ENERGY TRANSITION AS A FACTOR OF SUSTAINABLE DEVELOPMENT

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Abstract: *The global energy transition represents one of the central pillars of sustainable development in the twenty-first century. It embodies a structural transformation of the energy system—from fossil fuel dependence to the widespread use of renewable and low-carbon energy sources. This transition is driven by the necessity to mitigate climate change, improve energy security, and ensure equitable economic growth. The present article analyzes the role of the energy transition as a factor of sustainable development, emphasizing its environmental, economic, and social dimensions. Using statistical data from international organizations such as the International Energy Agency (IEA), World Bank, and UNDP, the study demonstrates the accelerating dynamics of renewable energy deployment, the decline in carbon intensity, and the rising investment in clean technologies. The research highlights that the energy transition is not only an environmental imperative but also a powerful engine of innovation, employment, and inclusive growth.*

Keywords: *energy transition, renewable energy, sustainable development, decarbonization, global energy policy, energy security, carbon neutrality, green investment.*

The energy transition has become one of the defining trends of modern civilization. It refers to the gradual but irreversible transformation of global energy production, distribution, and consumption patterns toward cleaner, more sustainable systems. Historically, each stage of human development was marked by a specific energy paradigm—from wood and coal during the industrial revolution to oil and natural gas in the twentieth century. Today, humanity is witnessing a new transformation: the rise of renewable energy technologies such as solar, wind, hydro, and biomass,

accompanied by the digitalization and decentralization of energy systems. This evolution is not merely technical but systemic, reshaping economies, societies, and geopolitical relations.

The link between energy transition and sustainable development is deeply embedded in the framework of the United Nations Sustainable Development Goals (SDGs), particularly Goal 7 — "Affordable and Clean Energy." Access to reliable and sustainable energy underpins all other goals, from poverty reduction and industrialization to climate action and innovation. The transition from fossil fuels to renewables reduces greenhouse gas emissions, improves air quality, enhances energy security, and creates new economic opportunities. In this sense, the energy transition is both a prerequisite and a driver of sustainable development.

The global momentum toward clean energy has accelerated remarkably in the past two decades. According to the International Energy Agency, the share of renewables in global electricity generation grew from around 20% in 2010 to over 32% in 2023. Solar and wind power, which were once niche technologies, now dominate new capacity additions worldwide. Meanwhile, energy efficiency improvements and electrification of transport and heating sectors are contributing to a steady decline in carbon intensity across economies.

Table 1. Global Energy Transition Indicators (2010–2024)

Indicator	2010	2015	2020	2024	Change (2010-2024)
Share of renewables in global electricity (%)	20.1	24.5	29.0	32.4	+12.3
Global CO_2 emissions (billion tons)	33.1	35.0	33.8	32.1	– 3.0%
Renewable energy investment (billion USD)	310	330	520	630	+103%

Global average cost of solar energy (USD/MWh)	180	110	60	40	–78%
Global clean energy jobs (million)	9.8	10.5	12.7	14.5	+48%

Source: IEA (2024), World Bank (2024), BloombergNEF (2024).

The data above illustrate the profound structural shift underway. While global emissions have only recently stabilized, the economic and technological foundations for deep decarbonization are rapidly strengthening. Investment in renewable energy exceeded 630 billion USD in 2024, surpassing fossil fuel investment for the first time in history. The cost of solar power has declined by nearly 80% since 2010, making it the most affordable source of electricity in many regions. These changes demonstrate how innovation, market forces, and policy interventions can align to accelerate sustainability. Energy transition policies vary across regions but share common goals: reducing carbon emissions, increasing energy efficiency, and ensuring energy access. The European Union, through its Green Deal and "Fit for 55" package, aims for full climate neutrality by 2050. China, the world's largest energy consumer, targets 1,200 GW of installed renewable capacity by 2030 and massive expansion of electric vehicles. The United States, under the Inflation Reduction Act (2022), has allocated over 370 billion USD to clean energy subsidies, reshaping the investment landscape. Developing countries are also advancing: India has become one of the top five renewable producers, while nations in Africa and Latin America are leveraging solar and hydro resources to achieve energy independence.

Beyond its environmental benefits, the energy transition has major economic implications. It generates new employment opportunities across the renewable energy value chain from research and engineering to installation and maintenance. According to the International Renewable Energy Agency (IRENA), the renewable energy sector employed more than 14.5 million people in 2024, a 50% increase compared to a decade earlier. Green investments are stimulating technological innovation and competitiveness, particularly in clean manufacturing, battery storage, and digital grid management. In this context, sustainability and profitability are increasingly converging. Socially, the energy transition contributes to improving the quality of life by expanding access to affordable and clean energy. Around 750 million people worldwide still lack electricity, primarily in Sub-Saharan Africa and South Asia. Expanding decentralized renewable systems such as mini-grids and off-grid solar kits helps close this gap, promoting inclusiveness and equity. Moreover, reducing

dependence on imported fossil fuels enhances national energy security and resilience to global price shocks. Thus, energy transition serves as both an environmental and a socioeconomic stabilizer.

Nevertheless, the global transition is uneven and faces significant challenges. Fossil fuels still account for about 80% of total primary energy consumption, and global subsidies for oil, coal, and gas exceeded 1 trillion USD in 2023. The infrastructure for renewables requires high upfront investments, and grid integration remains a technical obstacle. Furthermore, the geopolitical implications of the transition such as competition for critical minerals (lithium, cobalt, nickel) introduce new dependencies. Managing these risks requires international cooperation, sustainable mining practices, and circular economy principles to ensure that clean technologies do not generate new forms of environmental degradation. The energy transition also demands a profound rethinking of policy and finance. Governments play a central role in establishing clear regulatory frameworks, carbon pricing mechanisms, and research funding. At the same time, private capital must be mobilized through green bonds, sustainability-linked loans, and public-private partnerships. The World Bank and the International Monetary Fund increasingly integrate climate risk into economic assessments, while the European Investment Bank and Asian Development Bank have aligned their lending portfolios with the Paris Agreement. These trends indicate the growing centrality of finance in driving sustainable energy transformation. From a systemic perspective, the energy transition is both a technological revolution and a governance challenge. It requires coordination across multiple sectors energy, transport, industry, agriculture, and construction and across different levels of governance, from local communities to global institutions. Achieving net-zero emissions will depend on the coherence of these efforts, as well as on innovation in energy storage, hydrogen production, and carbon capture technologies. Digitalization and artificial intelligence can further enhance efficiency by enabling smart grids, predictive maintenance, and demand-side management. In the long term, the success of the energy transition will determine the trajectory of global sustainable development. A low-carbon economy promises not only to stabilize the climate but also to unlock new opportunities for inclusive growth and technological leadership. The experience of recent years suggests that the energy transition is self-reinforcing: as costs decline and benefits expand, social and political support for clean energy grows. However, ensuring that this transformation is equitable protecting vulnerable workers and communities is equally essential. Policies must include just transition frameworks that provide retraining, social protection, and regional diversification to avoid social fragmentation.

Conclusion. The energy transition is a cornerstone of sustainable development, linking environmental protection, economic modernization, and social well-being. It represents both a necessity and an opportunity: a necessity to prevent catastrophic

climate change, and an opportunity to create a resilient, inclusive, and innovative global economy. Statistical data confirm that renewable energy, once marginal, is now mainstream, and that investment and employment in the sector are growing at unprecedented rates. Yet, to realize the full potential of this transition, the world must overcome structural and financial barriers, expand international cooperation, and ensure that the process benefits all nations equitably. The energy transition is not only an energy policy it is the foundation of a sustainable civilization.

REFERENCES

1. International Energy Agency (IEA). World Energy Outlook 2024. Paris: IEA, 2024.
2. World Bank. State and Trends of Carbon Pricing 2024. Washington, D.C., 2024.
3. BloombergNEF. Energy Transition Investment Trends 2024. New York, 2024.
4. International Renewable Energy Agency (IRENA). Renewable Energy and Jobs: Annual Review 2024. Abu Dhabi, 2024.
5. United Nations Development Programme (UNDP). Human Development Report 2023: Climate and Energy. New York, 2023.
6. European Commission. Fit for 55: Delivering the European Green Deal. Brussels, 2021.
7. International Monetary Fund (IMF). Climate and Financial Stability Report 2024. Washington, D.C., 2024.
8. World Economic Forum. Fostering a Fair Energy Transition 2023. Geneva, 2023.
9. Organization for Economic Cooperation and Development (OECD). Clean Energy Finance and Investment Policy Review 2023. Paris, 2023.
10. International Energy Forum (IEF). Global Energy Security Review 2024. Riyadh, 2024.