



The 18th International Scientific Conference
**“DEFENSE RESOURCES MANAGEMENT
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ENHANCING ENERGY SECURITY IN EUROPEAN COUNTRIES

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Abstract:

Energy security is a critical concern for nations worldwide, as it directly impacts national economies, geopolitics, and environmental sustainability. This paper explores the relationship between energy security and the national economy, shedding light on the multifaceted dynamics that shape this nexus. The paper underlines the need for a holistic approach to energy security that balances economic imperatives with environmental sustainability and geopolitical stability. It underscores the importance of proactive policies, investments in renewable and sustainable energy sources, and international cooperation in addressing the challenges posed by energy security. In an era marked by energy transitions, this research paper provides an analysis of the critical link between energy security and national economies, offering insights and recommendations for policymakers, scholars, and stakeholders aiming to navigate the evolving energy landscape while safeguarding economic stability and growth.

Key words: energy, security, challenges, recommendations

1. Introduction

Energy security in the current defense environment poses a multifaceted challenge with strategic, operational, and logistical implications. The increasing global demand for energy, coupled with geopolitical uncertainties and regional instabilities, creates vulnerabilities for nations dependent on external energy sources. Military operations, particularly those in remote or austere environments, demand a secure and reliable energy supply to sustain critical infrastructure, communications, and weapon systems. The reliance on fossil fuels also raises concerns regarding environmental impact and the need to transition towards more sustainable and resilient energy solutions. Cybersecurity threats further amplify the risks, as digitalized energy infrastructure becomes a target for adversaries seeking to disrupt military capabilities. Addressing these challenges requires a comprehensive approach, encompassing diversification of energy sources, investment in renewable technologies, and the development of resilient energy infrastructures to ensure the operational effectiveness and long-term sustainability of defense forces in an evolving global security landscape.

2. Key Challenges

Europe's dependence on foreign energy sources poses significant challenges in the current defense environment, impacting both economic stability and national security. One of the primary concerns is the vulnerability of the energy supply chain to geopolitical tensions and disruptions. Many European countries heavily rely on energy imports from regions with volatile political landscapes, such as the Middle East and Russia. This dependency exposes Europe to the risk of



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supply interruptions, price fluctuations, and potential manipulation by external actors, which could have severe economic consequences.

Moreover, the interconnection between energy security and national defense is increasingly evident. The reliance on foreign energy sources can limit the strategic autonomy of European nations and impede their ability to respond effectively to security threats. In times of crisis or conflict, nations may find themselves susceptible to energy coercion, where external actors leverage control over energy supplies as a means of exerting influence. This vulnerability undermines the ability of European countries to pursue independent foreign policies and compromises their resilience in the face of geopolitical challenges. In the specific region of Central and East Europe, we can not talk about a unitary situation in terms of energy dependence, as it varies depending on the country, but many of these countries historically faced challenges related to energy security and dependence on external sources, as shown in figure 1.

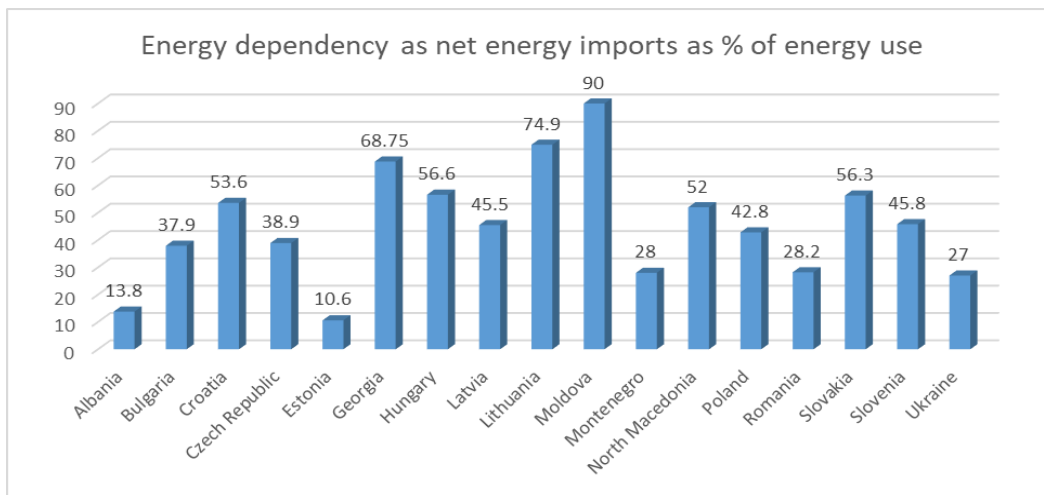


Figure 1 Source: <https://data.worldbank.org/indicator/EG.IMP.CON.S.ZS>

The data from World bank describes the energy dependence in terms of net energy imports estimated as energy use less production, both measured in oil equivalents. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport [1]. The Republic of Moldova is one of the countries with a very high dependence on energy imports, relying heavily on Gazprom for its natural gas supply, which makes it vulnerable to geopolitical tensions and fluctuations in gas prices. This dependency has raised concerns about energy security, prompting Moldova to explore diversification strategies. Efforts have been made to improve energy efficiency, develop renewable energy sources, and engage in negotiations with various partners to reduce reliance on Russian gas. Moldova's pursuit of closer ties with the European Union has also influenced its energy policies, with the EU supporting initiatives to enhance energy security, modernize infrastructure, and promote sustainable energy practices. Challenges such as outdated infrastructure and financial constraints persist, underscoring the need for continued efforts to achieve greater energy independence and resilience. Lithuania and also face a high level of energy dependence, as until 2014 the Russian energy giant Gazprom held a monopoly on gas supplies for the Baltic country, heavily influencing prices and terms of supply. More recently, Lithuania took steps towards transitioning to a zero-carbon economy, but currently



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only 14.2% of its energy needs are covered from renewable sources and the country still relies heavily on oil (62.6% of the domestic consumption) and gas (15.9% of domestic consumption). [2]

On the opposite side of the spectrum, Estonia has the lowest energy dependence from the selected countries. Even before the Russian aggression against Ukraine on February 24, 2022, Estonia had a generally low dependency on Russian energy imports, with a few notable exceptions in specific sectors. Despite its Soviet legacy and a pragmatic awareness of the potential threat from its eastern neighbor, Estonia has prioritized energy security in its policy since gaining independence. As a result of this longstanding approach, the country relies significantly on domestic resources for energy production. Estonia played a role in constructing a new floating storage and regasification unit in Finland, providing access to LNG imports from various countries. Additionally, there was a shift in some gas demand to oil shale, and efforts were initiated to explore green hydrogen, nuclear energy, and the expansion of renewable energy production. [3]

One of the key factors contributing to energy dependence in the region is the significant role of Russia as a supplier of natural gas and oil. Several Central and East European countries heavily relied on Russian energy resources, making them vulnerable to geopolitical tensions and fluctuations in energy prices. Out of 43 European countries, only 24 have relevant oil reserves, out of which Russia dominates with 80 billion oil barrels, followed at great distance by Norway and UK. Romania ranks on fourth place, with 0.6 billion barrels oil reserves, with an oil production of 61.28 thousand barrels per day in 2022. [4]

Oil reserves, billion barrels, 2021	
Russia	80
Norway	8.12
UK	2.5
Romania	0.6
Italy	0.5
Denmark	0.44
Ukraine	0.4
Turkey	0.37
Belarus	0.2
Albania	0.15
Spain	0.15
Netherlands	0.14
Germany	0.12
Poland	0.11
Serbia	0.08
Croatia	0.07
France	0.06
Austria	0.04
Bulgaria	0.02
Czechia	0.02
Greece	0.01
Hungary	0.01



The 18th International Scientific Conference
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Lithuania	0.01
Slovakia	0.01

In response to concerns about overdependence on Russian energy, some countries in the region have been making efforts to diversify their energy sources, including exploring alternative suppliers, investing in renewable energy, and enhancing energy efficiency measures. Many Central and East European countries are members of the European Union (EU), and in this quality these countries and the EU have been actively working to address energy security issues at the regional level. Efforts include the development of interconnections between member states, promoting energy efficiency, and supporting the transition to renewable energy. Some countries in the region, such as the Czech Republic and Hungary, have significant nuclear power capacity and have been considering or implementing plans to expand their nuclear energy capabilities as a means of reducing dependence on imported fossil fuels.

The region has been increasingly focusing on developing renewable energy sources, such as wind and solar power, to enhance energy security and reduce carbon emissions. However, progress varies among countries, and the transition to renewables often faces challenges related to infrastructure, financing, and policy frameworks. Limited energy infrastructure and outdated facilities in some countries can hinder efforts to diversify energy sources. Investments in modernizing and expanding energy infrastructure are crucial for improving energy security.

3. Policy Recommendations

Reducing European dependence on energy supplies from Russia has become imperative in light of the altered regional security environment following the Ukraine conflict. To achieve this goal, European nations should adopt strategic measures focusing on enhancing energy security and sustainability. Two key strategies include renewable energy expansion and nuclear energy development.

In the realm of renewable energy, there is a need for accelerated deployment, involving increased capacity and efficiency of existing infrastructure alongside the construction of new facilities. Support mechanisms such as subsidies, tax incentives, and regulatory frameworks are crucial to hasten the transition from fossil fuels to wind, solar, and hydroelectric power. Additionally, addressing the intermittent nature of renewable sources requires prioritizing advancements in energy storage technologies, such as batteries and pumped hydro storage. The creation of interconnected energy grids at regional and continental levels further contributes to stability by enabling the sharing of excess energy and facilitating a resilient, interconnected network.

On the front of nuclear energy, responsible expansion involves investment in advanced technologies like small modular reactors (SMRs) and next-generation designs. These alternatives offer increased safety, efficiency, and reduced nuclear waste production. International cooperation in nuclear energy development is promoted through knowledge sharing, joint research efforts, and standardized safety practices. Collaborative initiatives address concerns related to nuclear proliferation, ensuring alignment with global safety and environmental standards. Acknowledging public concerns is vital, and comprehensive public education campaigns and transparent communication about the safety and benefits of nuclear power can build acceptance and support for responsible nuclear energy development.



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The pursuit of these combined strategies would enable European countries not only to reduce reliance on Russian energy supplies but also to enhance energy security, promote sustainability, and contribute to global climate change mitigation efforts. This comprehensive approach aligns with the evolving energy landscape and geopolitical realities, ensuring a resilient and diverse energy portfolio for the future.

To further diminish energy dependence on Russia, European countries should prioritize strategic infrastructure investments as part of their comprehensive energy security strategy. One crucial aspect is the development and implementation of smart grids. Smart grids represent a technologically advanced approach to energy distribution and management, integrating digital communication and control systems. These grids enable real-time monitoring and optimization of energy usage, enhancing overall efficiency and resilience. By adopting smart grids, European nations can adapt their energy infrastructure to accommodate the growing share of renewable energy sources in the grid.

In conjunction with smart grids, substantial investments in energy storage technologies are imperative. The intermittent nature of renewable energy sources like wind and solar power requires efficient energy storage solutions to ensure a consistent and stable energy supply. Research and development initiatives in advanced energy storage technologies, such as improved battery systems and novel storage mediums, can mitigate the challenges posed by the variable nature of renewables. These advancements would not only contribute to a more reliable energy grid but also support the integration of renewable sources into the energy mix, reducing the reliance on traditional and potentially geopolitically sensitive energy suppliers.

Moreover, infrastructure investments in energy storage have the potential to revolutionize the grid's responsiveness to demand fluctuations and supply variability. By deploying large-scale, technologically advanced energy storage systems, European countries can store excess energy during periods of high production and release it when demand peaks, effectively balancing the grid and ensuring a continuous and stable energy supply. This approach aligns with the broader goals of transitioning towards a sustainable and resilient energy infrastructure, contributing to the overall reduction of Europe's vulnerability to external energy pressures.

To significantly reduce energy dependence on Russia, European countries should also adopt a strategic approach centered on energy efficiency measures. This involves focusing on both demand-side management and building retrofit programs, which collectively contribute to a more sustainable and resilient energy infrastructure.

Promoting energy efficiency measures through demand-side management is a crucial step. This approach involves optimizing the consumption of electricity by influencing when and how consumers use energy. Implementing energy-efficient technologies, such as smart meters and appliances, can facilitate real-time monitoring and control of energy usage. Additionally, incentivizing consumers to shift their energy consumption to off-peak hours and promoting energy conservation practices in industries and households can lead to a significant reduction in overall energy demand. This not only helps in immediate energy savings but also contributes to a more balanced and resilient energy grid.

Implementing building retrofit programs is another effective avenue to enhance energy efficiency. Many existing buildings across Europe have outdated insulation and energy systems, leading to unnecessary energy losses. Retrofit programs aim to address these issues by upgrading insulation, installing energy-efficient windows, and incorporating modern heating, ventilation, and air conditioning (HVAC) systems. By making these improvements, European countries can substantially decrease the energy demand associated with heating and cooling, which often accounts for a significant portion of overall energy consumption. Additionally, such programs create jobs,



The 18th International Scientific Conference
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IN THE 21st CENTURY”
Braşov, November 9th-10th 2023



stimulate economic activity, and contribute to environmental sustainability by reducing carbon emissions.

Combining demand-side management with building retrofit programs creates a synergistic effect. By reducing overall energy consumption through demand-side measures and simultaneously enhancing the efficiency of buildings, European nations can achieve a more comprehensive and sustainable energy ecosystem. The integrated approach not only lowers the immediate need for energy but also positions these countries to better handle fluctuations in energy supply, contributing to energy security.

International cooperation stands out as a critical and multifaceted strategy for European countries aiming to curtail their energy dependence on Russia. This approach involves proactive engagement in partnerships with diverse energy suppliers and the initiation of diplomatic initiatives to address geopolitical tensions and establish stable energy trade relationships.

One pivotal aspect of international cooperation is the deliberate diversification of energy suppliers. Relying on a single source or region for energy leaves nations vulnerable to geopolitical uncertainties and potential disruptions in supply. European countries should actively seek and cultivate partnerships with a diverse array of energy suppliers, including those within the European Union, neighboring regions, and other global players. Collaborative ventures with nations rich in energy resources, such as those producing natural gas or developing renewable energy projects, can create a more resilient and secure energy supply network. This diversification not only mitigates geopolitical risks but also fosters a competitive energy market, potentially leading to more favorable terms and prices for consumers.

Engaging in diplomatic efforts is equally crucial to navigate the complex geopolitical landscape surrounding energy resources. European countries can initiate diplomatic dialogues aimed at fostering understanding and cooperation with both traditional and emerging energy suppliers. These initiatives involve negotiating stable and mutually beneficial trade agreements, addressing geopolitical tensions that may impact energy supplies, and promoting transparent and fair business practices in the energy sector. Diplomatic efforts can also include conflict resolution mechanisms to address disputes that may arise in the context of energy trade. By fostering positive diplomatic relations, European nations can create a more conducive environment for reliable and secure energy partnerships.

Beyond bilateral engagements, European countries can explore the formation of strategic alliances and energy security agreements at regional and global levels. Collaborative frameworks can include joint infrastructure projects, shared energy resources, and coordinated responses to energy-related challenges. These alliances strengthen the collective bargaining power of nations, enhancing their ability to secure favorable energy deals and navigate geopolitical complexities. Additionally, shared resources and expertise within alliances can contribute to technological advancements, innovation, and the development of sustainable energy solutions.

Investing in research and innovation stands out as a pivotal strategy for European countries aiming to decrease their energy dependence on Russia. This multifaceted approach involves increasing funding for research in clean energy technologies and implementing technology transfer programs to foster collaboration and knowledge-sharing among European nations.

A key element in reducing energy dependence is staying at the forefront of developments in the energy sector. European countries should significantly increase funding for research and innovation in clean energy technologies. This includes supporting groundbreaking research in areas such as advanced materials, energy storage, smart grid technologies, and next-generation renewable energy sources. By investing in cutting-edge research, nations can unlock new possibilities, improve energy efficiency, and discover innovative solutions that contribute to a more sustainable and



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independent energy landscape. Government incentives, public-private partnerships, and collaboration with academic institutions and research centers can play a crucial role in fostering a vibrant research ecosystem focused on energy innovation.

Facilitating the transfer of advanced energy technologies among European countries is equally important. Establishing technology transfer programs enables the seamless exchange of knowledge, expertise, and technologies across borders. This collaborative approach fosters regional cooperation and helps nations benefit from each other's strengths in the energy sector. By creating a framework for the transfer of proven technologies, European countries can accelerate the adoption of clean energy solutions, reduce development costs, and collectively address common energy challenges. These programs can be structured to promote cross-border partnerships between research institutions, industries, and startups, creating a dynamic environment for innovation and knowledge exchange.

Investing in research and innovation not only enhances individual countries' capacities but also encourages regional collaboration and synergy. By sharing research findings and innovative technologies, European nations can collectively advance their energy capabilities. This collaborative approach not only strengthens the resilience of the energy sector but also positions Europe as a global leader in sustainable and innovative energy solutions. Joint research projects, collaborative funding initiatives, and shared research facilities can further solidify regional cooperation, creating a robust foundation for a diversified and self-reliant energy future.

4. Conclusions:

In conclusion, the intricate nexus between energy security, national defense, and geopolitical dynamics underscores the imperative for European nations to reassess and fortify their energy strategies. The multifaceted challenges, as outlined in the introduction, necessitate a holistic and adaptive approach to ensure the resilience and sustainability of energy sources. The vulnerability of European nations to external energy pressures, particularly from Russia, highlights the need for strategic diversification, investment in renewable technologies, and the development of resilient energy infrastructures. The interconnection of energy security with broader geopolitical realities requires a nuanced policy framework that encompasses both regional collaboration and global engagement.

The key challenges faced by countries in Central and East Europe in particular and Europe in general, underscore the diversity of energy dependence within the region. The presented policy recommendations offer a comprehensive roadmap, advocating for a balanced blend of renewable energy expansion, responsible nuclear energy development, strategic infrastructure investments, and international cooperation. These strategies, if implemented collectively, not only mitigate geopolitical risks but also pave the way for a sustainable, resilient, and diversified energy portfolio, aligning with the evolving energy landscape and addressing the complex challenges of the future.

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The 18th International Scientific Conference
“DEFENSE RESOURCES MANAGEMENT
IN THE 21st CENTURY”
Braşov, November 9th-10th 2023



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