

THE TRANSITION TO GREEN ENERGY AS A STRATEGY FOR STRENGTHENING THE ECONOMIC SECURITY OF THE REPUBLIC OF MOLDOVA

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Abstract: *The research aims to evaluate the impact of the transition to green energy on the economic security of the Republic of Moldova by analyzing the benefits of diversifying energy sources and reducing dependency on imports, thus enhancing national energy autonomy. The research methodology employs a mixed approach, combining quantitative analysis of statistical data on energy consumption, production, and dependence, with qualitative analysis of relevant international policies, ensuring rigorous substantiation of the conclusions. The importance of the research arises from the necessity to strengthen the economic security of the Republic of Moldova through the transition to green energy as a sustainable solution to mitigate vulnerabilities arising from external energy dependence and fluctuations in the international energy market. The development and integration of renewable energy sources contribute to economic stability, attract investments, facilitate alignment with European standards on environmental protection and energy efficiency, thereby promoting energy independence, sustainable economic growth, and environmental sustainability.*

Keywords: *green energy, economic security, renewable sources, energy diversification, energy efficiency, economic sustainability, energy dependence.*

Classification JEL: Q43, O13, Q01, F52.

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Introduction

In light of the rapid global transformations and due to certain national and international factors, for the Republic of Moldova, the transition to green energy is not an option, but a necessity, as the country remains largely dependent on imported energy resources. The Republic of Moldova is not among the states endowed with abundant conventional energy sources and cannot afford the luxury of a slower transition to green energy, as this shift has a direct impact on ensuring energy supply. This, in turn, directly affects the development of the economy and business environment, contributing to the well-being of the population and the economic security of the state.

The aim of this study is to assess the impact of the green energy transition on the economic security of the Republic of Moldova by analyzing the advantages of diversifying energy sources and reducing dependency on imports, with the goal of strengthening national energy autonomy. At the same time, the study explores European practices and policies that could influence national governmental strategies, encouraging a faster shift to renewable sources to ensure a more complex form of energy autonomy and reduce import reliance. This would lay a solid foundation for decreasing energy consumption, increasing the competitiveness of enterprises, and attracting

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foreign investors to projects with mutual benefits that would foster economic growth and ensure a stable economic security for the Republic of Moldova.

To achieve the proposed aim, this study adopts a mixed-method approach, combining quantitative analysis of statistical data related to energy consumption, production, and dependency with qualitative analysis of relevant international policies to ensure a rigorous foundation for the conclusions. The detailed analysis highlights the key challenges that hinder a rapid transition to green energy, underscoring the need for this transition to be adopted as a core strategy aimed at strengthening the country's economic security.

Results and Discussion

A thorough analysis of the topic addressed cannot be effectively conducted without clearly defining the key elements that will be studied in this article. The definition of each main component will help us better understand their significance within the context of the addressed issue.

The current geopolitical context requires that a state's national security encompasses all the constitutive elements of a security system, as these elements are interdependent and interconnected. It is essential that they be managed in a coordinated manner to ensure the protection and stability of the state (Figure 1).

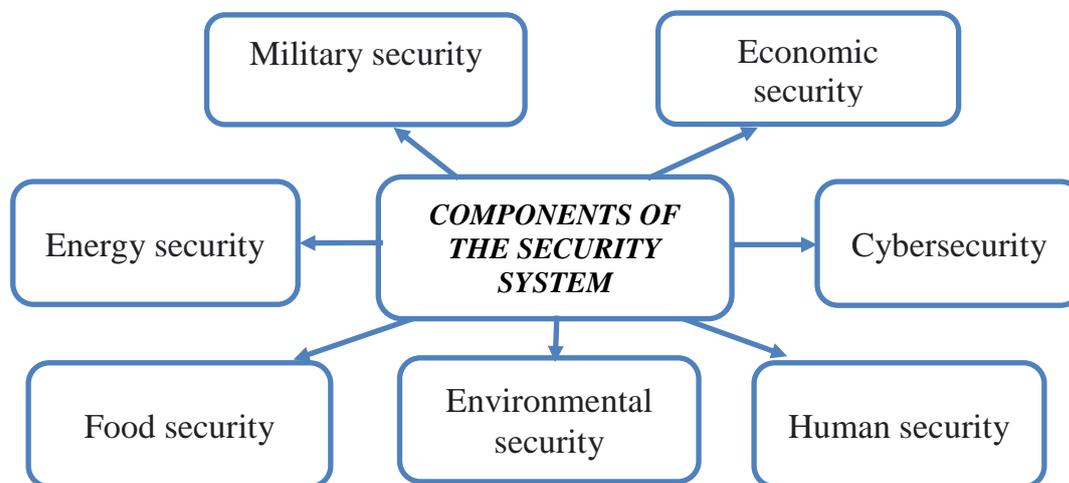


Figure 1. Components of the Security System

Source: adapted by the author based on Cutcovschi, V., 2024

Even though one element may seem independent, the others maintain their existence, underscoring their connection. Even though these elements of a security system are all intricately linked, economic considerations appear to take precedence over the others. Because having access to owning, and controlling finances, markets, and resources are fundamental needs for free and thriving development, which ensures a state's stability and security, economic strength is more and more becoming the core of any security system (Sațuța, 2007).

The economy is the bedrock of a state's survival because it enables other key aspects necessary for its functioning. The economy is the foundation of military strength and a key factor in determining a nation's power, encompassing both its social and political spheres. G. Belostecinic defines economic security as "a state of economic relations among economic actors, individuals, and state institutions, both domestically and in the realm of international economic activity" (Belostecinic & Sakovici & Moiseenko, 2011).

Acknowledging the need to define a key term within this study, we observe that a single, universally agreed-upon definition of "green energy" doesn't exist. Different organizations, institutions, and publications offer various interpretations. Generally, it's understood as energy generated from renewable resources, minimizing environmental impact, and thus contributing to a more sustainable energy system.

For instance, the International Renewable Energy Agency (IRENA), in its publications and materials, defines renewable energy (a term often used interchangeably with green energy) as "energy derived from natural sources that are replenished at a rate faster than they are consumed." Similarly, the United States Environmental Protection Agency (EPA) states that "green energy comes from renewable sources and often includes solar, wind, geothermal, biomass, and low-impact hydroelectric energy."

An additional definition is offered by the organization Green Start-up, which notes: "Green energy is a type of energy that comes from natural sources, whether it is sunlight, water currents, wind, or even waves, which generate tidal energy" (Ioniță, 2025).

Unlike the previous definitions, the National Grid company argues that although the terms green energy, renewable energy, and clean energy are often used interchangeably, there are certain distinctions among them. Green energy is described as "energy that can be produced using a method and from a source that does not harm the natural environment." The essential difference between green and renewable energy, in their view, lies in the fact that while most sources of green energy are also renewable, not all renewable energy sources are entirely green.

What green, clean, and renewable energy have in common is their growing use in generating electricity, aiming to gradually phase out the use of fossil fuels such as coal and natural gas – key contributors to climate change (National Grid, 2025).

Based on the above, we can conclude that: *green energy is energy derived from natural sources that regenerate naturally and have a lower environmental impact compared to conventional energy sources.*

Conventional energy sources, mainly fossil fuels, are associated with significant environmental issues, such as air pollution and climate change (Yan & Haroon, 2023). Transitioning to renewable energy sources, including wind, solar, and hydroelectric power, is essential for mitigating these adverse effects. The transformation is capital-intensive and requires systemic changes in energy infrastructure, which many countries are currently in the process of creating. Green finance, characterized by the allocation of financial resources to environmentally sustainable initiatives, has arisen as a mechanism to address this

disparity, fostering investments in renewable energy and other sustainable practices (Wen & He & Jing & Haroon, 2025).

The necessity of transitioning to green energy in the Republic of Moldova holds paramount importance from multiple perspectives: economic, political, and environmental. All these aspects, which are part of the broader security system previously mentioned, can be analyzed individually; however, given their interdependence and the fact that their effects ultimately impact the same entity-the state-we will examine them in an integrated manner.

The transition to green energy refers to the process of shifting from conventional energy sources, based on fossil fuels, to renewable and sustainable sources such as solar, wind, hydro, and bioenergy. Geothermal energy can also be included in this list; however, given its limited potential in the Republic of Moldova, we will focus primarily on the energy sources available in greater volume. In other words, the energy transition involves shifting energy production from sources that emit greenhouse gases-such as fossil fuels-to those that release little or no greenhouse gases. This change aims not only to reduce the negative environmental impact but also to increase energy efficiency and strengthen the state's economic security.

Table 1. Objectives of the green energy transition strategy

Objectives	Benefits
Reducing dependence on energy imports	Decreases vulnerability to external shocks and the energy policies of other states, particularly within the current geopolitical context.
Diversifying the energy mix	Increases the share of renewable sources in electricity and heat production, ensuring greater stability and resilience of the national energy system.
Stabilizing and reducing long-term energy costs	Although it requires initial investment, energy from renewable sources has low operating costs and eliminates the volatility associated with fossil fuel prices.
Stimulating sustainable economic development	Generates new employment opportunities in the production, installation, and maintenance of green technologies, as well as in related sectors.
Improving economic competitiveness	Access to clean and stable-priced energy can attract foreign investment and enhance the competitiveness of Moldovan enterprises.
Contributing to climate change mitigation	Contributes to the reduction of greenhouse gas emissions in accordance with the Republic of Moldova's international obligations.
Enhancing well-being and community health.	Reduces air contamination linked to burning fossil fuels.

Source: elaborated by the author

Any developed strategy is characterized by the establishment of specific goals that are intended to be achieved to ensure its success. The following table outlines the main objectives the Republic of Moldova aims to achieve through the implementation of its green energy transition strategy. These objectives are largely designed to enhance and develop the energy and economic sectors, as they form the foundation for ensuring long-term

economic security and improving the quality of life for the population. Alongside setting these objectives, we also identify the expected outcomes-or more precisely, the benefits-that are anticipated as a result of achieving the proposed goals. In our case, Table 1 presents the benefits expected to materialize.

Although plainly required and obviously advantageous, the Republic of Moldova faces certain obstacles in its move to renewable energy:

- Reliance on existing energy infrastructure – The current energy system is largely outdated and designed mainly for fossil fuels. Modernization and incorporating renewable energy sources will demand considerable investments. To effectively handle large amounts of fluctuating renewable energy, the system could necessitate substantial improvements. These upgrades could involve strengthening transmission lines, updating substations, and implementing smart grid technologies. The present grid might be unable to cope with the instability of solar and wind power, making grid enhancements unavoidable. Connection capacity with Romania needs upgrading to enable energy trading and balance the grid. Enhancing cross-border lines is key for both importing and potentially exporting green energy. Increased interconnection capacity enables the Republic of Moldova to access the EU energy market and provides a safeguard against internal supply variations (Governmental Investment Service, 2025).
- Limited energy storage capacity – Solar and wind power are intermittent powers, which pose severe challenges to grid stability and could have to be dealt with using energy storage, demand management, and flexible generation sources. Energy storage solutions – for instance, accumulators or batteries – have to be invested in to ensure a stable supply of electricity. Energy storage enables the storage of excess renewable energy when available and released when needed, ensuring a more stable and uniform energy supply.
- High Initial Costs – The upfront money invested in the technology of renewable energy sources such as solar panels, wind turbines, grid modernization, and storage systems can be extremely high and will demand serious money as well as new funding modalities. Government funding, international funding, and private sector investments will be most critical in overcoming this barrier. Renewable energy projects usually need high initial capital investment that has to come from a combination of public and private funding sources.
- Limited Technical and Human Capacities – The establishment of a workforce capable of installing, maintaining, and operating renewable energy systems, as well as the operation of an advanced grid with integrated renewable sources, will require long-term investments in education, training, and technology transfer (Ministry of Energy of the Republic of Moldova, 2025). The acquisition of local expertise is essential to the long-term sustainability of the green energy transition. There must be a skilled workforce to facilitate the effective installation and performance of renewable energy technologies.
- Insufficient or Unclear Regulatory Framework and Policies – Although the Republic of Moldova has advanced its energy law to EU levels, further efforts are needed to streamline permitting procedures, define in clear terms and with guidelines the development of renewable energy, and open access to the grid for renewable energy

producers. A predictable and stable regulatory environment is necessary to encourage investment and stimulate the development of the renewable energy industry. Clear and enabling regulations reduce risks for investors and facilitate the process of implementing renewable energy projects. Elimination of administrative bottlenecks and facilitation of right coordination among concerned stakeholders are also crucial (IRENA, 2019). Bureaucracy and lack of coordination hinder the progress of renewable energy projects. Efficient administrative procedures and better inter-institutional coordination can accelerate the process of green energy projects.

- Limited Public Awareness and Acceptance – Lack of knowledge or inadequate awareness of the benefits of green energy can create resistance to change. Public education and targeted awareness campaigns are essential to build confidence, facilitate behavior change, and secure public support for renewable energy projects.
- Limited Access to Financing and Investment – Attracting private investment and securing international funding continue to pose difficulties. Bolstering financial tools, creating a more favorable investment environment, and easing the path to green finance are essential to fully unlock the renewable energy sector's potential.

Moldova's energy system heavily depends on outside sources, with 82.78% of its total energy needs in 2022 met by imports. In 2022, electricity demand was 4.4 TWh. Of that, 10.72% came from Ukraine/Cuciurgani Moldavskaya GRES (MGRES), a gas-fired plant (61.19%) in Transnistria, or 10.86% from Romania. This strong dependence on external energy puts the country's economy at risk from supply interruptions or price volatility. It presents a danger to Moldova's economic, social, and energy security and a considerable challenge to the nation's sustainable economic advancement.

Lately, Moldova has been trying to boost energy efficiency and develop a renewable energy sector, while also drawing in foreign investment in the energy field. Using renewable energy resources can greatly lessen reliance on imported energy.

The shift towards renewable energy sources has accelerated, starting around 2018, and this momentum grows each year. The data in Figure 2 shows the yearly growth of installed renewable energy capacities. The figures show the advancement of each type of renewable energy source present on the local energy market. The most dramatic growth, in installed capacity, has been felt by photovoltaic systems (2018 – 4.020 MW; 2025 – 433.37 MW), followed by wind power systems. Biogas systems have made extremely timid progress, and hydro systems have changed little.

Photovoltaic systems, with a total installed capacity of 433.37 MW, represent the most widespread technology, accounting for 67% of the total installed renewable energy capacity. These are followed by wind power installations, with a total capacity of 188.98 MW, representing 29% of the total. Hydropower and biogas installations account for 16.75 MW (3%) and 7.01 MW (1%) respectively (National Energy Service, 2025).

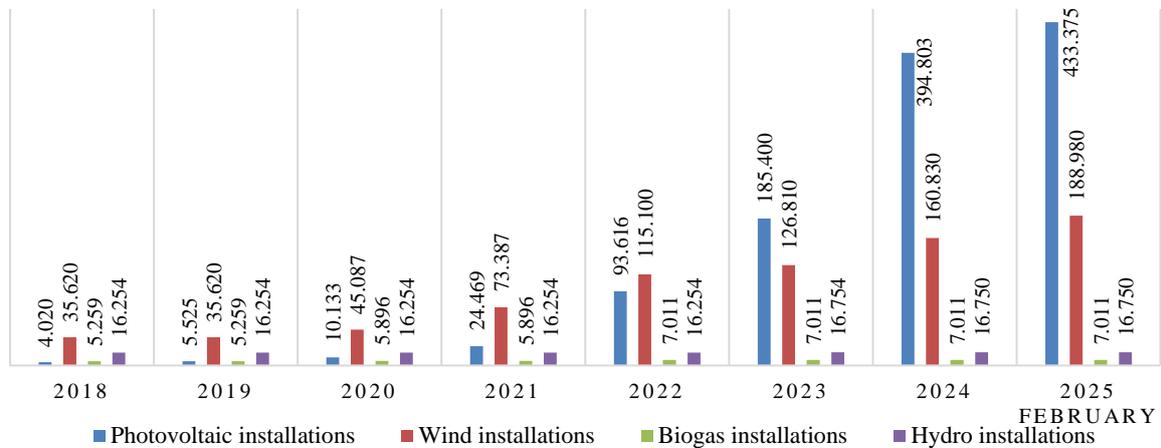


Figure 2. Evolution of installed E-RES capacities in the period 2018 – Feb. 2025, MW

Source: elaborated by the author based on data from the National Energy Service. (n.d.), 2025

The evolution of electricity production capacities from renewable sources reflects the Republic of Moldova's commitment to the green energy transition and the integration of alternative electricity generation sources into the national energy mix. The increasing share of renewable energy confirms the country's progress toward achieving the target of at least 27% in gross final energy consumption by 2030. This objective is aligned with both European Union policies and international agreements aimed at reducing greenhouse gas emissions and promoting energy sustainability.

Conclusions

In conclusion, the transition to green energy represents an essential and multifaceted strategy for strengthening the economic security of the Republic of Moldova. The country's current dependence on fossil fuel and electricity imports exposes it to significant vulnerabilities, further exacerbated by regional geopolitical instability. The adoption of green energy offers a promising pathway to reduce this dependency, stabilize energy prices, create new economic opportunities, attract investments, and ensure energy security.

The analyzed findings indicate significant potential for the development of renewable energy in the Republic of Moldova, particularly in the fields of solar and wind energy. The data analyzed in this, such as: national energy statistics, data on the installed capacity of renewable energy sources, data on energy resource imports, cover the analysis period between 2018-2025, being taken from the official websites of the relevant institutions. The limitations of the methodological analysis were caused by incomplete data for some sectors of renewable energy sources, dependence on national estimates, statistical data that were not analyzed and published by the National Bureau of Statistics.

Achieving the targets set in the National Integrated Energy and Climate Plan (NECP) by 2030 would lead to a substantial reduction in import dependency and a considerable increase

in the share of renewable energy within the national energy mix. Its economic advantages will be the provision of employment, capital investment attraction, and energy price stabilization, which will make the Moldovan economy more competitive and the quality of life higher. Though it would mean increased costs now, the economy will undoubtedly benefit in the mid and far future. If all countries in the area progress similarly, Moldova's failure to make tangible improvements could lead to economic decline and chronic reliance on imports.

Despite the shift to green energy, several obstacles remain. The existing energy infrastructure requires improvements, despite the potential for absorbing large investments. It's also essential to develop technological skills and capacities and to constantly improve the laws and regulations. The intermittent nature of renewable sources like solar and wind means that efficient storage and grid management strategies are needed. Energy storage plays a vital role in supporting widespread renewable energy use, as it mitigates generation variations and ensures a more consistent power supply.

Moldova's focus on renewable energy, along with its work to foster a favorable investment climate, should draw in renewable energy investments - from within the country and from abroad - which would boost economic growth and spur technological advancements. Recently, international investment firms and banks have shown an interest in investing in this sector. A transparent regulatory system, inviting policies, and the opportunity to align Moldova's market with the European Union offer an attractive outlook for investments in green energy. Institutional funding from the EBRD and USAID is already flowing into the construction of energy interconnections and the expansion of renewable energy capacity. This external support is crucial for financing the initial stages of the transition, providing not only financial resources but also technical expertise and best practices for the development of the green energy sector.

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