

FINANCING PROJECTS RELATED TO THE CREATION OF RENEWABLE ENERGY SOURCES

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Abstract

The article examines the problems and presents proposals for achieving energy security and sustainable development as a key priority for all countries of the world community. The article examines the main trends in the development of renewable energy sources in the world and in Uzbekistan, and also highlights the economic aspects of using clean energy. According to the author, in the context of global climate change and depletion of natural resources, taking into account Uzbekistan's energy dependence on supplies of extracted energy, the transition to renewable energy sources (solar and wind) will help reduce this dependence and ensure a sustainable energy future for the country, while reducing the negative impact on the environment.

Keywords: renewable energy sources, traditional energy sources, energy security, solar energy, wind energy, geothermal energy, biofuel, power units, hydroelectric power plants, “green” economy.

Introduction

All countries of the world community pay attention to energy security and problems that impede the achievement of sustainable development and their solution as a top priority. The use of solar, wind, hydro and other renewable energy sources, including geothermal energy, the use of biomass (organic waste) for energy production, biofuels (bioethanol, biomethanol, biodiesel, biogas, etc.) is widespread in the world. According to the report of the German global data platform Statista: “In 2022, solar photovoltaics was the renewable technology that accounted for the largest share of investments. Investments in Solar PV amounted to almost USD 300 billion that year. Onshore wind energy followed with a total of USD 140 billion invested. Meanwhile, investments in geothermal energy stood at roughly USD 180 million” [1]. In the context of global climate change and depletion of natural resources, Uzbekistan's increasing need for importing natural gas and oil requires the introduction of effective measures to switch to renewable energy sources as a decisive solution. Reducing this energy dependence



will help ensure a sustainable energy future for the country while reducing the negative impact on the environment.

The importance of renewable energy sources in achieving sustainable development, their role in ensuring economic security, the problems that arise in ensuring energy security, as well as areas for improving the sustainable energy future of the country are being studied in the world. Despite the research and theoretical studies conducted within the framework of this topic, the fact that the issues of financing projects related to the creation of renewable energy sources have not been fully studied, comprehensively and systematically, and this indicates the need for in-depth scientific research in this area.

Along with the radical improvement of the business and investment environment in Uzbekistan, attention is also paid to environmental protection, the prevention of environmental crises, the creation of renewable energy sources, thereby developing the country's economy based on the principles of a "green economy". In the reforms to ensure the welfare of the population through stable economic growth of the republic, such goals as "Transition to a green economy, a radical increase in the use of renewable energy as its basis" [2] are among the priority goals of Uzbekistan for the near future.

Literature Review

Many scientists have contributed to the development of renewable energy in the world, one of the most famous of them is the former Director-General of the International Renewable Energy Agency (IRENA) Adnan Z. Amin in his lectures said: "The changing climate is largely being driven by emissions from burning fossil fuels, although there are other important contributors. To stem climate change we must reduce our consumption of these carbon-intensive fuels. Renewables can and must be a central part of this plan.

The increased deployment of renewables will also bring other benefits. Renewable energy technologies create jobs, reduce local air pollution and require less water. Renewable energy technologies almost exclusively use local resources and therefore help insulate our economies from external energy security shocks" [3], and the current Director-General of this international agency Francesco La Camera believes that: "The International Renewable Energy Agency (IRENA) is at the forefront of calls for an inclusive, resilient and fair energy transition. We are urging bold, collective action uniting developed and developing, transitional and emerging countries as well as small island States.

IRENA is convinced that only by accelerating action on renewables is it possible to provide climate resilience, build energy security for all, and promote global economic growth and social inclusion" [4].

Victor Badaker and Iva Brkic, researchers of solar and wind energy projects in the CIS countries, state: "The energy sector is in transition and undergoing significant structural changes to ensure universal access to affordable, reliable, sustainable and modern energy for all. The key is to transform energy systems by integrating a variety of traditional and renewable energy sources across a wide range of capacities. By creating policy, market and regulatory conditions, countries can attract investment and accelerate innovation through smart grids, efficient, reliable and sustainable technologies. However, countries need to prepare to mitigate potential challenges when attempting to integrate renewable energy sources" [5].



The energy structure plays an important role in economic development, which is noted in the works of K. Block and E. Nieuwlaar [6], linking the development of society with the transformation of the energy structure and highlighting the role of renewable energy sources as a new direction in the transformation. Also, in the works of J. Twidell and T. Weir [7], the features of integrating individual types of renewable energy sources into systems are highlighted. D. Maradin [8] in his scientific articles notes the advantages and disadvantages of introducing renewable technologies and how to avoid possible risks for the energy system.

Research Methodology

Various research methods were used in the article: statistical observation, analysis and synthesis method, systematic approach, grouping and comparison methods, fact gathering method, etc.

Analysis and Results

In the era of globalization, countries are closely interconnected with each other, and the energy sector, due to both the natural advantage of some countries (fossil fuels are unevenly distributed) and the development of international trade and increasing dependence on supply chains, is one of the vulnerable areas for energy importing countries.

Electricity and fuel are an important component of any country's economy, since all sectors depend on its use: industry, agriculture and services, as well as the competitiveness of exports. Moreover, the well-being of the population depends on access to electricity sources.

Previously, environmental arguments were mainly cited in favor of the introduction of renewable energy, such as reducing CO₂ emissions, but now economic problems have become acute, the causes of which are the threat to the energy sector. The economic background comes to the fore.

Priorities in the field of economics and ecology have come to unity, and their agreed vision means great prospects for alternative energy. Broad coalitions are interested in building a new energy economy, and the crisis that has erupted has proven the importance of restructuring the economic system.

According to the International Energy Agency, in 2023, the world produced 29,734 terawatt-hours of electricity, approximately 1/3 of which was coal, 1/5 was oil and gas, and 1/10 was nuclear energy. 8959 terawatt-hours, or 30% of all global electricity, was produced from renewable energy sources [9].



Table 1 Breakdown of global electricity supply and emissions, 2021-2026 [9]

TWh	2021	2022	2023	2026	Growth rate 2021-2022	Growth rate 2022-2023	CAAGR 2023-2026
Nuclear	2 809	2 668	2 741	2 959	-5.0%	2.7%	2.6%
Coal	10 284	10 442	10 613	10 088	1.5%	1.6%	-1.7%
Gas	6 556	6 609	6 639	6 785	0.8%	0.5%	0.7%
Other non-renewables	852	857	782	705	0.6%	-8.8%	-3.4%
Total renewables	7 925	8 549	8 959	12 158	7.9%	4.8%	10.7%
Total Generation	28 426	29 124	29 734	32 694	2.5%	2.1%	3.2%

Mt CO ₂	2021	2022	2023	2026	Growth rate 2021-2022	Growth rate 2022-2023	CAAGR 2023-2026
Total emissions	13 263	13 448	13 575	13 111	1.4%	0.9%	-1.2%

It is important to note that investments in this area are currently increasing, as evidenced by data from the International Energy Agency report: “Global energy investment is set to exceed USD 3 trillion for the first time in 2024, with USD 2 trillion going to clean energy technologies and infrastructure. Investment in clean energy has accelerated since 2020, and spending on renewable power, grids and storage is now higher than total spending on oil, gas, and coal” [10].

Modern energy systems and infrastructures require high financing costs and investments. However, the impact on project economics has been partially offset by easing supply chain pressures and falling prices. Solar panel costs have decreased by 30% over the last two years, and prices for minerals and metals crucial for energy transitions have also sharply dropped, especially the metals required for batteries.

“There are tentative signs of a pick-up in energy investments: in our assessment, clean energy investments are set to approach USD 320 billion in 2024, up by more 50% since 2020. This is similar to the growth seen in advanced economies (+50%), although trailing China (+75%). The gains primarily come from higher investments in renewable power, now representing half of all power sector investments in these economies. Progress in India, Brazil, parts of Southeast Asia and Africa reflects new policy initiatives, well-managed public tenders, and improved grid infrastructure. Africa’s clean energy investments in 2024, at over USD 40 billion, are nearly double those in 2020” [10].

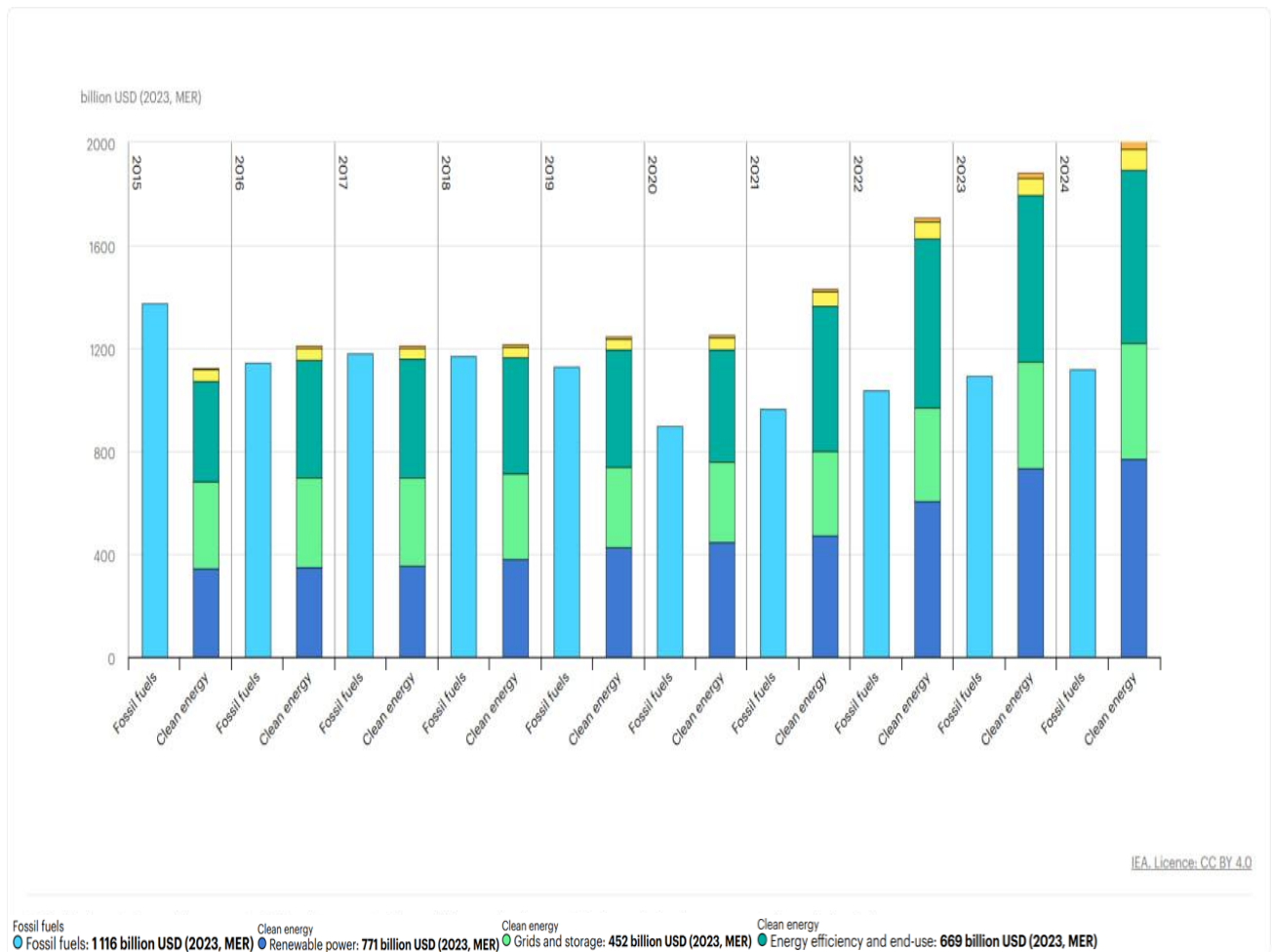


Figure 1. Global investment in clean energy and fossil fuels, 2015-2024 (in billion USD)
[10]

Power sector investment in solar photovoltaic (PV) technology is projected to exceed USD 500 billion in 2024, surpassing all other generation sources combined. Though growth may moderate slightly in 2024 due to falling PV module prices, solar remains central to the power sector’s transformation. In 2023, each dollar invested in wind and solar PV yielded 2.5 times more energy output than a dollar spent on the same technologies a decade prior.

In 2015, the ratio of clean power to unabated fossil fuel power investments was roughly 2:1. In 2024, this ratio is set to reach 10:1. The rise in solar and wind deployment has driven wholesale prices down in some countries, occasionally below zero, particularly during peak periods of wind and solar generation. This lowers the potential for spot market earnings for producers and highlights the need for complementary investments in flexibility and storage capacity.

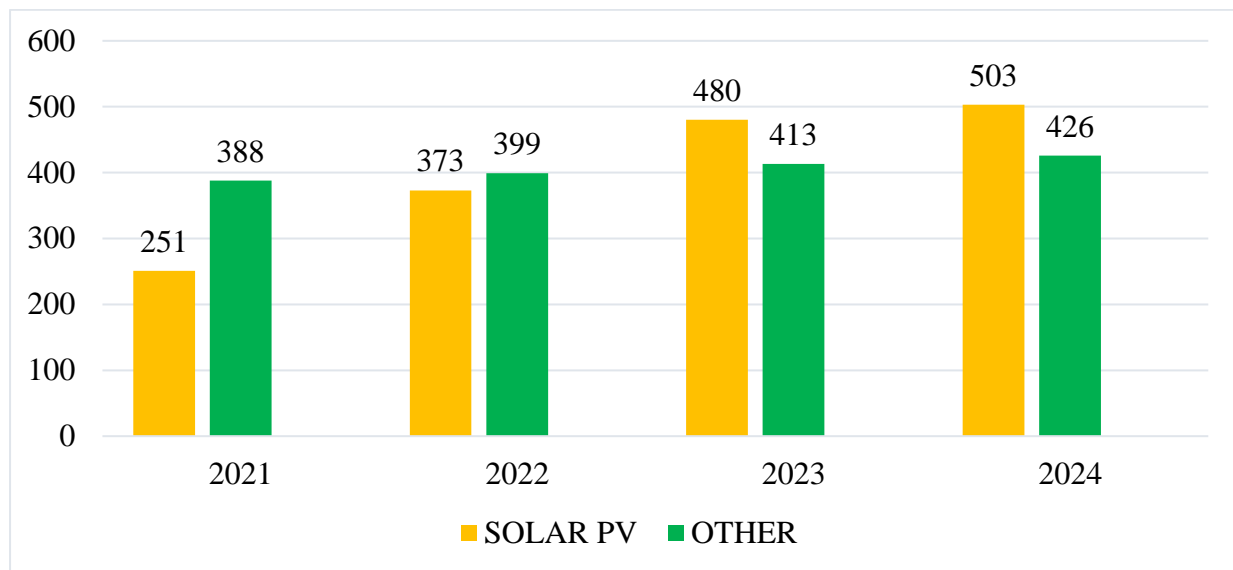


Figure 2. Global annual investment in solar PV and other generation technologies, 2021-2024 (in billion USD) [10]

Investments in nuclear power are expected to pick up in 2024, with its share (9%) in clean power investments rising after two consecutive years of decline. Total investment in nuclear is projected to reach USD 80 billion in 2024, nearly double the 2018 level, which was the lowest point in a decade.

Grids have become a bottleneck for energy transitions, but investment is rising. After stagnating around USD 300 billion per year since 2015, spending is expected to hit USD 400 billion in 2024, driven by new policies and funding in Europe, the United States, China, and parts of Latin America. Advanced economies and China account for 80% of global grid spending. Investment in Latin America has almost doubled since 2021, notably in Colombia, Chile, and Brazil, where spending doubled in 2023 alone.

Investments in battery storage are ramping up and are set to exceed USD 50 billion in 2024. But spending is highly concentrated. In 2023, for every dollar invested in battery storage in advanced economies and China, only one cent was invested in other EMDE.

The growth of investments in renewable energy projects is mainly supported by the goals of reducing harmful gas emissions, modern technologies and technological advances, ensuring energy security and strategic goals set by governments. Industrialized countries are beginning to adopt new industrial strategies to promote clean energy production and gain a strong position in the market. To strengthen the supply chains of renewable energy, it is necessary to apply strong and effective measures of various incentives and compensations from the state to producers and consumers of clean energy in industrial production and for their own needs.

Conclusions and Suggestions

Today, in many countries around the world, the concept of "sustainable development" is promoted as the main goal of the state, efforts are being made to abandon the production of carbon fuel and switch to the use of clean fuels and technologies.

In order to establish the use of cheap, reliable, stable and modern energy in the national economy, ensure energy security and environmental protection, in our opinion, it is necessary to implement the following measures:

- integration of solar and wind energy into energy systems;
- creation of national institutions for planning energy consumption and production in the future;
- improvement of methods for combining reliable and timely statistical data on renewable and fossil fuels;
- development of legislative measures to support the integration of renewable energy sources into energy systems;
- use of international experience to harmonize national and international energy standards;
- use of modern technologies for the efficient production of solar and wind energy;
- implementation of measures to reduce carbon dioxide emissions and protect the environment in the energy sector;
- modernization of energy systems using production based on solar and wind energy;
- creation of a guide for potential investors willing to invest in renewable energy projects;
- training of national personnel for the integration of renewable energy into the country's energy system.

There are also a number of obstacles to expanding the use of renewable energy sources in our country:

1. Legislative factors. The legal basis for economic mechanisms to stimulate the use of renewable energy sources has not yet been sufficiently formed and completed.
2. Economic factors. Low capacity of renewable energy sources compared to traditional energy sources, the lack of introduction of benefits (tariffs and taxes) and specific financial mechanisms of state support for renewable energy sources do not exist.
3. Technological factors. Progressive equipment and technologies based on modern management systems are not sufficiently developed.
4. Information factors. Lack of information on the potential of renewable energy sources.

Several economic mechanisms are used in the world to promote the use of renewable energy sources. These mechanisms include economic mechanisms such as green certification systems, state reimbursement of technical costs, fixed tariffs for renewable energy and net metering systems.

In addition, we can include the following economic mechanisms to stimulate the use of renewable energy sources:

- creation of networks of producers of renewable energy sources (population and legal entities), as well as creation of conditions for the sale of excess energy from consumption;
- increase in tariffs for traditional energy sources;
- ensure free access of producers of renewable energy sources belonging to the private sector to the electricity market, including the sale of excess consumption;



- introduction of mandatory quotas for the consumption and production of renewable energy in some industries;
- collection of fines and taxes for emissions of harmful substances into the environment using fossil energy sources.

The use of a number of the above economic mechanisms to stimulate the use of renewable energy sources, as well as an increase in the share of renewable energy sources in total energy consumption will lead to increased economic efficiency, a decrease in the negative impact on the environment and, ultimately, to ensuring sustainable development of the country and energy security.

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