Capitolul 53. EXPLORAREA VULNERABILITĂȚII ENERGETICE ÎN REPUBLICA MOLDOVA: TANGENȚA CU BUNĂSTAREA GOSPODĂRIILOR

Chapter 53. EXPLORING ENERGY VULNERABILITY IN R. MOLDOVA: LINKAGES WITH HOUSEHOLD WELL-BEING

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Abstract

The energy vulnerability of Moldova's population has been increasing year by year since November 2021, when energy prices began to rise periodically. The increase in the price of gas led to a rise in the cost of electricity and heat. As a result, the energy poverty of the population increased, and the standard of living decreased. This study examines the conceptual distinction between energy poverty and vulnerability, investigates the structural causes of Moldova's energy vulnerability, and analyzes the mechanisms established by the government to mitigate the consequences of the energy crisis. The study uses two methodologies: statistical analysis and critical policy assessment. The goals of this study are to analyze the socioeconomic impacts of household energy vulnerability and to develop recommendations for transitioning from passive financial support to proactive measures that aim to reduce energy vulnerability. According to the study's findings, the compensatory measures implemented by the Moldovan government partially mitigated the burden of high tariffs on households; however, energy poverty ultimately increased.

Keywords: *energy vulnerability, energy poverty, energy access, living standards, household well-being.*
JEL: *Q41, I32, I31*

Introduction

The relevance of energy vulnerability research has increased, especially following the sharp rise in energy prices and their impact on social stability. Even after the energy crisis ended, prices stabilized but remained high, much higher than before the crisis. Repeated price increases hurt household social stability. Three factors underlie the rise in energy vulnerability and its impact on household well-being. The first factor is the dependence of the energy sector on imports, as Moldova lacks its own fossil fuels, including oil, gas, and coal. The second factor is external and internal price shocks, and the third factor is the socioeconomic vulnerability of households. Moldova purchases the most significant volumes of electricity from the Moldavskaya GRES (State District Power Station), located in Transnistria, and utilizes gas for power generation. Historically, Russia was the leading gas supplier. The Moldovan government decided to give up Russian gas and switch to gas purchased from other suppliers, primarily European. However, the European Union (EU) itself purchases gas, so in addition to the price increase resulting from the energy crisis, the new supply logistics have also led to higher prices, which in turn negatively impact household welfare and increase the number of people living below the poverty line.

The scientific novelty of the study lies in its interdisciplinary approach, which incorporates research on concepts from social sciences and energy policy, as well as a comprehensive analysis of the mechanism for targeting energy vulnerability. Its practical significance is to develop recommendations to ensure the transition from short-term anti-crisis measures to long-term strategies to improve the energy resilience of households.

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Research purpose and method

The primary objective of this research is to analyze the socioeconomic impacts of household energy vulnerability in Moldova. To achieve this goal, the following objectives were established:

- Define the conceptual distinction between energy poverty and vulnerability;
- Analyze the factors that shape energy vulnerability, including the structure of the energy market and the evolution of energy prices;
- Analyze government measures to mitigate the impact of the energy crisis and reduce energy vulnerability.
- Developing recommendations for improving household energy resilience.

Since the subject of the study is interdisciplinary, the authors employed a hybrid methodology that combines statistical analysis methods with a critical assessment of public policy. This study differs from other scholars' publications in that it is interdisciplinary and based on a comprehensive analysis of the economic and social consequences of energy shocks, as well as the policies implemented to mitigate the impact of rising prices on household well-being. Meanwhile, research by domestic and international scholars has focused on a narrower research topic: energy poverty in urban households (Stojilovska et al., 2021), energy poverty in households with children (Pérez-Peña et al. 2025), the impact of worries about energy security on self-rated health (Mayer and Smith 2019), the relationship between education and energy poverty (Apergis et al., 2022), the impact of the energy crisis on household well-being (Gutium, 2021), and the identification of exogenous and endogenous factors influencing energy poverty (Mochida et al., 2025).

Conceptual differences between energy vulnerability and poverty

Energy poverty refers to a situation where households are unable to pay their heating, electricity, and gas bills, and are forced to reduce their consumption and limit the use of electrical appliances and gas for space heating. Households connected to central heating accumulate debt on their bills. A classic indicator of energy poverty is a situation in which the share of energy expenditure accounts for more than 10% of a household's expenses. Energy poverty also refers to a situation where households lack access to modern energy sources (gas, electricity) and are forced to use solid fuels (wood or coal) for heating. Energy vulnerability is a precursor to energy poverty. The differences between them are shown in Table 1. The main distinction is that while energy poverty is an established reality, energy vulnerability is a forward-looking situation, representing the risk of energy poverty.

Table 1. Conceptual differences between energy vulnerability and poverty

Criteria	Energy poverty	Energy vulnerability
State character	A factual status (current, static)	Risk of future state (dynamics)
Timing of evaluation	Ex-post	Ex-ante
Main determinants	High energy tariffs, low disposable income, and a lack of access to modern energy sources	A combination of internal and external factors. These factors include income instability, low real income, which is insufficient for housing modernization and for the purchase of A+, A++, and A+++ electrical appliances, low energy efficiency of housing, the high probability of job loss (rising trend in the unemployment rate), a lack of a financial buffer, an ineffective social security system, and energy price volatility, etc.
Key indicators	The share of energy expenditure exceeds 10%, and there are debts on bills for electricity, heat, and natural gas consumed. Additionally, there is a self-assessment of the inability to use electrical appliances to the extent necessary for comfort and the inability to heat the house to comfortable temperatures.	The energy vulnerability index is a composite index that combines various aspects of vulnerability (structural vulnerability, consumer vulnerability, and others).

Source: *Authors' elaboration*

A new concept that has been the subject of research in recent years is *double energy vulnerability* (Sareen et al., 2022). This term encompasses household vulnerability to both residential energy costs and transportation fuel costs. Studying double energy vulnerability is particularly relevant for countries with significant income gaps between urban and rural households, where owning a personal vehicle is more important for rural residents than for urban residents, as transportation is essential for access to work and services. Countries that implement compensation to mitigate the impact of rising energy prices on vulnerable groups typically rely on a utility compensation system, ignoring the financial burden associated with transportation costs.

Energy sector and energy poverty in Moldova

Moldova is an energy-importing country. Due to geopolitical disagreements with its former leading gas supplier and considering Moldova's commitment to European development, the country began purchasing gas from other suppliers at a significantly higher price than Russian gas. Disagreements also arose with Transnistria. A project was implemented to synchronize Moldova's power grids with the European ENTSO-E (European Network of Transmission System Operators for Electricity) network, allowing Moldova to purchase electricity from Romania and reduce its dependence on the Moldavskaya GRES.

As a result of these policies, the volume of natural gas purchased has been declining in 2022 and 2023 (Figure 1). Consequently, according to energy balance data, gas imports decreased by 22% in 2022 and 34% in 2023 compared to the previous year, and the share of gas in total consumption decreased from 36.5% in 2010 to 22.0% in 2023.

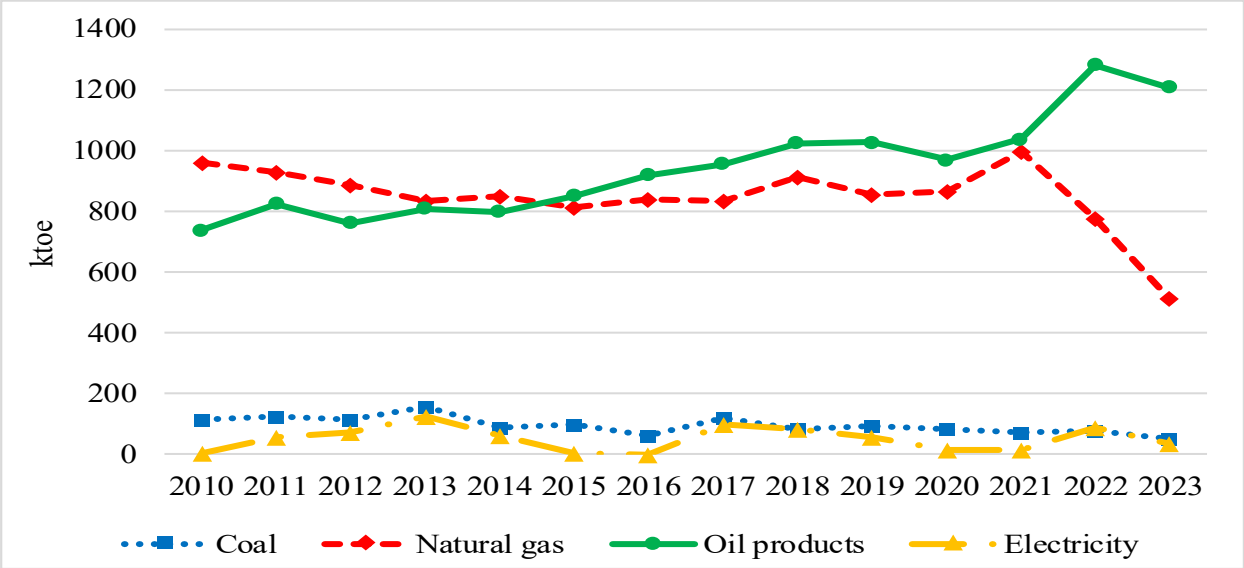

Figure 1. Import of energy resources, 2010-2023

Source: *Data from the National Bureau of Statistics (NBS) (2025)*

Gas prices rose sharply between the second half of 2021 and the first half of 2023. Households paid an average of 19.32 lei per cubic meter (all taxes included) (Band – D2) in January-June 2023. It is 4.2 times more than in the same period in 2021 (Figure 2). The increase in gas tariffs is due to rising purchase prices at European hubs. Since Moldova decided to give up Russian gas, the state-owned company Energocom SA began purchasing gas on spot markets, which are highly volatile (Gutium and Postolaty, 2019). The company's second decision was to store gas in facilities in Ukraine and Romania. Storage fees are required. Consequently, natural

gas tariffs continued to rise, even after the end of the energy crisis. In the first half of 2025, gas tariffs for households increased on average by 2.22 lei per m3 compared to the second half of 2024.

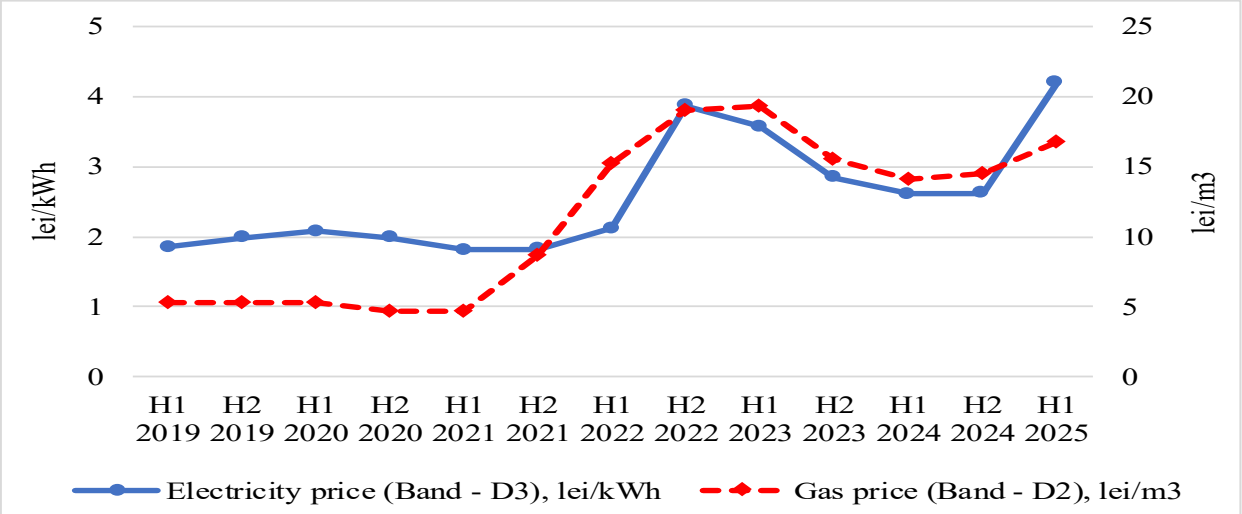

Figure 2. Electricity and gas price dynamics for households (all taxes included)

Source: *Data from the NBS (2025)*

Electricity prices more than doubled in 2022. However, paradoxically, the highest electricity tariff was recorded in the first half of 2025, not during the energy crisis. Factors influencing the final price of electricity include the cost of gas (since electricity is generated by Moldavskaya GRES and CHP (Combined Heat and Power plant), which run on gas), the number of operators (intermediaries) between producers and final consumers (according to the Third Energy Package, producers are not allowed to sell electricity to end consumers directly), and grid losses. After synchronization with the European ENTSO-E grid, grid losses increased. The primary reason is the flow of electricity from Romania to Ukraine through the Moldovan power grid, which overloads the lines and increases losses. Therefore, the government's strategy proved ineffective, leading to an increase in both energy vulnerability and energy poverty among households. However, there is a way to reduce the price of electricity; to achieve this, it is necessary to develop green energy (Gojaeva et al., 2024), which has been growing in recent years (Table 2). In 2024, the volume of electricity produced from Renewable Energy Sources (RES) increased 1.7 times compared to 2023, and 7.2 times compared to 2019.

Table 2. Production of electricity from renewable energy sources, 2019-2024 (million kWh)

	2019	**2020**	**2021**	**2022**	**2023**	**2024**
Wind energy	36.9	50.1	76.3	142.4	191.3	257.9
Solar energy	1.4	3.3	7.8	30.3	77.7	213.1
Biogas	28.8	27.8	32.2	23.5	13.8	17.3
Hydroelectric energy	0.3	0.1	0.2	0.1	0	0
Total electricity produced from RES	67.4	81.3	116.5	196.3	282.8	488.3

Source: *Data from the National Energy Regulatory Agency (ANRE 2024)*

Analysis of consumer spending structure revealed that energy poverty among rural households increased from 2022 to 2024 (Figure 3). The share of energy expenditure reached 16.6% in 2019, 19.7% in 2023, and 19.2% in 2024. More than two-thirds of household expenditures are allocated to food, beverages, housing, water, electricity, and gas. Only one-third of household spending goes to clothing, transport, communication, health, education, and other

needs. It is natural that during the analyzed period, the absolute poverty rate in rural areas has increased from 34.5% in 2019 to 42.9% in 2024.

The energy poverty rate of urban households is lower than that of rural households, at 15.6% in 2024 (Figure 4). Half of all expenditures go to food, beverages, housing, and energy. The absolute poverty rate increased from 2022 to 2024, reaching 21.6% in 2024. However, this indicator, in the case of the urban population, is lower than the absolute poverty rate of the rural population.

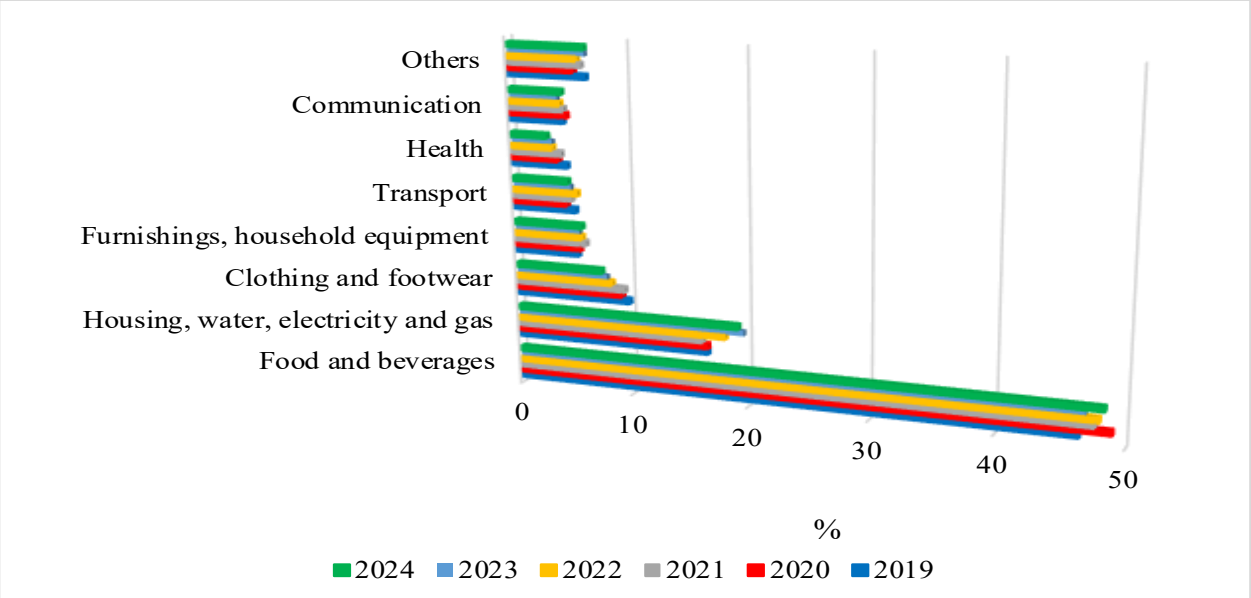

Figure 3. Structure of consumption expenditures in rural areas

Source: *Authors' calculations using data from the NBS (2025)*

In 2022, the Moldovan government established the Energy Vulnerability Reduction Fund (EVRF) to mitigate a potential sharp decline in the population's energy vulnerability and prevent an increase in the absolute poverty rate. Assistance to the population was provided through the "Help with the meter" program, accessible to citizens through the website compensatii.gov.md. The vulnerability assessment was conducted using a multifactor model. Each household was assigned a vulnerability category based on a coefficient.

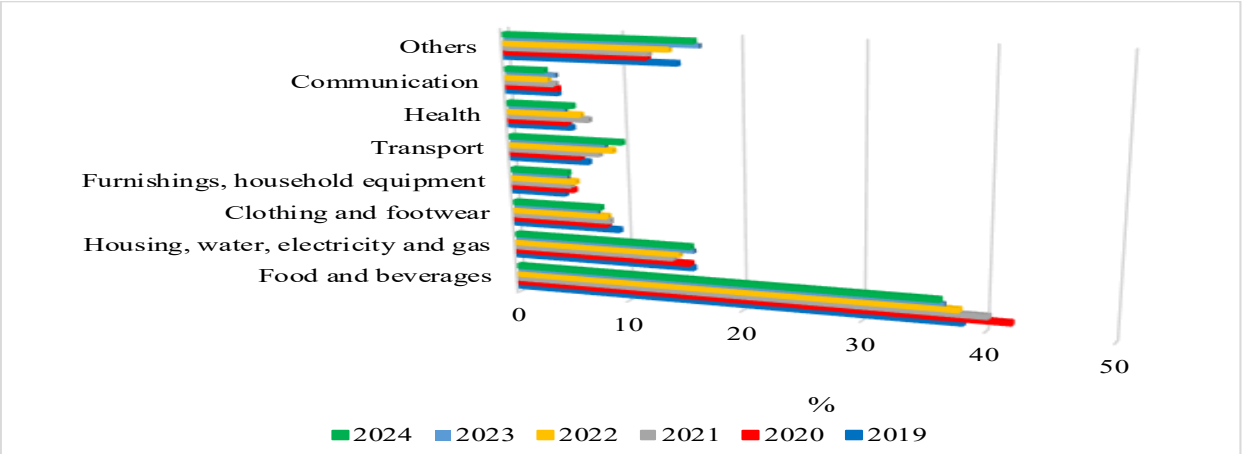

Figure 4. Structure of consumption expenditures in urban areas

Source: *Authors' calculations using data from the NBS (2025)*

This coefficient is calculated as the ratio between the estimated energy costs (during the cold season) and the family's disposable income, adjusted for the number of family members. The amount of compensation depended on the category of vulnerability. To discourage excess energy consumption, the amount of compensation was calculated based on the estimated energy consumption, not the actual consumption. Therefore, households that saved significant amounts of energy were able to cover a larger share of their energy consumption.

Conclusion

The results of this study showed that the combined impact of external and internal factors on energy vulnerability and poverty was so significant that, despite the measures taken by the Moldovan government, household energy poverty increased, and the number of people living below the poverty line grew. To enhance the result of government policy, we propose: encouraging individuals and small businesses to install solar panels, improving the compensation mechanism (to this end, it is necessary to consider transport vulnerability, as the share of transport expenses for urban households has grown significantly, reaching 9.9% in 2024), providing grants for thermal modernization of housing for the most energy-vulnerable households, conduct an audit of SA Energocom's procurement policy and develop a gas acquisition strategy to avoid the mistakes made previously in purchasing large volumes at peak spot prices, and further developing green energy.

Acknowledgments

Studies have been conducted under the framework of 25.80012.0807.57SE, "Estimation of energy vulnerability and its impact on the living standards of the population of the Republic of Moldova" (funded by the National Agency for Research and Development).

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