

Renewable Energy and Economic Growth: Georgia's Experience and Prospects

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ABSTRACT

In the modern world, energy security and sustainable development have become one of the most significant directions of economic policy. The paper examines the importance of renewable energy in economic growth and analyzes the economic, social, and environmental effects of using alternative energy sources. The theoretical framework of the research is based on the concepts of sustainable economic development and energy security.

The article discusses the role of renewable energy in Georgia's economic development and identifies primary directions for improving the country's energy and economic policies.

In conclusion, it demonstrates that the development of renewable energy helps reduce the country's energy dependence, increase economic competitiveness, protect the environment, and create new jobs. The research findings can be used in the decision-making process related to energy policy, economic strategies, and sustainable development.

INTRODUCTION

In the modern world, economic development is closely linked to the energy sector, as energy constitutes one of the main foundations of economic activity. Population growth, industrialization, and technological progress significantly increase the demand for energy resources, forcing states to seek new ways to ensure energy security and maintain economic stability. The large-scale use of traditional energy resources - oil, natural gas, and coal - has generated substantial economic benefits; however, it has also caused environmental pollution, climate change, and the depletion of natural resources.

Against the backdrop of these challenges, renewable energy has gained particular importance, including solar, wind, hydro, geothermal, and bioenergy. Renewable energy sources are not only environmentally safe but also stimulate economic development, attract investments, and create new jobs. The experience of many countries confirms that energy transformation is one of the key prerequisites for sustainable development.

The development of renewable energy is particularly important for developing countries, where economic stability often depends on imported energy resources. For Georgia, the advancement of renewable energy is of special significance. The country is rich in hydropower resources and has considerable potential for improving solar and wind energy. The use of local renewable resources reduces energy dependence, increases energy independence, and improves the country's economic competitiveness.

Although the relationship between renewable energy and economic growth has been extensively examined in international literature, most studies focus either on global trends or on large developed economies. Existing studies on Georgia primarily discuss the country's renewable energy potential, energy security, or specific sectoral issues. However, there is still a lack of integrated research that simultaneously examines renewable energy development, economic growth, energy security, investment attractiveness, and future development prospects within the Georgian context. Furthermore, recent changes in global energy markets, post-pandemic economic recovery, and the growing role of renewable energy in national security require renewed analysis. This article seeks to fill this gap by providing a comprehensive assessment of the economic significance of renewable energy in Georgia, combining international theoretical approaches with recent national statistical and policy data.

THE PAPER AIMS to identify the main trends, challenges, and prospects of renewable energy use and analyze the mechanisms by which alternative energy sources affect economic growth, investment, employment, and environmental protection.

LITERATURE REVIEW

The relationship between renewable energy and economic development represents one of the significant research directions in contemporary economic literature. Scholars pay particular attention to how the transformation of the energy sector contributes to economic growth, environmental protection, and social welfare improvement.

One of the important theoretical foundations regarding the economic significance of energy is presented in classical and neoclassical economic theories, where energy is considered one of the key factors of production. David I. Stern notes that economic growth is directly linked to energy consumption and improvements in energy efficiency. According to the author, sustainable economic development is impossible without modernizing energy systems (Stern, 2011).

Todd Moss and Jacob Kincer confirm that the positive relationship between energy and economic growth is clear: nowhere in the world is there a wealthy country that consumes only small amounts of energy, nor a poor country that consumes large amounts of it (Moss & Kincer, 2023).

Important studies on the role of renewable energy are provided by the International Energy Agency (IEA), whose reports emphasize that renewable energy promotes innovation, diversification of economic sectors, and the strengthening of energy security. According to IEA data, investment growth in the solar and wind energy sectors in recent years has significantly increased employment rates and contributed to economic stability (IEA, 2025).

Research by the International Renewable Energy Agency (IRENA) indicates that the renewable energy sector creates millions of jobs worldwide. According to the organization's report, the energy transition is not only an ecological necessity but also an important factor of economic development, as it increases investment volumes and technological progress. In IRENA's report *Renewable Energy Benefits: Measuring the Economics*, it is noted that doubling the share of renewable energy by 2030 could increase global GDP by 1.1% (IRENA, 2016).

The development of renewable energy sources can reduce energy prices for consumers, increase market competition, and decrease dependence on imported resources (Dirma et al., 2024).

The development of renewable energy creates a balance between economic growth and ecological sustainability. The environmental and economic benefits of renewable energy use include generating energy without greenhouse gas emissions from fossil fuels, reducing certain types of air pollution, diversifying energy supply, and reducing dependence on imported fuels (United States Environmental Protection Agency, 2026). United Nations Climate Action also emphasizes that renewable energy is not only beneficial for the climate but also a major force for economic growth, job creation, and poverty reduction.

Empirical studies on the relationship between renewable energy and economic growth demonstrate that the use of alternative energy sources positively affects gross domestic product growth. At the same time, state policy plays a significant role in the development of renewable energy. Many developed countries have set the ambitious goal of achieving a decarbonized energy system by 2030. Achieving this goal is crucial for strengthening energy security, increasing sustainability, and ensuring affordable and clean energy for households and industry (Stark, 2025).

Nikoleishili & Tabatadze (2025), in the article *Renewable Energy as a Factor in National Security*, consider renewable energy as a political resource that

strengthens national sovereignty, reduces vulnerability to external influence, and supports strategic autonomy in foreign policy (Nikoleishili & Tabatadze, 2025).

Kobiashvili & Kukhalashvili (2025) argue that renewable resources ensure not only the political and economic security of the state but also its military security (Kobiashvili & Kukhalashvili, 2025).

Despite numerous positive effects, researchers also focus on the challenges associated with renewable energy development. The advancement of technological infrastructure, mobilization of financial resources, and improvement of energy storage systems remain significant issues (Report, 2026). In addition, developing countries often face limitations in investment and access to technology (Giguashvili, 2022).

Thus, the existing literature confirms that renewable energy represents an important factor in economic development. Studies indicate that energy transformation contributes to economic growth, energy security, environmental protection, and the achievement of sustainable development goals.

METHODOLOGY

This study employs a qualitative descriptive-analytical research design aimed at evaluating the role of renewable energy in Georgia's economic development. The object of the study is the renewable energy sector of Georgia and its relationship with economic growth, energy security, investment attraction, and sustainable development.

The research is based on secondary data analysis. Data were collected from scientific articles published in peer-reviewed journals, reports of international organizations (International Energy Agency – IEA, International Renewable Energy Agency – IRENA, United Nations, World Bank), official publications of the Georgian State Electrosystem (GSE), the National Statistics Office of Georgia (Geostat), and other governmental and institutional sources.

The selection of literature and statistical materials was based on four criteria:

- Relevance to renewable energy and economic development;
- Scientific credibility and publication in academic journals or official institutional reports;
- Availability of recent data, primarily covering the period 2020–2026;
- Direct applicability to the Georgian energy and economic context.

The analytical procedure consisted of four stages:

- Review and systematization of theoretical literature on renewable energy and economic growth;
- Collection and examination of statistical indicators related to energy consumption, electricity demand, GDP growth, and renewable energy development;
- Comparative analysis of international trends and Georgia's energy sector performance;
- Interpretation of findings to identify major challenges, opportunities, and future prospects for renewable energy development in Georgia.

To ensure the reliability and validity of information, data were cross-checked using multiple independent sources and official statistical publications.

Priority was given to internationally recognized organizations and governmental institutions.

RESEARCH RESULTS

The analysis of the literature demonstrates that the energy sector is the backbone of the modern economy. Its importance for national development is immeasurable and encompasses both macroeconomic and microeconomic aspects. The economic significance of energy is mainly reflected in the following factors:

1. Economic Growth and Job Creation

- There is a direct relationship between energy consumption and GDP (Gross Domestic Product) growth. Access to energy directly affects economic activity.
- The energy sector (oil, gas, electricity, renewable energy) creates thousands of jobs, both directly in production and in related industries.

2. Energy Independence and Security

- **Reduction of import dependence:** By utilizing local renewable resources, countries reduce their dependence on fossil fuels (oil, gas), thereby increasing energy independence.
- **Price stability:** Renewable energy sources (solar, wind) are freely available, eliminating economic risks from fuel price fluctuations.

3. Environmental Benefits and Cost Reduction

- **Combating climate change:** By reducing carbon dioxide emissions, renewable energy directly mitigates climate change.
- **Reduction of healthcare costs:** Decreasing the combustion of fossil fuels improves air quality, reducing disease rates and consequently lowers the economic burden on healthcare systems.

4. Innovation and Competitiveness

- **Technological development:** The renewable energy sector stimulates research and innovation in energy efficiency, storage technologies, and smart grids.
- **Long-term cost reduction:** As technologies improve, the cost of generating solar and wind energy continues to decline, making them increasingly competitive.

5. Sustainability and Inclusive Growth

- **Access to energy:** Renewable sources, particularly decentralized systems (e.g., solar panels), ensure energy supply to remote or sparsely populated areas, thereby contributing to regional development.

Sustainable energy development implies a synergy of energy efficiency, renewable energies, and policy development, which in turn requires the availability of resources, significant investments, strong political will, and cooperation between different regions and countries (Giguashvili, 2025).

Compared to the year 2000, today's global economy produces 36% more GDP per unit of energy. New technologies are rapidly being integrated into the system. In recent years, the development and adoption of artificial intelligence (AI) have accelerated significantly, raising the question of what the widespread

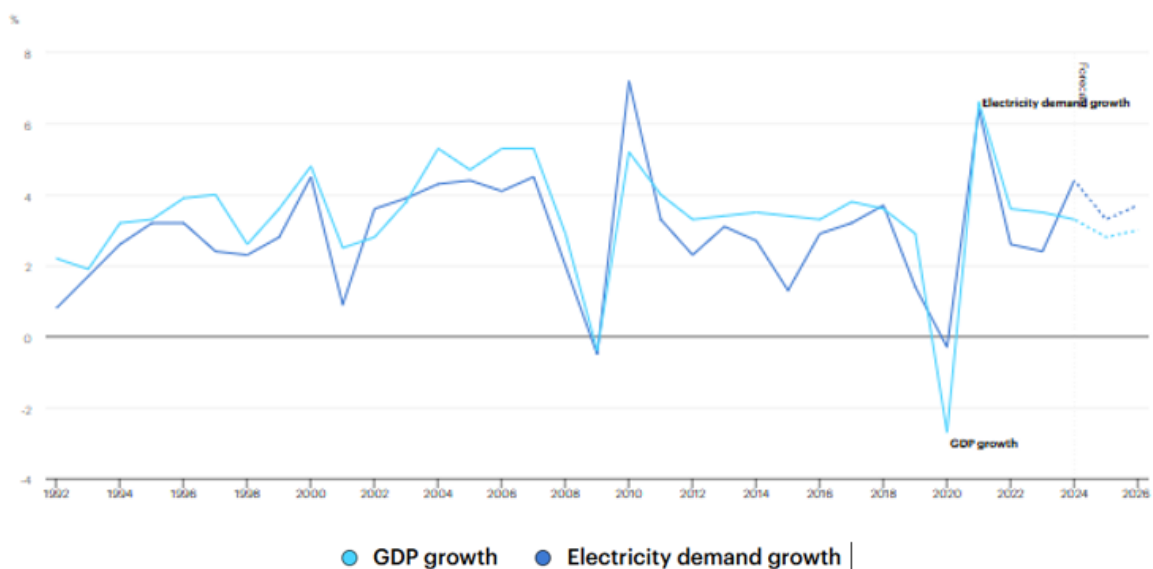
diffusion of this technology means for the energy sector. Without energy, artificial intelligence cannot exist. At the same time, AI has the potential to transform the energy industry's operations if deployed widely.

World Energy Outlook 2025 (WEO-2025) examines three main scenarios: 1. Current Policies Scenario (CPS); 2. Stated Policies Scenario (STEPS); 3. Net Zero Emissions by 2050 Scenario (NZE), which outlines pathways to achieve specific energy and climate-related goals by 2050 (WEO, 2025).

Global electricity demand is steadily increasing, mainly driven by the growing needs of industry, artificial intelligence (AI) data centers, electric vehicles, and air conditioning. Growth in energy demand in 2025 was approximately 3%, while for 2026 the growth rate is projected to accelerate to between 3.3% and 3.7% (IEA, 2025^a).

Figure 1

Year-on-year percent change in global electricity demand, 1992-2026



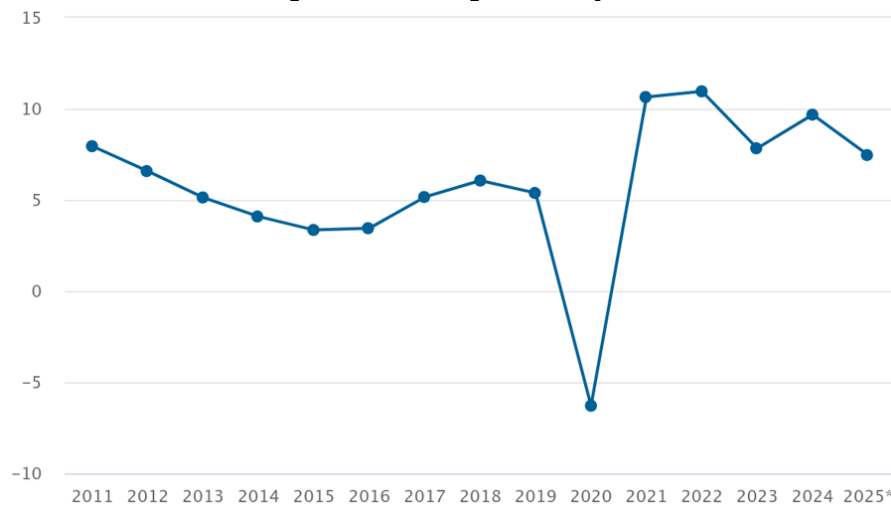
Source: www.iea.org (IEA, 2025^b)

It is noteworthy that energy demand is increasing significantly in developing countries, including Georgia. In our country, the average annual growth rate of electricity consumption is projected at 3.4% for the period 2026–2035. The study shows that, like the rest of the world, the energy consumption growth is closely linked to economic development.

It is important to note that in the post-COVID-19 pandemic period, Georgia's economy has grown substantially (Giguashvili et al., 2022). According to the National Statistics Office of Georgia, despite global challenges, the economy continues to develop steadily. Between 2021 and 2025, Georgia recorded an average real Gross Domestic Product (GDP) growth rate of 9.3%. The forecast for economic growth in 2026 has been set at 6.5%.

Figure 2

Cumulative Growth Indices of Gross Domestic Product compared to the same period of the previous year, %



Source: www.geostat.ge

The continued growth of the economy will largely depend on improving energy policy. Hydropower represents one of the main pillars of the country's energy system; however, in recent years, interest in solar and wind energy has also been increasing. The costs of wind turbines and solar panels are steadily declining, making the utilization of wind and solar energy increasingly attractive. Georgia intends the share of renewable energy in total final energy consumption to become 27.4% by 2030. By that period, the projected integration capacity could be 1,332 MW of wind power and 520 MW of solar power plants (Kvaratskhelia, 2023).

It is noteworthy that our country is rich in renewable energy resources, including wind, solar, geothermal energy, and biomass. Their utilization attracts foreign investment, creates new jobs, and increases regional economic activity.

At the same time, Georgia's energy sector is attempting to address many challenges, including seasonal energy deficits, infrastructural problems, and insufficient investment volumes. Nevertheless, the efficient use of renewable energy provides the country with the opportunity to develop a "green economy," reduce negative environmental impacts, and strengthen economic competitiveness at both regional and international levels.

It is important to note that Georgian State Electrosystem has developed the Ten-Year Network Development Plan 2023–2033, implementation of which will significantly contribute to solving existing sectoral problems and supporting economic development (Ten-Year Network, 2023–2033).

The main challenge for our country is not only meeting the growing energy demand but also reducing dependence on imports and ensuring the timely development of local generation. According to the assessment of Galt & Taggart, Georgia could become a net exporter of electricity from 2028 onward, while by 2035, 95% of consumption may be covered by renewable energy (Gelashvili,

2026). The future development of Georgia's energy sector belongs to renewable energy sources (Tchiotashvili, 2025).

Due to its favorable geographical location, Georgia has the potential to serve as a regional energy hub and acquire strategic importance in energy integration for the countries of the Caucasus and the Black Sea basin.

CONCLUSIONS AND RECOMMENDATIONS

Thus, renewable energy represents not only an energy resource but also a strategic economic asset. Successful energy innovations can generate enormous economic and social outcomes.

For Georgia, the development of renewable energy constitutes an important foundation for sustainable economic growth. The support and expansion of this sector will contribute to the country's economic progress, energy security, and long-term social well-being.

RESEARCH LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study has several limitations. First, it relies exclusively on secondary data obtained from scientific publications, institutional reports, and official statistics. Therefore, no primary empirical data, surveys, or interviews were conducted. Second, some statistical indicators related to renewable energy projects and investments in Georgia remain incomplete or are periodically updated, which may affect the accuracy of long-term assessments. Third, the study focuses primarily on macroeconomic aspects and does not investigate firm-level or household-level impacts of renewable energy adoption.

Future research could employ quantitative econometric models to measure the causal relationship between renewable energy development and economic growth in Georgia. Additional studies may also examine the socio-economic effects of renewable energy projects at the regional level, the role of foreign direct investment in the renewable energy sector, and the impact of emerging technologies such as energy storage systems and artificial intelligence on the country's energy transition.

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