

THE ROLE OF RENEWABLE ENERGY IN COMBATING CLIMATE CHANGE: AN ECONOMIC PERSPECTIVE IN THE CONTEXT OF COP29

განახლებადი ენერჯის როლი კლიმატის ცვლილების წინააღმდეგ ბრძოლაში:
ეკონომიკური პერსპექტივა COP29-ის კონტექსტში

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Abstract. COP29 underscored renewable energy's critical role in combating climate change and driving economic growth. Technologies like wind, solar, and hydropower reduce greenhouse gas emissions while fostering energy security and job creation. This article explores the economic benefits and challenges of renewable energy adoption, with a focus on international collaboration.

Keywords: Renewable energy; Climate change; COP29; Economic growth; Sustainable development; Greenhouse gas emissions; International cooperation; Energy security.

ლია ბიბილაშვილი

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აბსტრაქტი

COP29 სამიტმა ხაზი გაუსვა განახლებადი ენერჯის მნიშვნელოვან როლს კლიმატის ცვლილებასთან ბრძოლასა და ეკონომიკური ზრდის უზრუნველყოფაში. ისეთი ტექნოლოგიები, როგორცაა ქარის, მზისა და ჰიდროენერჯია, ამცირებს სათბურის აირების ემისიებს, ერთდროულად ზრდის ენერგეტიკულ უსაფრთხოებას და ქმნის სამუშაო ადგილებს. სტატიაში განხილულია განახლებადი ენერჯის დანერგვის ეკონომიკური სარგებელი და გამოწვევები საერთაშორისო თანამშრომლობის კონტექსტში.

საკვანძო სიტყვები: განახლებადი ენერჯია; კლიმატის ცვლილება; COP29; ეკონომიკური ზრდა; მდგრადი განვითარება; სათბურის აირების ემისიები; საერთაშორისო თანამშრომლობა; ენერგეტიკული უსაფრთხოება.

Introduction. As COP29 approaches, the global spotlight has intensified on renewable energy as a critical solution to the escalating climate crisis and economic instability. Serving as the principal decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), COP29 aims to accelerate actions toward reducing greenhouse gas (GHG) emissions while ensuring a sustainable energy future. In this context, renewable energy emerges as a transformative force, offering pathways to mitigate climate change while addressing pressing economic and social challenges.

The urgency of transitioning to renewable energy lies in the global energy sector's outsized contribution to climate change, with fossil fuels accounting for over 80% of primary energy consumption worldwide. Beyond environmental benefits, the economic implications of renewable energy adoption—ranging from job creation and energy independence to fostering innovation—underscore its transformative potential. For countries like Georgia, leveraging renewable energy could lead to enhanced energy security, reduced reliance on imports, and sustainable economic growth.

This paper examines the multifaceted role of renewable energy in the context of COP29, focusing on its economic impacts, challenges to adoption, and the policy measures required to accelerate its integration. Drawing on data and analysis from leading institutions such as the International Renewable Energy Agency (IRENA) and the Intergovernmental Panel on Climate Change (IPCC), the article provides a comprehensive evaluation of renewable energy's role in reshaping global and regional economies.

Reason of research. The research is particularly relevant given the dual crises of intensifying climate impacts and geopolitical instability that disrupt global energy markets. As nations confront rising energy costs and the urgent need for climate action, renewable energy offers a sustainable alternative that aligns environmental objectives with economic growth.

Method. The scientific article is based on such research methods as empirical analysis, comparative-historical method, causal-comparative analysis, synthesis, abstraction, systematic analysis, modeling.

As COP29 convenes in a year of intensifying climate impacts and economic instability, the global focus has shifted more decisively towards renewable energy. The energy sector is responsible for the majority of global GHG emissions, with fossil fuels accounting for over 80% of the world's primary energy supply (IEA, 2022). This dependence on coal, oil, and natural gas has led to alarming increases in atmospheric CO₂ levels, contributing to rising global temperatures and more frequent extreme weather events. Renewable energy technologies offer a practical solution to this crisis by providing a means to decarbonize energy production while maintaining economic productivity.

Wind, solar, hydroelectric, geothermal, and biomass energy sources are inherently low-carbon, enabling substantial reductions in emissions compared to fossil fuels. For instance, the IPCC estimates that a global transition to 70-85% renewable electricity by 2050 could limit global warming to 1.5°C, a critical threshold for avoiding catastrophic climate impacts (IPCC, 2023).

Technological advancements have significantly reduced the costs of renewable energy, making it more accessible than ever before. Over the past decade, the cost of solar photovoltaic (PV) energy has fallen by 85%, and onshore wind energy has decreased by 56% (IRENA, 2022). These cost reductions have made renewables the cheapest source of power in many parts of the world, enabling widespread adoption.

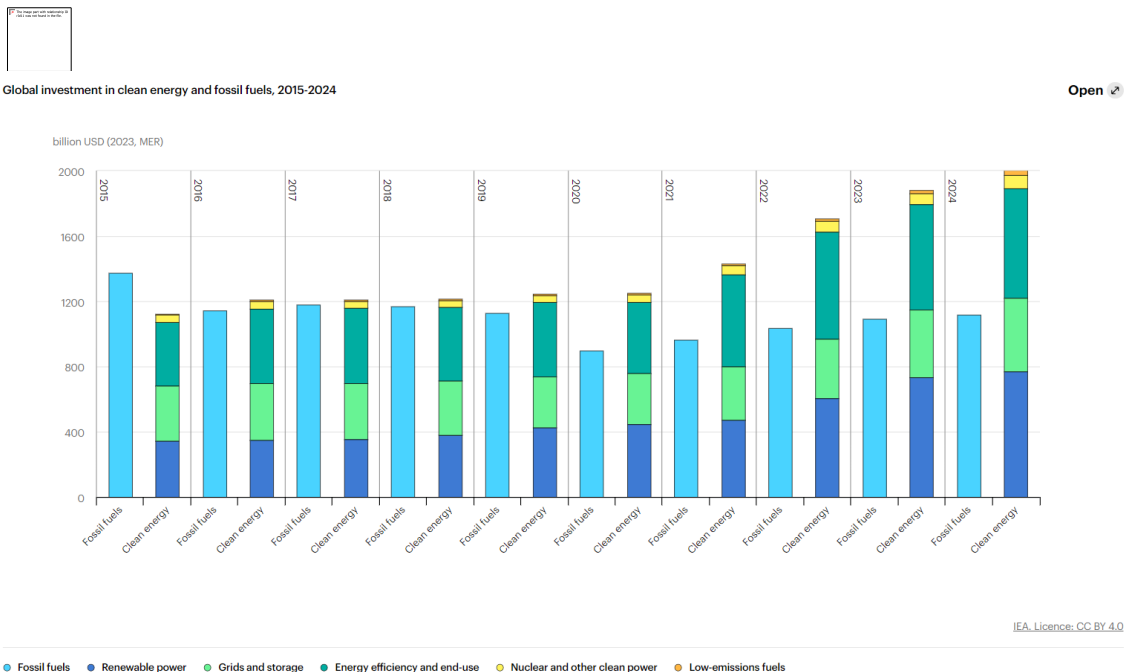
Economic Benefits of Renewable Energy. The transition to renewable energy brings substantial economic benefits, from job creation to enhanced energy security and economic growth.

1. Job Creation: The renewable energy sector is a dynamic source of employment, offering opportunities across the value chain, including manufacturing, installation, maintenance, and research. According to IRENA, the sector employed 12.7 million people globally in 2022, a figure projected to grow exponentially as countries ramp up renewable energy deployment. These jobs are often localized, providing economic opportunities in rural and underserved regions.

2. Energy Independence: Renewables reduce dependence on imported fossil fuels, enhancing energy security and insulating economies from price volatility in global energy markets. For instance, Europe’s REPowerEU initiative underscores the strategic importance of renewables in achieving energy independence, particularly in light of geopolitical tensions and supply disruptions caused by the Russia-Ukraine war (European Commission, 2023).

3. Economic Growth and Innovation: Renewable energy stimulates economic growth by driving innovation and attracting investment. The sector has seen over \$2.5 trillion in global investments over the past decade, with these funds supporting not only renewable technologies but also related industries such as battery storage and electric vehicles (BloombergNEF, 2023).

Figure 1. Global investment in clean energy and fossil fuels, 2015-2024



Despite its advantages, the transition to renewable energy faces significant obstacles. One major challenge is the intermittency of renewable energy sources like solar and wind, which

depend on weather conditions. This intermittency requires advanced energy storage systems and grid management solutions to ensure a reliable power supply. Advances in battery technology, including lithium-ion and solid-state batteries, are helping address this issue, but further investment and innovation are needed (Lazard, 2022).

High initial capital costs remain another barrier, particularly for developing countries. While operational costs for renewables are relatively low, the upfront investment required for infrastructure development can be prohibitive. Addressing this issue necessitates international financial support, innovative funding mechanisms, and public-private partnerships.

Social and political resistance also poses a challenge. Fossil fuel industries wield considerable influence in many economies, creating resistance to policies that promote renewables. Additionally, public skepticism about renewable energy's reliability and economic feasibility must be addressed through education and transparent policymaking.

To ensure a successful transition to renewable energy, governments and international organizations must implement comprehensive policy measures.

- 1. Infrastructure Development:** Investment in renewable energy infrastructure, including generation facilities, storage solutions, and grid modernization, is essential. Public-private partnerships can mobilize the capital needed for large-scale projects.
- 2. Carbon Pricing:** Mechanisms such as carbon taxes and cap-and-trade systems incentivize renewable energy adoption by making fossil fuels less economically attractive. Successful examples from Sweden and Canada demonstrate the effectiveness of these policies.
- 3. Global Collaboration:** International cooperation is critical to bridging the technology and financing gaps between developed and developing nations. Initiatives such as the Green Climate Fund provide valuable models for facilitating technology transfer and capacity building.
- 4. Support for Innovation:** Governments should prioritize funding for renewable energy research and development, focusing on next-generation technologies such as floating wind turbines and advanced photovoltaics.
- 5. Just Transition Policies:** To address resistance from affected industries and communities, governments must implement policies that provide retraining and support for workers transitioning from fossil fuel sectors to renewable energy jobs.

The Case of Georgia. Georgia stands to benefit significantly from the global renewable energy transition. With abundant hydropower resources and growing potential for solar and wind energy, the country has the opportunity to become a regional leader in clean energy. Investments in renewable energy would reduce Georgia's reliance on imported natural gas, enhancing energy security and lowering energy costs. Additionally, the development of renewable projects could stimulate rural economies, create jobs, and support climate resilience.

Georgia's government has already taken steps to promote renewables, but further action is needed to diversify its energy mix, modernize infrastructure, and align with EU energy standards. By doing so, Georgia can achieve sustainable economic growth while contributing to global climate goals.

Conclusions and recommendations. The transition to renewable energy is not merely an environmental necessity; it is a strategic opportunity to redefine the global economy in a

sustainable and equitable manner. Renewable energy offers a solution to the twin challenges of climate change and economic instability, promising significant benefits in terms of emission reductions, job creation, and energy security.

For nations like Georgia, the shift to renewable energy represents a pathway to achieving energy independence, fostering economic development, and addressing climate vulnerabilities. By leveraging its natural resources and aligning with international best practices, Georgia can play a vital role in the global energy transition.

As COP29 highlights the urgency of climate action, it is crucial for governments, businesses, and international organizations to prioritize renewable energy in their strategies. Overcoming the challenges of intermittency, initial costs, and political resistance will require bold policies, sustained investment, and collaborative efforts. However, the rewards—a cleaner, more sustainable world—are well worth the effort.

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