally unregulated and countries were not bound by legal agreements to obtain this capability. Also, it was believed that the Soviet authorities have attempted to divert the world's attention form their nuclear weapons program by establishing nuclear power facilities for public use while they could continue to develop their nuclear weapons discreetly[33]. Despite skepticism, it was a revolution in power engineering and the Soviet initiative demonstrated how nuclear power could be peaceful as well.

Today, at least 13 countries across the world are using nuclear as a source to produce electricity for public use. The decades in between have been spent on deliberating whether such a transition in power engineering and generation would remain responsible, who should and who should not be permitted, and the establishment of IAEA in 1957, defining the thin line between peaceful and military use and saving the world from another nuclear catastrophe. However, the biggest hurdle remained the high cost of building enough nuclear plants to address the rationalized requirements of particular populations. Nevertheless, this high cost of building a nuclear plant is compensated by many factors that the resulting energy produced can cover, for instance, lower energy import bill, low carbon emissions, smoother supply as compared to renewables, economic sovereignty, etc. Currently, France, China, and the US dominate the energy market as they are capable of producing at least one third of their electricity needs through nuclear sources. France has pioneered the nuclear energy production inside the EU and set a positive precedent to the EU's climate goals of cutting down on fossil fuels, emissions, and using clean energy for industry.

[33] L. Schewikart. "Soviet Union Completes Its First Nuclear Power Plant", (2023). https://www.ebsco.com/research-starters/power-and-energy/soviet-union-completes-its-first-nuclear-power-plant.

Europe current nuclear structure

The European region is inhabited by approximately 745 million people. The European Union consists of 27 European states with a commitment to work in cooperation and carry out unrestricted trade. The total EU population is estimated at 450 million. There are non-EU member countries in the region like Switzerland, Norway, the UK, and some Balkan states. As calculated in 2024, the EU electricity production mix was:

- 33% from fossil fuels and biomass
- 24% from nuclear
- 28% from wind and solar
- 15% from hydropower[34]

According to Euronuclear.org in October 2025, Europe has a total of 165 nuclear power reactors in different countries including Ukraine and Russia. Out of these 165 reactors, 9 units in the Asian part of Russia were under construction that held a net capacity of 9,969MWe. The remaining in the European continent have an installed capacity of 147,997MWe[35]. If the 36 reactors of Russia and 15 of Ukraine can be set aside, Europe is still left with 114 functioning nuclear units with 57 of them in France. Germany has 33 nuclear plants but none of them is operational[36]. The EU member states despite having varied opinions about the use of nuclear source as a replacement for energy, the European Commission has been implementing an energy strategy aiming to strengthen and integrate a union wide energy market with five main priorities:

- Enhance security of energy supply
- Build a single integrated energy market
- Increase energy efficiency
- Decarbonize the economy
- Boost research and innovation

[34] Nuclear Power in the European Union Updated Thursday, 10 July 2025. https://world-nuclear.org/information-library/country-profiles/others/european-union.

[35] MWe: Megawatt electric; electric output of a power plant in megawatt. The electric output of a power plant is equal to the thermal overall power multiplied by the efficiency of the plant. The power plant efficiency of light water reactors amounts to 33 to 35% compared to up to 40% for modern coal-, oil- or gas-fired power plants. https://www.euronuclear.org/glossary/mwe/ .

[36] https://www.euronuclear.org/glossary/nuclear-power-plants-in-europe/.

The single electricity market concept faces resistance from several European economies which tows the whole idea of a common nuclear electricity market against the energy transition with lesser emissions[37].

The IAEA is operating since 1957. The agency has earned a universal legitimacy through its role as a "normative and awareness-raising" regulator in enhancing global nuclear security[38]. With a 171-member strength and closely aligned with the UN, the regulator has an important role in raising awareness among young nuclear energy professionals through its comprehensive nuclear safety guidelines. The IAEA claims that there are more than 400 nuclear plants operating in nearly 30 countries across the world. These plants are about 11% of the global electricity needs and it is expected that this number will rise to 39% by 2050. Poland has said that it wants to build a reactor while Belarus will also have two reactors in operation.

The cost of building a nuclear power plant is exorbitant but it is well compensated by the benefits of having one. One kg of uranium can produce 20,000 times more energy than what one kg of coal would produce. The raw material required is cheaper than other fossil-fuel based production plants and the operational costs are also below those of renewables. It can be a very lucrative high-capital investment with production efficient results. The climate safety with nuclear energy production is also more ensured. A nuclear reactor emits around 15-50 gm of CO_2 per KWh it produces, which is 450 gm of CO_2 for natural gas and 1,050 gm CO_2 for coal[39]. Another by-product is steam which is released after the cooling process ensuring a phenomenal cut down in greenhouse gas emissions[40]. It is a continuous and reliable source. The US is reported to have produced its 92% energy through nuclear power in 2021. The amount

[37] Two developments are cutting across the single electricity market concept, both related to ensuring that critical future demand can be met: national capacity markets; and demand response markets. France, Italy, Spain, Portugal, Italy, Greece and Ireland all offer capacity payments of some sort, which are often costly, distort the market, and run counter to the idea of phasing out fossil fuel subsidies in the long term. https://world-nuclear.org/information-library/country-profiles/others/european-union.

[38] Trevor Findlay. "The IAEA's Nuclear Security Role" Discussion Paper, (June 2013). https://www.nti.org/wp-content/uploads/2021/ 09/IAEA_Nuclear_Security_Role_3.pdf.

[39] Visit at https://energytracker.asia/nuclear-energy-advantages-and-disadvantages/

[40] Economics of Nuclear Power Updated Friday, 29 September 2023. https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power .

of emission in producing this amount of energy through traditional fossil fuels would have been tremendous. Therefore, it reduces reliance on fossil fuels.

There are high costs of managing the radioactive waste and this factor is a serious concern in terms of nuclear safety. This waste can cause hazard to biological life for thousands of years and the cost of its safe and recommended disposal is again very high. Hence, the EU is a very apt candidate for nuclear energy transition for a multitude of reasons. First, it is a community comprising comparatively of sounder economies than many other regions. Second, it has a massive amount of infrastructure with nearly 100 nuclear reactors in operational form. Third, it is more cognizant to climate change, therefore, it is expected to use the nuclear power more mindfully and responsibly and in a manner without waning its 2030 low emissions and 2050 net zero goals.

Green Politics and EU's energy policy

The debate inside the EU over the nuclear energy option has entered into a phase of 'Climate Wokeness' with the energy crisis being evermore strong in 2025. The EU parliament is a highly democratic entity with strong political representation from nearly 200 political parties participating through eight political groups. Nearly all these groups have maintained a strong climate change pledge in their vision and mission statements for years. Also, all of these groups strongly support sustainable utilization of natural resources and energy sovereignty of the EU in a way that makes the EU come across as the most climate cognizant region of the world[41]. While the present energy crisis of the EU is playing havoc with the economy in general, it is also likely to throw the EU far behind in its short- and long-term climate change targets. There is also a uniformly strong sentiment among all political parties that the EU must participate in the COP30 with full pride. However, these political parties are divided over major energy transition to nuclear power.

[41] European Parliament, The Political groups of the European Parliament. See https://www.europarl.europa.eu/about-parliament/en/organisation-and-rules/organisation/political-groups.

According to the EU Matrix update last drawn in 2022[42], the parties affiliated with EPP (European peoples Party) and the ECR (European Conservatives and Reformists) networks are advocates of acquisition and increasing nuclear energy capability of the EU. The central and left political forces are however not in sync with this idea and oppose it on fronts like safety, waste management, high costs, and the urgency to meet climate goals. In other words, European countries geographically closer to Russia are more comfortable with nuclear transition than those that are farther away. The divide between the EU members on the nuclear option is based on three main grounds:

- Exorbitant costs of nuclear power infrastructure and fuel procurement
- Subsequent risks of accidents and safety with nuclear materials
- Nuclear waste management

Exorbitant costs of nuclear power infrastructure and fuel procurement

Nuclear infrastructure incurs phenomenally high costs in initial phases. Subsequent operational costs revolve around economic dependency to procure uranium from outside Europe. While the cost factor of initial infrastructure investment is a valid concern for smaller economies, it is also an ongoing struggle for the stronger economies like the US. The uncertainties in the economic viability of basic infrastructure, its scalability, and the technological precariousness all make it challenging for the nuclear options acceptance for weaker economies. Yet, the catch lies in the fact that beyond the initial investment, the benefits come in the form of reliable, uninterrupted, and zero-carbon end product[43]. In its September 2023 briefing to the European Parliament, the European Parliamentary Research Service report has cited a very comprehensive account on the viability of SMRs (Small Modular Reactors)[44]. The report presents some

[42] https://eumatrix.eu/en/blog/nuclear-energy-political-index-where-does-each-party-stand#:~:text=Among%20the%20other%20groups%2C%20the,group%20are%20generally%20pro%2Dnuclear.

[43] https://www.newcivilengineer.com/latest/smrs-most-expensive-of-all-electricity-technologies-per-kw-generation-31-03-2025/#:~:text=Technology-,SMRs%20most%20expensive%20of%20all%20electricity%20technologies%20per%20kW%20generation,of%20electricity%20it%20compared%20against.

[44] European Parliamentary Research Service, "Nuclear Energy in the EU" (September 2023). https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/751456/EPRS_BRI(2023)751456_EN.pdf.

optimistic facts about the unfolding barriers related to the SMR design and costs including, "Globally, there are about 50 SMR designs in various stages of development. According to the IAEA, only four SMRs are close to being deployed, all located in Argentina, China and Russia"[45]. Initially, all technology is expensive but as its efficacy is improved and production made cost effective, its markets ultimately become optimized with supply and demand balance. Therefore, the European concern about the high costs is likely to be settled in near future, particularly because the US is also feeling burdened by it. There is another facet to this situation whereby France has invested in nuclear energy infrastructure and reaped economic benefits in the form of cheap electricity while the rest of the union continued to buy expensive Russian crude and gas and cheaper nuclear electricity from France[46]. It is imperative to fathom the overall bottom line of any major investment like France did. At the moment, it is the largest exporter of electricity within the EU to highly populous countries like Germany, Belgium, and Spain, becoming the cornerstone of the EU energy grid.

The procurement of nuclear fuel is another big concern. For the EU, the most feasible market remains Russia, yet, it is not the dead end. Possibilities of procuring nuclear fuel from another top exporter can be explored. Euratom and TFEU (Treaty on the Functioning of the EU-Article 194(2)[47] together permit the EU members to make their energy choices about nuclear energy independently while staying within the parameters in both the fundamental treaties. Russia is a major producer and exporter of uranium to the world but uranium market is led by Kazakhstan, Canada, Namibia and Australia[48]. The prime exporters of uranium to France in 2022 are[49]:

- Kazakhstan 37%

[45] Ibid.

[46] Brigham Mccown. "Securing Europe's Future", 01 July 2025. https://www.lesrencontres economiques.fr/en/debats-idees/securing-europes-future-frances-pivotal-role-in-energy-security/#:~:text=France's%20energy%20mix%20is%20secured.

[47] "Nuclear Energy in the EU" (September 2023).

[48] Top 10 countries by uranium production, *Development Aid*, 11 April 2025. https://www.developmentaid.org/news-stream/post/193859/top-countries-by-uranium-production.

[49] Visit at https://www.spf.org/iina/en/articles/takahashi_04.html#:~:text=%5B19%5D%20Kazakhstan%20was%20the%20top,%2C%20and%20Uzbekistan%20(13%25).

- Niger 20%,
- Namibia 16%
- Australia 14%
- Uzbekistan 13%

Subsequent risks of accidents and safety with nuclear materials

While major EU governments have shown a strong affinity to the nuclear phase out plans, the Chernobyl and Fukushima nuclear catastrophes have given them cold feet time and again. These countries have failed to change their public opinion about the feasibility of the nuclear energy following these incidents. Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Hungary, Italy, the Netherlands, Poland, and Sweden[50] were signatories of the nuclear phase out plan at one time, strongly advocating to fully unlock the nuclear potential and ease out financing to extend the lifetime of their existing nuclear reactors and provide affordable electricity to their populations. Unfortunately, their governments could not promote it any further due to the paralyzing safety concern. It is important to understand that the Chernobyl incident occurred too early into the nuclear age of its civilian use and Fukushima was technically built on a risky location. The nuclear power engineering has grown far ahead in 2025 with safety, utility, and non-proliferation as its most popular characteristics for countries. The new nuclear projects have precious learnings for precautionary considerations and infrastructure is under constant innovation and modernization.

Nuclear waste management

Euratom assigns each EU member country to develop a comprehensive national policy of safety standards for nuclear power generation, medical, and research purposes. Nuclear waste is classified into three main categories:

- High level waste
- Intermediate level waste
- Low level waste
- Decommissioned sites

[50] https://www.euronews.com/green/2024/04/01/europe-is-divided-on-nuclear-power-which-countries-are-for-and-against-it#:~:text=Belgium%2C%20Bulgaria%2C%20Croatia%2C%20Czechia,safeguard%20energy%20security%20and%20competitiveness%E2%80%9D.

With nuclear capability comes greater nuclear responsibility. To make a commodity a public utility and a source of revenue, national consensus is of great significance. As climate cognizance is a vital characteristic of the EU identity, the necessity of making nuclear phase out a safe event for national economy and public is primary. Euratom provides comprehensive guidelines to manage radioactive waste and France has taken it a notch up by recycling radioactive waste into further nuclear energy production. This provides a strong example for the EU members who question the safety and proper management of nuclear waste in this scenario. France actively purses a fuel cycle that is both safe and sustainable. This has not only minimized the costs of energy production for the country but also reduced the volume of nuclear waste produced at the end of each production cycle, thus cutting down the disposal costs too. According to the French model of nuclear energy production, 96% of the end product is reusable material[51].

Collectively, most of the concerns of the EU members against the nuclear phase out are answered through examples within their present structure of nuclear power production. The individual governments of the member countries need to be made aware of the pros against the cons to find it a unanimously favorable shift. Difficult times lead to difficult decisions. Therefore, it can be hoped that the EU can weigh its options with careful deliberation.

Conclusion

The EU is in financial and strategic fix due to conflict between Russia and Ukraine getting deeper and the Trump administration urging the union to make abrupt changes to its policies. It is crucial for a strategically important region like the EU to be more independent and sovereign in its internal and regional policy matters in order to appear as a dignified global strategic partner. The energy crisis for Europe has become a rather periodic ordeal as a slight commotion in global political climate, disagreements on oil prices, or military endeavors of strategic neighbors can throw the continent's energy equilibrium out of its momentum. In addition, the constant international pressures that Europe endures as a consequence of being a significant portion of the NATO greatly compromises its economic political freedom and coherence. If Europe can end its reliance on fossil

[51] *World Nuclear News*, 8 March 2024. https://world-nuclear-news.org/Articles/France-confirms-long-term-recycling-plans#:~:text=From%20the%20very%20beginning%20of, fuel%20made%20from%20recycled%20uranium.

fuel imports altogether, it can become financially enabled to channel its spending on other public welfare areas like healthcare and food security. Self-reliance in energy through a major transition to nuclear power can also enhance its production capacity and exports output. Although a power engineering transition to nuclear sources is likely to incite heavy opposition from the global community and peace quarters, difficult times, nevertheless, call for difficult decisions.