EU REPower Plan 2022: Reducing Russian Energy Dependence Through Renewables and Energy Security Framework

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Abstract

The REPowerEU initiative (2022–2025) illustrates a strategic transition in the European Union's energy policy, centered on three pillars: energy efficiency, clean energy expansion, and diversification of energy imports. The research highlights the progress in decreasing reliance on Russian fossil fuels and advancing renewable energy deployment. Significant achievements include a marked decline in Russian energy imports and a surge in solar and wind capacity across the EU. Germany's rapid solar rollout underlines effective implementation, while Eastern European states face challenges due to underdeveloped LNG infrastructure, revealing disparities in national readiness and investment. Despite these improvements, the initiative faces structural obstacles such as delayed permitting processes and uneven implementation across member states. REPowerEU has also influenced the EU's geopolitical orientation, reinforcing energy ties with the U.S. and Norway. However, new dependencies particularly on hydrogen and critical raw materials pose long-term strategic risks. Addressing these issues requires streamlined regulatory frameworks, targeted funding to alleviate energy poverty, and proactive measures to manage emerging vulnerabilities. The research presents a subtle insight into REPowerEU's potential to reshape the EU's energy landscape, highlighting the momentum gained and the enduring complexities of achieving a sustainable and resilient energy future.

Key Words*: REPower, EU, Liquid Natural Gas, Energy Security, Emissions.*

Introduction

The year 2022 marked a momentous instant for European energy safety, as Russia's invasion of Ukraine dramatically revealed the vulnerabilities of the European Union's energy infrastructure. The conflict was far from being a localized military operation and initiated a profound reassessment of the EU's reliance on Russian fossil fuels, a dependency that had been cultivated over decades. Before the invasion, the EU imported approximately 40% of its natural gas and 27% of its oil from Russia. This substantial dependence, while economically advantageous, created a strategic vulnerability, allowing Russia to exert considerable political influence through its energy exports. The invasion, therefore, acted as a stark wake-up call, compelling the EU to confront the consequences of its energy dependency and embark on a rapid overhaul of

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https://doi.org/10.58932/MULA0067

its energy policy. The direct repercussions of the invasion included elevated concerns over potential supply disruptions and escalating energy expenses. In response to this crisis, the European Commission unveiled the REPowerEU plan in May 2022. This comprehensive initiative sought to accelerate the EU's transition away from Russian fossil fuels and bolster its energy independence. The REPowerEU plan represents a momentous strategic change, demonstrating a commitment to diversifying energy sources, accelerating the deployment of renewable energy, and enhancing energy efficiency. This plan is not merely a reaction to a singular crisis but a strategic realignment of the EU's energy policy.

The central purpose of this article is to examine the role of the REPowerEU plan in reshaping EU energy policy in the wake of the Ukrainian clash. Specifically, this research will explore how the plan addresses the critical challenges of energy safety and diversification. It is crucial to comprehend the plan's specific strategies and mechanisms to effectively assess its potential influence. The REPowerEU plan outlines a multi-faceted approach, emphasizing the diversification of gas supplies through increased imports of liquefied natural gas (LNG) and the development of alternative pipeline routes. Additionally, the plan prioritizes the accelerated deployment of renewable energy sources, such as solar, wind, and hydrogen, and the implementation of robust energy efficiency measures. These elements contribute to the goal of decreasing reliance on Russian fossil fuels and enhancing the EU's energy resilience.

Moving beyond the central purposes, this study will delve into the specific strategies and potential implications of the REPowerEU plan. The plan's focus on diversifying gas supplies, for instance: involves substantial investments in LNG infrastructure and the installation of new collaborations with alternative suppliers. Similarly, the accelerated deployment of renewable energy sources requires significant investments in research, development, and infrastructure. These initiatives are not without their challenges, including logistical hurdles, technological limitations, and economic considerations. Furthermore, the enhancement of energy efficiency measures necessitates a comprehensive approach, encompassing building renovations, behavioral changes, and the adoption of energy-efficient technologies.

To thoroughly understand the potential effect of the REPowerEU plan, it is crucial to evaluate the broader geopolitical context. The plan's success hinges not only on its technical and economic feasibility but also on its ability to navigate the complex geopolitical landscape. The EU must develop new alliances, address potential conflicts of interest, and guarantee the long-term sustainability of its energy supply chains. By analyzing the REPowerEU plan within this broader context, this research seeks to provide a comprehensive assessment of its potential to reshape EU energy policy and improve the region's energy safety. This research will help understand the effectiveness of the REPowerEU plan, and if the plan is reaching its intended goals.

Research Deesign and Methodology

This study employs a qualitative case study approach to examine the European Union's REPowerEU initiative (2022–2025), chosen for its ability to provide rich, contextual insights into complex policy processes. By focusing on the initiative within its real-world setting, the research explores its goals, strategies, and early impacts while accounting for the geopolitical and policy context. The methodology integrates primary sources, such as official EU policy documents and related frameworks like the European Green Deal, with secondary sources including reports from the IEA, academic literature, and Eurostat statistics. This combination ensures a comprehensive analysis through triangulation, enabling a nuanced understanding of REPowerEU's implementation and challenges.

Conceptual Framework: Energy Security Theory

The concept of energy security has developed immensely over time, moving beyond a limited focus on the uninterrupted physical availability of energy resources to encompass wider dimensions such as affordability, accessibility, environmental sustainability, and resilience to various threats (Kruyt et al., 2009; Sovacool, 2011). Traditionally, energy security was primarily concerned with supply-side risks, such as the depletion of fossil fuel reserves or disruptions due to geopolitical instability in producing regions (Bohi & Toman, 1996). However, contemporary understandings acknowledge the increasing importance of demand-side factors, including energy efficiency and demand management, as well as the integration of renewable energy sources into the energy mix (Chester, 2010).

Furthermore, the theoretical terrain of energy safety has been shaped by multifarious schools of thought. Realist perspectives often emphasize the role of states and the pursuit of national interests in securing energy supplies, viewing energy as a strategic resource and a potential source of power. Liberal institutionalism, on the other hand, emphasizes the importance of international cooperation, market mechanisms, and the development of robust regulatory frameworks to enhance energy security through interdependence and the creation of shared norms. More recently, critical perspectives have occurred, focusing on social, environmental, and justice implications of energy systems, advocating for a shift towards more sustainable and equitable energy futures (Bridge et al., 2013; Goldthau, 2012). These diverse theoretical lenses offer valuable frameworks for analyzing the EU's energy policy choices and their implications for energy security.

5A 's' of Energy Security

The 5A's of Energy Security represent five critical dimensions that collectively ensure a reliable, affordable, and sustainable energy supply. These are Availability, Accessibility, Affordability, Acceptability, and Adaptability.

Table 1: *5A's of Energy Security*

Component	Definition	Key Aspects
Availability	Relates to the continuous presence of adequate energy supplies to meet current and future demand	Diversification of energy sources
Accessibility	Concerns the ability to obtain and distribute energy resources regardless of geographical, political, or technical barriers	Infrastructure development (pipelines, grids)
Acceptability	Addresses the environmental and social sustainability of energy systems	Compliance with environmental regulations
Affordability	Relates to the economic dimension of energy, ensuring that energy costs remain reasonable for both consumers and industries	Price stability mechanisms
Adaptability	The ability of energy systems to respond to changing conditions, disruptions, and emerging challenges	Grid resilience to extreme weather events

Source: Sovacool, & Mukherjee, 2017; Cherp, & Jewell, 2014).

EU Energy Policy Evolution

The EU's energy policy has undergone a substantial transformation over the decades, compelled by a convergence of factors including market liberalization, climate change concerns, and geopolitical events (Egenhofer & Behrens, 2016). Before the REPowerEU initiative, the EU's energy policy was considerably shaped by the goals of creating a single energy market, promoting energy efficiency and renewable energy sources, and ensuring the security of supply within the broader context of its climate action goals, most notably through the "Fit for 55" package and the European Green Deal (European Commission, 2019).

The Fit for 55 package, launched in 2021, aspired to modify the EU's climate, energy, and transport-related legislation to align with the target of decreasing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels (European Commission, 2021). This comprehensive set of suggestions included measures to boost renewable energy deployment, enhance energy efficiency in buildings and transport, and strengthen the EU's Emissions Trading System (ETS).

Similarly, the European Green Deal, revealed in 2019, provided a roadmap for attaining climate neutrality by 2050, with energy policy playing a central role in decarbonizing the economy through investments in clean technologies and the phasing out of fossil fuels (European Commission, 2019). These pre-2022 initiatives highlighted the EU's obligation to a dual agenda of climate mitigation and a gradual transition towards a more sustainable energy system. However, the terrain of EU energy policy underwent

a substantial transformation following the escalation of geopolitical uncertainties in 2022. The focus increasingly shifted towards energy autonomy and decreasing the EU's reliance on external, particularly Russian, fossil fuel supplies (European Commission, 2022). This pivot was driven by the need to guarantee the security of supply in the face of potential disturbances and to mitigate the economic and political leverage exerted by dominant energy exporters. The urgency of this goal led to the adoption of measures sought to diversify energy sources and accelerate the deployment of indigenous renewable energy capacity, marking a notable recalibration of the EU's energy policy priorities.

EU-Russia Energy Relations

The energy relationship between the EU and Russia has been illustrated by a long history of interdependence, with Russia functioning as a major supplier of oil, natural gas, and coal to the European market (Pirani, 2011; Stern, 2006;). This dependence evolved over decades, driven by geographical immediacy, established infrastructure, and the cost-competitiveness of Russian fossil fuels. While this interdependence provided a degree of stability and predictability for both sides, it also created vulnerabilities for the EU, particularly regarding the safety and dependability of Russian energy supplies, as well as Russia's potential use of energy as a geopolitical tool (Goldthau, 2008; Smith, 2013). Academic publications have proposed diverse expositions of the EU's diversification plans before 2022. Some scholars asserted that the EU's efforts to diversify its energy sources and routes were often slow, fragmented, and hampered by conflicting national interests and insufficient investment (Loughran, 2011; Monaghan, 2016). Others suggested the challenges of finding reliable and cost-effective alternatives to Russian gas, emphasizing the boundaries of existing infrastructure and the geopolitical complexities associated with alternative suppliers (Huber & Nowag, 2016). These critiques often emphasized the deeply entrenched nature of the EU-Russia energy relationship and the substantial hurdles in achieving genuine diversification.

Data Analysis and Discussion

Navigating the Multifaceted Landscape of REPowerEU

The REPowerEU Plan, launched by the European Commission in May 2022 as a direct response to Russia's invasion of Ukraine and its weaponization of energy supplies, represents a transformative strategy to fundamentally reshape Europe's energy landscape. This comprehensive initiative stands on three interconnected pillars: achieving substantial energy savings, accelerating the deployment of clean energy production, and pursuing aggressive supply diversification. The plan emerged from the urgent need to phase out dependency on Russian fossil fuels while simultaneously accelerating the green energy transition, thereby addressing both geopolitical vulnerabilities and climate imperatives. According to the European Commission, REPowerEU has mobilized close to €300 billion in funding, with the Recovery and Resilience Facility (RRF) at the heart of this financial architecture. (Borsukiewicz, 2023).

Three years after its implementation, the EU has successfully met most of its ambitious short-term targets and is now on track to completely eliminate Russian fossil fuels while continuing to pursue its green transition objectives. This analysis examines the implementation of REPowerEU from 2022 to August 2025, integrating quantitative assessments with qualitative observations of emerging geopolitical realities. The plan has not only safeguarded EU citizens and businesses from energy shortages but has also supported Ukraine by weakening Russia's financial capabilities, accelerated the clean energy transition, and contributed to stabilizing energy prices after the dramatic peaks witnessed in 2022. This research evaluates policy implementation from 2022 to 2025, integrating quantitative benchmarks with emerging geopolitical realities.

Pillar 1: Energy Savings and Efficiency Targets – Structural Reforms and Regional Disparities

The EU's enhanced binding target to reduce energy consumption by 13% by 2030 (compared to 2020 projections) has driven substantial regulatory reforms across multiple sectors. By August 2025, energy efficiency improvements in buildings and industries have cut primary energy consumption by approximately 9%, putting the EU on track to meet its interim targets, though progress remains uneven across member states . The revised Energy Efficiency Directive, agreed by co-legislators in September 2023, increased the ambition for EU countries to collectively ensure an additional 11.7% binding reduction in final energy consumption by 2030, compared to the projections of the EU reference scenario 2020 . This "energy efficiency first" principle has become a cornerstone of EU energy policy, requiring member states to consider energy efficiency in all relevant policy and major investment decisions. (Enescu, & Szeles, 2023).

- **Building Retrofit Programs**: Germany leads in large-scale building retrofits, cutting energy use by 12% through comprehensive upgrades of about 1.2 million homes, supported by a €6.2 billion budget that expanded in 2024 to fund 335,000 individual renovations. Denmark has replaced over 21,200 oil and gas heating systems with heat pumps or district heating, while France supports energy renovations in 1.45 million households (700,000 already aided) and 40,000+ social housing units. (European Commission, 2022).
- **Regional Disparities**: Southern and Eastern Europe lag with only 5-7% energy reductions due to funding and administrative issues. Romania renovates 3.2 million m² of apartments and 2.3 million m² of public buildings, backing over 120,000 solar panel installations and 30,000 efficiency upgrades. Bulgaria commits to upgrading 3.6 million m² of residential and 1.4 million m² of non-residential buildings, and Croatia supports 1.9 million m² of renovations, including earthquake-affected structures. (Kete, 2023).
- **Infrastructure Investments**: An €800 million investment in cross-border infrastructure, smart grids, and digital systems cut transmission losses by 15% in Western Europe but meets only 40% of Central Europe's projected needs, underscoring funding disparities. (European Commission, 2022). From August

2022 to January 2025, the EU cut gas demand by 17% (70 bcm/year), surpassing a 15% target, bolstering energy security and aiding gas storage refilling to avoid blackouts during winters.

Table 2: *Energy Efficiency Progress Across Selected EU States (2022-Aug 2025)*

Country	Reduction in Energy Consumption	Key Initiatives
Germany	12%	Comprehensive renovation program with €6.2 billion budget
France	10%	Support for 1.45M households, 40K social housing units
Denmark	11%	Replacement of 21,200 oil burners and gas furnaces
Romania	7%	Renovation of 3.2M m² multi-family buildings
Bulgaria	6%	Renovation of 3.6M m² residential buildings
EU Average	9%	Combined efficiency measures

Source: Katinas, 2025

Pillar 2: Clean Energy Production Surges - Remarkable Growth Amid Persistent Challenges

Renewable energy capacity has experienced exponential growth across the European Union, with solar and wind installations increasing by a remarkable 36% since 2021. By Q1 2025, renewables account for 38% of the EU's energy mix, rapidly approaching the ambitious 42.5% target set for 2030 (with an aspiration to reach 45%) . This accelerated deployment has been facilitated by significant regulatory reforms, including the revision of the Renewable Energy Directive that entered into force in November 2023, and substantial public and private investments mobilized through the REPowerEU framework.

- **Solar Energy Expansion**: Solar capacity surged to around 420 GW in 2024, a 90% rise since 2021, driven by initiatives like Germany's Solarpaket subsidies and Spain's faster permitting, which cut approval times by up to 40%. (FIIA. (2022). The EU installed nearly 338 GW of new solar capacity, with solar and wind together surpassing gas electricity production in 2022, and wind alone overtaking gas in 2023. (Márquez Sobrino, Díaz Cuevas, Pérez Pérez, & Gálvez Ruiz, 2023).
- **Wind Energy Challenges**: Offshore wind faces delays, with only 60% of the 60 GW target reached by 2025 due to supply chain issues, complex permits, and rising costs. Permitting delays remain the biggest barrier, prompting EU infringement actions against non-compliant countries. Germany exemplifies faster permitting, approving 15 GW of onshore wind in 2025—seven times the amount five years earlier—by using Overriding Public Interest laws to reduce legal challenges.
- **Financial mobilization**: The European Investment Bank supports clean energy with a €5 billion package helping banks issue guarantees for wind manufacturers,

catalyzing €80 billion in investments and 32 GW of new wind capacity. Other major loans include €1 billion to Naturgy (Spain), €243 million to ERG (Italy, France, Germany), and €400 million to ČEZ (Czech Republic) for grid upgrades.

Table 3 : *Renewable Energy Capacity Growth and Targets (2021-2030)*

Energy Source	2021 Capacity	2024 Capacity	2030 Target	Progress Status	Key Challenges
Solar PV	220 GW	420 GW	592 GW	On track	Grid integration, storage
Wind	190 GW	234 GW	510 GW	Not on track	Permitting, supply chains
Biomethane	3.5 bcm	8.2 bcm	35 bcm	Not on track	Investment, feedstock
Renewable Hydrogen	<0.1 mt	0.3 mt	20 mt	Not on track	Electrolyzer capacity

Source: KPMG International, 2022.

Pillar 3: Diversification and LNG Partnerships - Reshaping Europe's Energy Supply Map

The EU has made remarkable progress in reducing its dependence on Russian energy imports, particularly in the natural gas sector. Russian gas imports have plummeted from 155 bcm in 2021 to just 52 bcm in 2024, with the share of Russian gas in total EU imports dropping from 45% to 19% . (Helm, 2022). This reduction has been achieved through a combination of EU sanctions, voluntary demand reduction measures, and successful diversification of supply sources. The EU's coordinated approach through the EU Energy Platform and its demand aggregation mechanism 'AggregateEU' has been instrumental in this achievement, pooling gas demand from European companies and matching it with competitive supply offers from the global market .

- **LNG Infrastructure Expansion:** The EU has expanded LNG import capacity by 40%, driven by investments like Poland's Świnoujście expansion and Italy's Adriatic hub, raising capacity to 50 bcm per year by May 2024 and projected to reach 70 bcm by year-end. Numerous new floating storage and regasification units (FSRUs) commissioned recently have enabled increased LNG imports mainly from the U.S. (45%), Norway (20%), and Qatar (18%), reshaping the EU's energy supply.
- **Persistent Vulnerabilities:** However, Eastern Europe still faces infrastructure gaps, with Bulgaria and Slovakia dependent on Russian gas via TurkStream, illustrating fragmented EU energy solidarity and the need for more interconnectors and reverse flow setups. In 2024, 10 EU countries imported Russian gas, 3 imported Russian oil, and 7 imported enriched uranium or uranium services from Russia. To address this, the May 2025 REPowerEU Roadmap sets actions to eliminate Russian energy imports entirely. (Relich, 2024).
- **Regulatory Measures:** The Roadmap mandates banning Russian gas imports under new and spot contracts by end of 2025, and under long-term contracts by end of 2027.

Member states must submit detailed national plans by March 2026 for phasing out Russian gas and oil imports. Transparency is enhanced via mandatory disclosure of Russian gas contracts and systematic information exchange among customs, authorities, and the Commission.

Table 4: *EU Natural Gas Import Sources (2021 vs. 2024)*

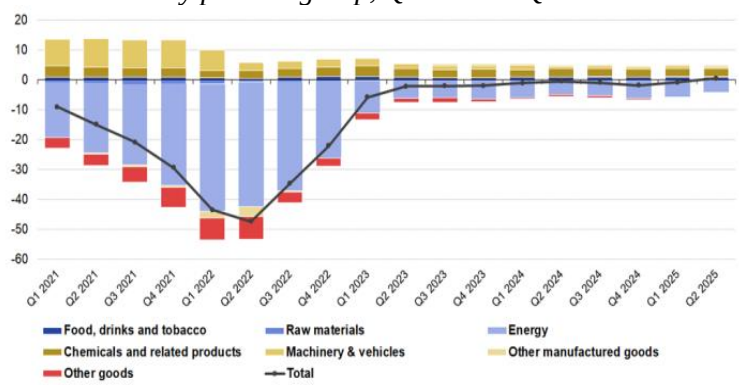
Source Country	2021 Import	2024 Import	Volume Change	Key Infrastructure Developments
Russia	45%	19%	-103 bcm	TurkStream continuation
Norway	24%	31%	+22 bcm	Pipeline expansions
USA	6%	25%	+59 bcm	Increased LNG terminals
Algeria	8%	11%	+12 bcm	Trans-Med pipeline optimization
Qatar	5%	9%	+21 bcm	LNG contract expansions
Others	12%	5%	-11 bcm	Various

Source: Siddi, 2024

Progress Assessment: Achievements vs. Structural Barriers

Reduction in Russian Dependence: The EU's rapid diversification has reshaped energy trade dynamic. Since 2022, the EU has accelerated efforts to reduce reliance on Russian energy, spurred by geopolitical tensions. Prior to 2022, Russia supplied over 40% of the EU's natural gas and 27% of its oil. By 2023, however, Russian gas imports plummeted to just 8%, with LNG imports from the U.S. and Norway compensating for 39% of the gap. The REPowerEU strategy, aiming to phase out Russian fossil fuels by 2027, has driven this shift, supported by a €300 billion investment in renewable energy and infrastructure. This transition aligns with broader energy diversification. By 2025, EU renewable capacity is projected to reach 1,200 GW, covering 45% of energy demand, up from 22% in 2021. Simultaneously, Russian oil imports fell to 450,000 barrels per day (bpd) in 2023—down from 2.2 million bpd in 2021—due to sanctions and alternative suppliers like Saudi Arabia and Kazakhstan.

Figure 1: *EU - Russia trade balance by product group, Q1 2021 to Q2 2025.*



Source: Eurostat, 2025

Economic sanctions have further strained Russia's energy revenue, which dropped by 24% in 2023. The 13th sanctions package (2024) targets LNG and dual-use tech, aiming to cut remaining energy ties. While challenges like infrastructure delays persist, the EU's LNG import capacity is set to expand by 35% by 2025, reducing vulnerabilities. This multi-pronged approach underscores Europe's strategic pivot toward energy security and decarbonization.

Renewables Growth and Grid Limitations: While solar and wind expansion exceeded expectations, grid modernization lags. Over 50 GW of renewable capacity faced curtailment in 2024 due to insufficient storage and transmission lines, costing €12 billion in lost generation . The TEN-E framework has prioritized 18 hydrogen corridors, but only 20% are operational, delaying the phase-out of natural gas in industries .

Permit Delays and National Disparities: Permitting timelines for wind farms averaged 9 years in 2023, down from 12 years in 2021 but still far exceeding the EU's 2-year target . Southern Europe streamlined approvals through "go-to zones" for renewables, but Poland and Hungary rejected centralized planning, citing sovereignty concerns. (Siddi, 2023).

Navigating the Multifaceted Landscape of REPowerEU: Building upon the foundational analysis of REPowerEU's policy components, progress assessment, and overarching challenges, this section delves deeper into specific case studies that illuminate the divergent pathways of implementation across the European Union. Furthermore, it provides a more granular examination of the evolving geopolitical implications, including both the strengthening of new alliances and the emergence of potential long-term vulnerabilities. Finally, this section synthesizes the key findings, identifies persistent structural and geopolitical constraints, and proposes policy recommendations to enhance the effectiveness and equity of the REPowerEU initiative. To further illustrate the complexities and nuances associated with the implementation of REPowerEU, it is crucial to examine specific case studies of individual EU member states, highlighting both successes and persistent challenges.

Germany's Solar Acceleration: A Model of Policy Alignment

Germany's solar acceleration under the Solarpaket (2022) exemplifies effective policy alignment within the context of the EU's REPowerEU strategy. The REPowerEU initiative emerged as a rapid response to the energy security crisis precipitated by the Russia-Ukraine conflict. Germany's Solarpaket introduced strategic measures designed to transform the renewable energy landscape.

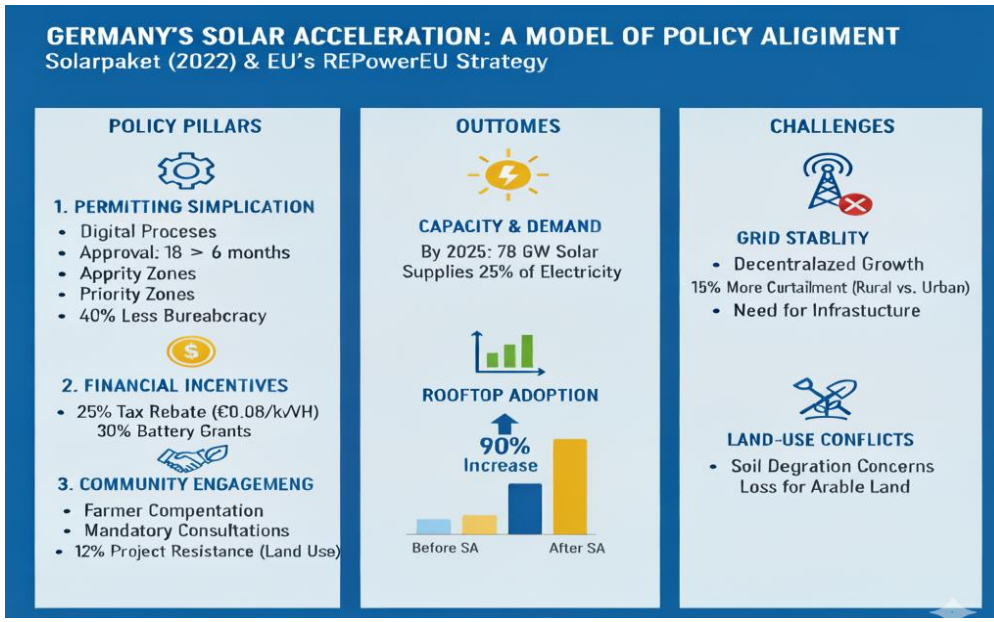
- **Permitting Simplification: Streamlining Regulatory Processes:** The first pillar of the Solarpaket focused on reducing bureaucratic bottlenecks. By digitizing application processes, the German government slashed approval timelines from 18 months to just 6 months. Furthermore, the designation of "priority zones" for solar projects in low-conflict areas further accelerated project deployment. These measures reduced bureaucratic processes by 40% between 2022 and 2025, significantly expediting project timelines. (Clean Energy Wire, 2023).

- **Financial Incentives: Fueling Adoption:** The second key component involved creating financial incentives to encourage solar adoption. Homeowners and businesses benefited from a 25% tax rebate for residential solar installations, feed-in tariffs guaranteeing €0.08/kWh for surplus energy, and grants covering 30% of battery storage costs. This combination of incentives made solar investments more attractive, leading to a 90% increase in rooftop solar adoption. This dramatic increase is also shown in the bar chart.
- **Community Engagement: Addressing Land-Use Conflicts:** Recognizing potential conflicts over land use, the Solarpaket included community engagement measures. Compensation schemes were introduced for farmers leasing land for solar farms, alongside mandatory community consultations, particularly in Bavaria. Despite these efforts, 12% of utility-scale projects faced resistance due to concerns about soil degradation and the loss of arable land. This underscores the inherent tensions between renewable energy expansion and agricultural preservation, highlighting the necessity of inclusive planning processes. (RWTH Aachen, 2023).
- **Outcomes and Challenges: Capacity, Demand, and Grid Stability:** By 2025, these comprehensive measures had propelled Germany's solar capacity to 78 GW. This capacity enabled solar energy to supply 25% of the nation's electricity demand. The rapid, decentralized growth, however, introduced new challenges. Grid stability has become a concern, with rural regions experiencing 15% more curtailment than urban areas. The disparity underscores the need for further investments in grid infrastructure and smarter energy management systems. This challenge needs to be addressed to fully harness the benefits of distributed solar generation.
- **Lessons for Energy Transition:** Germany's experience illustrates how integrated policy design—combining regulatory reform, financial support, and community involvement—can drive rapid renewable energy deployment. While it also highlights the need to carefully manage the energy transition to balance technological progress with social and infrastructural realities, this will ensure both sustainability and public acceptance. This integrated approach serves as a valuable lesson for other nations pursuing ambitious renewable energy goals. (Di Carlo, Hassel, & Höpner, 2023). Figure 2 below illustrates how Germany's Solarpaket (2022) accelerated solar deployment through permitting reform, financial incentives, and community engagement, boosting rooftop adoption by 90% and lifting capacity to 78 GW by 2025. It also highlights challenges such as grid stability and land-use conflicts that require infrastructural and social solutions.

Eastern Europe's LNG Infrastructure Gaps: A Tale of Delays and Dependency

Eastern Europe's struggle to diversify energy sources, particularly in the context of REPowerEU, highlights systemic challenges that hinder the region's energy transition and prolong its reliance on Russian gas. The EU's broader strategy seeks to bolster energy security and independence among member states but faces significant hurdles in Eastern Europe.

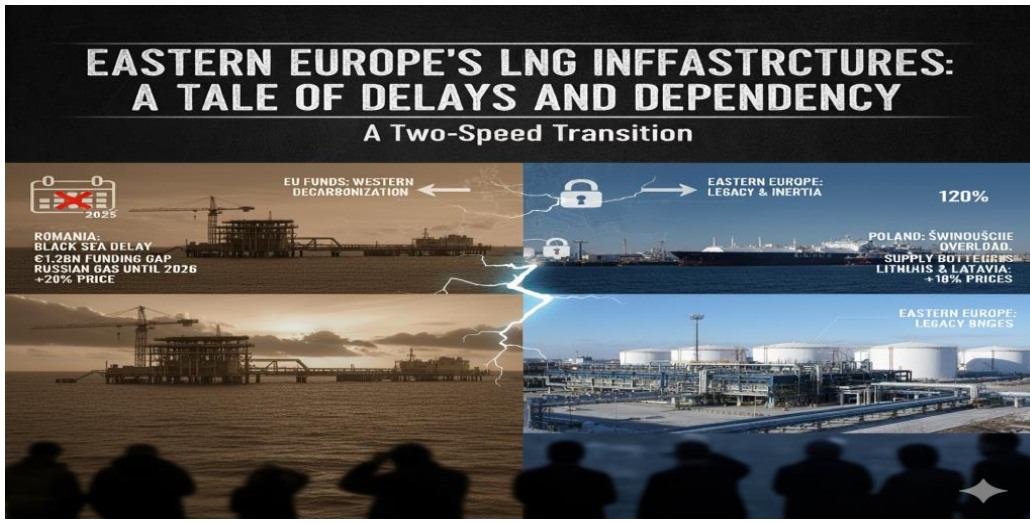
Figure 2: *Germany's Solar Acceleration: A Model of Policy Alignment*



Source: Made by the researcher

- **Romania's Black Sea LNG Terminal Delay: A Cascade of Challenges:** Romania's Black Sea LNG Terminal project, initially slated for completion in 2024, faced a two-year setback due to a confluence of factors, including a €1.2 billion funding shortfall, environmental lawsuits, and technical complexities related to deep-water construction. This delay has forced Romania to continue relying on Russian gas via Bulgaria's TurkStream pipeline until 2024, incurring a 20% price premium compared to its EU peers. The project exemplifies the multifaceted challenges hindering Eastern European nations from achieving energy independence. (Kovacevic, 2017).
- **Poland's Świnoujście Terminal Overload: Straining Regional Supply Chains:** In contrast to Romania's delays, Poland's Świnoujście Terminal has been operating at 120% capacity since 2023, indicating a different set of challenges. While the terminal's high utilization rate demonstrates Poland's commitment to diversifying gas supplies, it has also resulted in supply chain bottlenecks that have inflated LNG prices in neighboring Lithuania and Latvia by 18%. The limited number of interconnectors with neighboring states has exacerbated these shortages, highlighting gaps in regional solidarity and infrastructure. This situation underscores the need for enhanced regional cooperation and infrastructure development to ensure a more resilient energy supply across Eastern Europe. (Gritz, & Wolff, 2024).

Figure 3: *Germany's Solar Acceleration: A Model of Policy Alignment*



Two-Speed Transition: Disparities and Political Realities

These disparities underscore a "two-speed transition," where Western members are leveraging EU funds for rapid decarbonization, while Eastern states grapple with legacy infrastructure and political inertia. The political context within each member state often plays a crucial role, with varying degrees of commitment to EU energy policies and differing priorities in energy security. This creates a fragmented landscape where the benefits of REPowerEU are not uniformly distributed, leading to continued vulnerabilities in the Eastern region.Geopolitical Implications: Alliances, Risks, and Vulnerabilities. (Weiner, Kotek, & Takácsné Tóth, 2024). Figure 3 below highlights Eastern Europe's slow and uneven LNG transition, where delays like Romania's Black Sea project and Poland's terminal overload maintain dependency on Russian gas. It shows how funding gaps, infrastructure bottlenecks, and rising prices contrast with faster Western EU decarbonization, underscoring a two-speed energy shift.

Strengthened Partnerships with the U.S. and Norway: Beyond Energy Trade

- **U.S.-EU Energy Council**: Established in 2023, this body coordinates not only LNG trade but also joint ventures in green hydrogen and rare earth mining. For instance, the U.S. firm Plug Power's €500 million investment in Spanish hydrogen electrolyzers (2024) exemplifies transatlantic tech collaboration.
- **Norway's Strategic Role**: Beyond supplying 30% of EU gas, Norway's partnership in the *Northern Lights* carbon capture project (storing 1.5 million tonnes of CO_2 annually by 2025) and its offshore wind investments in the Baltic Sea highlight a shift from hydrocarbon dependency to climate-driven alliances. (Di Bella, Flanagan, Foda, Maslova, Pienkowski, Stuermer, & Toscani, 2022).

Hydrogen Dependency Risks: Replicating Past Mistakes?

- **Green Colonialism Concerns**: In North Africa, EU-funded hydrogen projects, such as Morocco's €10 billion *Desert Bloom* initiative, prioritize exporting green hydrogen to Europe over local needs. Only 15% of output is reserved for domestic use, risking energy access disparities.
- **Algeria's State Control**: Mirroring past gas disputes, Algeria's mandate for state-owned Sonatrach to oversee all hydrogen exports has led to contract renegotiations, delaying the *H2Med* pipeline's launch to 2027. This echoes the 2021 gas price renegotiations, highlighting recurring sovereignty clashes. (Hamouchene, 2025).

Long-Term Vulnerabilities: Critical Minerals and Authoritarian Leverage

- **China's Rare Earth Dominance**: The EU imports 60% of its rare earths (e.g., neodymium for wind turbines) from China. The 2023 Critical Raw Materials Act aims to diversify sources, but domestic mining faces hurdles: Sweden's Norra Kärr lithium project, delayed until 2038, faces opposition over Sami land rights.
- **Hydrogen Supply Chains**: Reliance on Gulf states for ammonia-based hydrogen transport (e.g., Qatar's 2024 deal for 2 million tonnes annually) risks replicating gas dependency dynamics, compounded by geopolitical instability in the Strait of Hormuz. (Zhang, 2023).

Synthesis: Balancing Ambition and Realism in the EU's Energy Transition

The ambitious goals of the REPowerEU plan are increasingly tested by persistent structural constraints and glaring equity gaps among member states. While the collective vision for energy independence is clear, the path forward reveals a complex struggle between unified ambition and divergent national realities, requiring a careful balance of pressure and support.

Structural Constraints and Equity Gaps

- **Insufficient and Inequitable Funding Mechanisms:** A primary obstacle is the mismatch between financial resources and actual needs, particularly in Eastern Europe. While the EU's €800 million infrastructure fund provides a foundation, it falls drastically short, covering less than 30% of the identified modernization requirements for Eastern European member states. This funding gap delays critical projects, such as the upgrades to Bulgaria's gas storage facilities, which are essential for regional energy security. In response to this shortfall, a proposed REPowerEU Bond has gained traction in 2025, with projections suggesting it could mobilize up to €300 billion by 2030. This mechanism is specifically designed to target investments in lagging regions, aiming to prevent a permanent economic and energy divide within the Union. (European Commission, 2025).
- **The Enduring Tension Between National and Collective Priorities:** This financial disparity is compounded by political resistance to centralized governance. The bloc's unity is frequently challenged by member states

prioritizing national sovereignty over collective action. A stark example was Hungary's 2023 veto of EU-wide gas-sharing agreements, a move justified on grounds of national interest. Similarly, Poland's continued reluctance to accelerate its coal phase-out schedule, currently set for 2040, directly clashes with the EU's net-zero trajectory. These conflicts underscore the difficulty of implementing a homogeneous energy policy across a politically diverse continent and highlight the need for more flexible, incentive-based frameworks.

- **The Persistent Scourge of Energy Poverty:** The consequences of these disparities are most acutely felt by citizens, with Southern and Eastern Europe bearing a disproportionate burden. As of mid-2024, countries like Greece and Romania continued to report energy poverty rates hovering around 30%, a figure that remains largely unchanged according to the EU's Energy Poverty Observatory dashboard updated in July 2025. National measures, such as Italy's Social Bonus program which reduces bills by 20% for low-income households, offer crucial but fragmented relief. The lack of an EU-wide standardized approach leads to a postcode lottery of support, undermining the principle of a just transition and leaving millions of citizens vulnerable to energy price shocks. (Gaspar, & Petrescu, 2024).

Policy Recommendations: Bridging Gaps and Mitigating Risks

To address these interconnected challenges, policymakers must adopt a more targeted and assertive strategy. The following recommendations aim to bridge the existing gaps while mitigating future risks.

- **Implement Accelerated and Binding Permitting Reforms:** The current variability in approval timelines remains a critical bottleneck. The EU should move beyond guidelines to mandate binding 18-month approval caps for renewable energy projects. To ensure compliance, this policy could be tied to EU funding, with financial penalties for non-compliant states. This creates a direct incentive for governments to streamline their bureaucratic processes, unlocking the rapid deployment of clean energy. (International Energy Agency, 2025).
- **Forge Equitable Hydrogen Partnerships to Avoid Neo-Colonialism:** As the EU looks to import green hydrogen from outside its borders, it must learn from past mistakes. Future agreements must integrate mandatory "local benefit clauses" to ensure host communities are not merely extraction zones. A promising model is the 2025 EU-Tunisia agreement, which piloted a requirement that 30% of hydrogen production serves local energy and industrial needs. This approach fosters sustainable development in partner countries and secures more stable, equitable long-term supply chains. (Kowalski, 2024).
- **Prioritize Critical Mineral Diplomacy and Circular Economy Measures:** Reducing strategic dependencies is paramount. The EU must fast-track strategic trade pacts with reliable partners like Canada (for lithium) and Australia (for cobalt) to diversify away from China, which currently dominates the supply of

rare earths. Concurrently, the bloc must aggressively fund recycling initiatives. The recently launched Circular Materials Fund in early 2025 aims to boost recycling rates, with a target of cutting raw material demand for key technologies by 40% by 2035. This two-pronged approach of securing new sources while maximizing the value of existing materials is essential for long-term energy security. (Stavridou, 2025).

Conclusion: Navigating the Path Towards a Resilient and Sustainable European Energy Future

The REPowerEU plan represents a pivotal and accelerated strategic shift in the European Union's energy policy, fundamentally driven by the geopolitical upheaval following Russia's invasion of Ukraine. This analysis, covering the period from 2022 to 2025, demonstrates that the initiative has been largely successful in achieving its immediate objective: drastically reducing the EU's dependency on Russian fossil fuels. The bloc has made remarkable progress through a three-pillar strategy focusing on energy savings, a rapid scale-up of renewable energy, and aggressive supply diversification. The surge in solar and wind capacity, coupled with a strategic pivot towards LNG imports from the United States and Norway, has reshaped Europe's energy landscape more rapidly than many anticipated, enhancing short-term energy security and stabilizing markets.

However, this journey has also exposed significant and persistent challenges that threaten the long-term sustainability and equity of the energy transition. The implementation of REPowerEU reveals a "two-speed Europe," where member states like Germany have rapidly advanced their renewable agendas, while Eastern European countries grapple with legacy infrastructure, funding gaps, and political inertia. This disparity is not merely technical but has real socio-economic consequences, as seen in the persistently high rates of energy poverty in Southern and Eastern Europe. Furthermore, the rapid deployment of renewables is straining existing grid infrastructure, leading to costly curtailment, while protracted permitting processes continue to hinder projects, particularly in wind energy.

Looking ahead, the EU must navigate new strategic risks to avoid repeating past mistakes. The push for green hydrogen and critical raw materials, essential for decarbonization, carries the danger of creating new dependencies on authoritarian regimes or fostering "green colonialism" in partner countries. The concentration of critical mineral supply chains, particularly with China, presents a clear vulnerability. Therefore, the success of REPowerEU cannot be measured by the reduction of Russian gas alone; it must be judged by the EU's ability to build a resilient, integrated, and just energy system.

Finally, REPowerEU has provided the necessary momentum, but the path to a truly secure and sustainable energy future requires deeper structural reforms. The EU must bridge its internal divides through more equitable funding and binding permitting reforms. Externally, it must pursue diplomacy that ensures future energy partnerships are mutually beneficial and ethically sound. By balancing its ambitious decarbonization goals

with a pragmatic approach to these structural and geopolitical realities, the EU can solidify REPowerEU's legacy not just as a crisis-response measure, but as the foundational blueprint for a resilient, sovereign, and equitable energy union.

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