

Prospects for Alternative Energy Development in Uzbekistan

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ABSTRACT

Purpose – This study aims to explore the potential and prospects of alternative energy development in Uzbekistan, highlighting the imperative transition to renewable energy sources.

Design/methods/approach – This research employs a documentary research method, which involves systematically collecting and analyzing existing documents, records, and data. The methodology integrates archival research and content analysis to provide a comprehensive understanding of Uzbekistan's energy landscape.

Findings – The study reveals that Uzbekistan has significant potential for alternative energy development, particularly in solar and wind energy. However, the current utilization of these resources remains minimal. The findings underscore the necessity for policy support, investment, and public awareness to achieve the country's renewable energy goals.

Research implications/limitations – The research emphasizes the need for Uzbekistan to invest in renewable energy infrastructure and develop supportive policies to encourage the adoption of alternative energy sources. Limitations of the study include the reliance on secondary data and the focus on Uzbekistan, which may limit the generalizability of the findings.

Originality/value – This study contributes to the existing literature by providing a detailed analysis of the prospects and challenges of alternative energy development in Uzbekistan. It offers valuable insights for policymakers, investors, and researchers interested in the transition to renewable energy.

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Introduction

The study's purpose will be discussed towards the end. Before unveiling the study's purpose, we will delve into the background and conduct an initial literature review to establish the current state of knowledge, setting the stage for a "gap analysis" to identify the research's novelty in comparison to existing articles, research, and hypotheses.

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Despite persistent uncertainties related to policy incentives and competition from historically low natural gas prices, the alternative energy sector continues to gain momentum. Particularly, the growth of wind and solar power has consistently outpaced earlier projections. While challenges persist, the alternative energy industry remains resolute in its progress.

Notably, the Republic of Uzbekistan, under the leadership of President Shavkat Mirziyoyev, has committed to embracing "green" technologies and expanding the use of renewable energy sources (RES) as part of its decarbonization efforts within the energy sector. President Mirziyoyev announced ambitious plans during the second International Summit "Partnership for Green Growth and Global Goals - 2030" (P4G), aiming to increase the share of electricity produced from renewable energy sources in Uzbekistan by more than threefold, reaching 25% within the next decade.

The industry's optimistic growth prospects are driven by a combination of established and emerging trends. Innovative business models, such as public solar power initiatives, are broadening the market and attracting both new consumers and suppliers. Government mandates focusing on the resilience of electrical grids are promoting the adoption of distributed renewable generation. Corporations are also committing to sourcing 100% of their energy from renewables in the near future. Furthermore, government policies, like the clean energy plan, are poised to further facilitate industry growth.

By adhering to these requirements, your introduction will effectively set the stage for your research, providing the necessary context and highlighting the novelty of your scientific investigation within the field of alternative energy.

Energy issues come out on top in the world among the most important problems and challenges that society will have to solve in the XXI century. The existing energy resource base, on which the entire economic activity of mankind is built, will be exhausted, and in the foreseeable future. In this regard, the issues of energy conservation, development and implementation of alternative energy or renewable energy sources (RES) are becoming one of the most urgent.

Managing the use of alternative energy sources is a multi-faceted problem that includes the role of the state, the specifics and technologies of its activities in this area, as well as relations with business and the population. The range of managerial and economic problems includes organizational forms, economic mechanisms and tools for attracting investment in this area of activity; stimulating electricity production and effective development of regional energy markets. Studies of these aspects are devoted to the research of Russian scientists: M. N. Afanasyev, S. Yu. Glazyev, G. V. Gorlanova, G. A. Drobova, S. S. Evtyukhov.

YM Koryakina, R.D. Margulova, N.N. Moiseeva, D. Reilly, J. Frisch, V. Hefele, D. Emonds and others were engaged in forecasting the development of the energy sector. As well as the Chinese leaders Mao Zedong and Zhou Enlai. There is a fairly extensive range of literature containing generalizations on the aspects of reforming the electric power industry. These are the works of V. V. Khlebnikov, T. N. Kirilova, L. A. Korshunov, Lester Brown, J. Wong, Sun Xia, Sun Yat-sen, Che Tshai, Mu Sheshai, Lu Yumei, Yun Jo.

Theoretical research of these problems and development of scientific and practical measures for their implementation is a very urgent task, which is important for the development of the national economy and solving urgent social problems of citizens.

Today, the energy sector includes:

- traditional component of technological development;
- the institutional environment (regulatory rules, business norms);
- configurations of factors and their social practices (relationships and interactions between energy producers and consumers, regulators, public organizations, etc.);
- socio-cultural context (cultural values and socio-economic trends).

At the same time, many aspects of the development of the electric power industry in theoretical and methodological terms are insufficiently studied. The variety of different aspects of managing the electric power complex, the urgency of finding new approaches to solving the problems of the electric power industry and state management of structural transformations of the industry makes it important to conduct further scientific research in this direction.

In the last century, 90 years since the beginning of the decade, the international community has also realized the growing importance of climate change. In response to climate change, it adopted the United Nations Framework Convention on Climate Change and its Kyoto Protocol. Today, many countries have gradually thrown out various forms of a commitment scheme to reduce greenhouse gas emissions: the EU officially proposed a 20 % emissions base by 2020 in 1990 %, a reduction in the case of an international treaty of 30 % target. Australia committed 2020 in 2000 emissions based on 5 % - 15 %, the US also stands at 2020 annual emissions back to 1990 levels, Japan also said it will announce year 2020 emission reduction targets in quantitative terms commitment to 89 programs in other developed countries is also expected to continue to drop. At the same time, major developing countries also concave out of the commitment scheme, such as South Africa's commitment to its emissions in 2025 peaked around a year ago, South Korea announced it would release its year 2020 annual emission reduction targets . China's economic and social development in the field of sustainable energy development has ambitious goals. But with the rapid development of industrialization, urbanization, while dependent on the large consumption of fossil energy resources to create great material wealth, Chinese energy resources and environmental problems are becoming more prominent, with climate change as a representative of global environmental problems becoming a common challenge for the world's countries.

The world uses a variety of alternative energy methods that are effectively operated. The main ones are as follows:

Alternative energy - is a set of promising methods of generating energy that are not as common as traditional ones, but are of interest because of the cost-effectiveness of their use with a low risk of causing harm to the environment. Types of alternative energy: solar energy, wind energy, biomass energy, wave energy, gradient temperature energy, shape memory effect, tidal energy, geothermal energy.

Solar energy is the conversion of solar energy into electricity using photovoltaic and thermodynamic methods. For the photoelectric method, photoelectric converters (PEPs) are used with direct conversion of the energy of light quanta (photons) into electricity.

Geothermal energy - is a method of generating electricity by converting the Earth's internal heat (energy from hot steam and water sources) into electrical energy. This method of generating electricity is based on the fact that the temperature of rocks increases with depth, and at the level of 2-3 km from the Earth's surface, it does not exceed 100 ° C. There are several schemes for generating electricity from a geothermal power plant.

Wind energy - is a branch of energy that specializes in the use of wind energy (the kinetic energy of air masses in the atmosphere). A wind farm is an installation that converts the kinetic energy of the wind into electrical energy. It consists of a wind turbine, an electric current generator, an automatic device for controlling the operation of the wind turbine and generator, and means for their installation and maintenance.

Energy of the temperature gradient. This method of energy production is based on temperature differences. This is not very common. With its help, you can generate quite a large amount of energy at a moderate cost for generating electricity.

Renewable energy accounts for more than a quarter (26%) of global electricity production. Since 2000, except hydroelectric power, the generation –of renewable energy has increased more than 10 times, and wind and solar energy are in the first place.

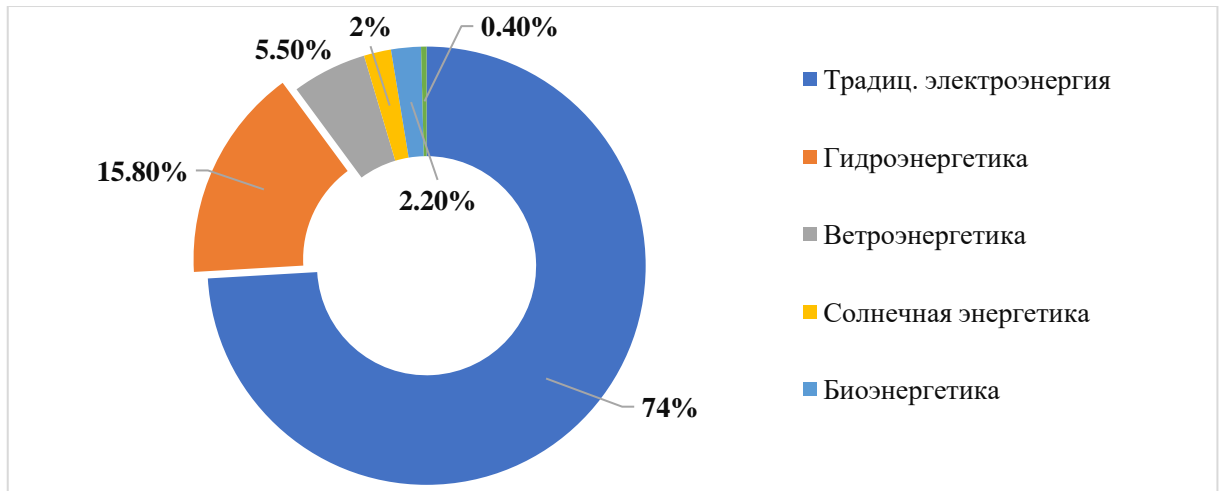


Figure 1. Share of renewable energy sources in total electricity production in the world in 2019

Source: REN21 data

1.1. Leading countries in the production of renewable energy.

The main countries are leaders in the production, commissioning of renewable energy the past three years, China, the United States, Brazil, India, and Germany have been the main leaders in the production, commissioning of renewable energy capacities, and investment in new energy technologies. By the way, in 2019, Russia ranked 59th in the international rating for this indicator.

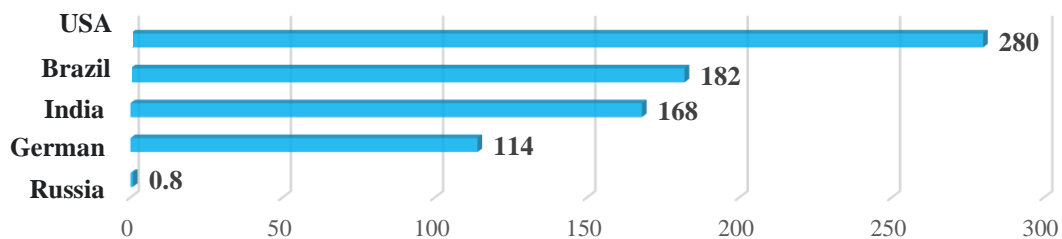


Figure 2. Global investments in renewable energy in the world for 2006-2019, billion US dollars.

Source: REN21 data

These countries also occupy a leading position in terms of electricity generation in the world over the past three years (Figure 3).

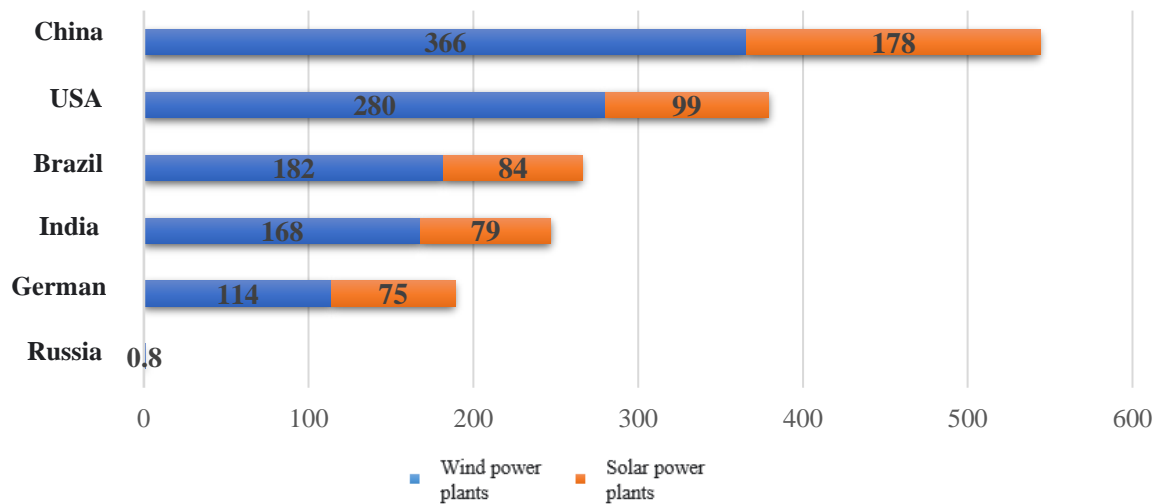


Figure 3. Global renewable energy generation in 2019, billion kWh

Source: REN21 data

- The technical potential of renewable energy sources is significant:
 Biomass of 800 MW;
 Solar photovoltaic power 593,000 MW;
 Wind 1600 MW;
 Small hydroelectric power station with a capacity of 1800 MW.
- * Renewable energy sources are currently very poorly developed:
 1.5 MW biomass;
 Solar photovoltaic power <1 MW;
 Wind <1 MW;
 Small hydroelectric power station with a capacity of 394 MW. [3]

Methods

Type of Research: Documentary Research

Documentary research is a systematic method of gathering and analyzing existing documents, records, and data relevant to a specific research topic (Wilson, 2014). It is a valuable approach for gaining insights into historical trends, policy documents, and other written materials that can inform a comprehensive understanding of the subject matter. In the context of this study, documentary research served as the primary methodological tool.

Sources of documents used in this research

The sources of documents used in this research consist of archival materials and pertinent content from various reliable repositories. These encompass historical records, government publications, policy documents, and scholarly articles related to Uzbekistan's energy landscape. The utilization of these diverse sources enhances the comprehensiveness of the study.

Utilized Documentary Research Methods

Within the realm of documentary research, we employed two complementary methods to shed light on Uzbekistan's alternative energy landscape: archival research and content analysis.

1. **Archival Research:** Archival research involved an in-depth exploration of historical records, government archives, and official documents pertaining to energy policies and initiatives in Uzbekistan. By delving into the archives, we unearthed valuable insights into past strategies, challenges, and accomplishments in the realm of alternative energy. This historical perspective forms the foundation upon which our analysis of the current energy landscape is built.

2. **Content Analysis:** Content analysis, on the other hand, is a systematic examination of textual, visual, or audio content aimed at identifying patterns, themes, and key messages (Krippendorff, 2018). In our study, content analysis was applied to analyze relevant reports, publications, and media coverage concerning alternative energy developments in Uzbekistan. This method allowed us to extract valuable insights from a diverse range of sources, bridging historical perspectives with contemporary observations.

How to analyze using Content Analysis

Content analysis is a systematic and objective method for studying and analyzing the content of textual, visual, or auditory materials. In this research, content analysis was employed to dissect and interpret the textual data gathered from the documents. This method involves identifying patterns, themes, and key messages within the content. Researchers scrutinize the documents, segment them into manageable units, and categorize the content based on predefined criteria. By systematically examining the textual data, content analysis enables a structured exploration of themes and insights, contributing to a robust research outcome.

In the following sections, we will present the outcomes and discussions stemming from our documentary research. This combined approach of archival research and content analysis enables us to offer a comprehensive perspective on the prospects and challenges of alternative energy development in Uzbekistan, seamlessly connecting historical foundations with current insights.

Result

1. **Current State of Renewable Energy in Uzbekistan** The analysis of Uzbekistan's energy landscape reveals that, as of 2023, renewable energy sources, excluding medium and large hydropower, contribute to less than 2 percent of the total energy consumption in the country. This figure falls far short of the government's ambitious goal of achieving a 21 percent share of renewable energy in total energy consumption by 2030.

2. **Regulatory Framework and Policy Initiatives** Uzbekistan has taken commendable steps in recent years to create a conducive environment for the development of renewable energy. Key legislative measures, such as the "Law on the Use of Renewable Energy Sources" and the "Law on Public-Private Partnership," provide a regulatory framework for accelerating renewable energy projects in the country. These laws aim to attract foreign investments and promote cooperation with international partners to achieve the country's renewable energy goals.

3. **Technological Potential and Environmental Impact** The study highlights the diverse range of renewable energy sources available in Uzbekistan, including solar, wind, biomass, and geothermal energy. These sources possess significant technological potential, with the capacity to harness and convert natural resources into clean electricity. Among these, solar energy stands out as a promising avenue, given the country's ample sunlight. Moreover, the environmental impact of renewable energy sources in Uzbekistan is generally minimal to acceptable.

Discussion

1. **Challenges and Recommendations** While Uzbekistan's renewable energy prospects are promising, several challenges persist. These include the need for further education and awareness campaigns, infrastructure development, and financial support mechanisms for renewable energy projects. To address these challenges, the government should consider incentives for renewable energy adoption, streamlining permitting processes, and fostering innovation in the sector.

2. **International Comparisons** To gain insights into global trends and experiences in transitioning to renewable energy, the study conducts a comprehensive review of prior research and global statistics. Countries like China, the United States, Brazil, India, and Germany have been leaders in renewable energy production and investment. Their experiences serve as valuable benchmarks for Uzbekistan's renewable energy development.

3. **Future Prospects** Looking ahead, Uzbekistan's prospects for alternative energy development are promising. The country's commitment to increasing the share of renewable energy in its energy consumption is a significant step towards achieving energy security, environmental sustainability, and economic growth. The successful execution of planned projects and the continued collaboration with international partners will be key drivers for realizing these prospects.

Table 1. Main types of renewable energy sources and their characteristics

Aspect	Current State	Regulatory Framework	Future Prospects
Utilization of Renewables (excluding hydropower)	<2% of total energy consumption population	New laws provide regulatory	Ambitious goals for 2030:
			- 10 GW of new renewable
			- Construction of 5 GW of solar

	Low awareness among	framework for development	<ul style="list-style-type: none"> - Expansion of 1.9 GW of hydro - Attracting foreign investments - Development of 3 GW of wind - Collaboration with international partners
Technological Potential	Abundant sunlight and resources available	State Program sets targets:	- Solar energy utilization
	Diverse renewable sources	- 10 GW new renewable capacity	<ul style="list-style-type: none"> - Geothermal energy potential - Biomass and wind capacity
Environmental Impact	Minimal acceptable to	Laws encourage eco-friendly practices in renewable energy development	<ul style="list-style-type: none"> - Reduced greenhouse gas emissions - Improved air quality
International Comparisons	Benchmarking against leading nations in renewable energy adoption	Valuable lessons from global leaders inform	- China, U.S., Brazil, India, Germany as benchmarks
			- Global investment trends
Challenges and Recommendations	Ongoing education and awareness campaigns needed	Need for incentives, streamlined permitting, and innovation	- Infrastructure development
			- Financial support mechanisms
			- Encourage innovation

This table provides a consolidated overview of key aspects related to the "Results and Discussion" section, assisting readers in quickly assessing the current state, regulatory framework, development prospects, and recommendations for addressing challenges in the field of renewable energy in Uzbekistan.

The prospects for alternative energy development in Uzbekistan are encouraging, with the potential to transform the country's energy landscape and contribute to a sustainable and environmentally responsible future. Continued commitment to renewable energy initiatives, along with the necessary policy support, will be pivotal in achieving the nation's renewable energy goals.

Conclusion

Of course, as the share of electricity generated from non-permanent sources such as wind and solar increases, there are growing concerns about the ability of utilities to maintain the quality and reliability of electricity on the grid, but technological advances are making this transition easier. For alternative energy companies themselves, rapid growth can raise questions such as, how prepared they are for the organizational consequences associated with training and development, culture, productivity management, and staff readiness that are the result of rapid growth. Their success is also attracting a different kind of attention: acquisitions of wind and solar energy assets are steadily increasing, and more potential buyers are waiting in the wings.

The main factors determining the rapid transformation of energy systems in the world are:

- striving to improve the reliability and efficiency of energy systems;
- striving to expand the availability of energy using innovative technologies;
- striving to ensure a high level of environmental and climate safety.
- reducing the cost of electricity production and consumption technologies;
- development of electrification of the economy;
- expanding digitalization and automation of energy systems.

One of the challenges that many countries are currently facing in their efforts to make large-scale use of renewable energy sources,

- this is a shortage of qualified technical personnel. Electric power industry of the CIS countries

- this is more than 330 GW of installed capacity of power plants with an annual electricity generation of about 1,400TWh.

Within the framework of the association of electric power systems of the CIS member states, seven national energy systems of the states The Commonwealth works synchronously.

The energy sector of many CIS countries operates on "low-carbon" and / or "carbon-free" energy sources:

- In the Republics of Tajikistan and Kyrgyzstan, electricity is produced mainly at large hydroelectric power plants;

- * Thermal power plants in Turkmenistan, the Republic of Belarus, Uzbekistan, Moldova and the Republic of Azerbaijan, which form the basis of the electric power industry in these countries, run on natural gas;

- * B Hydroelectric power plants, nuclear power plants and natural gas-fired thermal power plants play a decisive role in the structure of generating capacities of the Republic of Armenia. Despite the progress made, the diversification of sustainable energy sources has not yet been achieved. We need to actively adopt renewable energy technologies and invest in future sustainable energy systems.

The transition to a greater share of electricity generation from intermittent sources such as wind and solar raises concerns about grid reliability and quality. However, technological advancements are facilitating this shift. For alternative energy companies, rapid growth presents challenges related to organizational readiness, including training and development, cultural alignment, productivity management, and workforce preparation. The success of these companies is also attracting increased interest, as acquisitions of wind and solar assets continue to rise, with more potential buyers entering the market.

Key drivers for the rapid transformation of global energy systems include efforts to enhance system reliability and efficiency, expand energy accessibility through innovative technologies, and ensure environmental and climate safety. Reducing the cost of electricity production and consumption technologies, advancing economic electrification, and expanding digitalization and automation of energy systems play pivotal roles in this transformation.

A significant challenge faced by many countries in scaling up the use of renewable energy sources is the shortage of qualified technical personnel. The power industry in CIS countries boasts over 330 GW of installed capacity across power plants, generating approximately 1,400 TWh annually. The association of electric power systems in CIS member states synchronously operates seven national energy systems, with a notable emphasis on "low-carbon" and/or "carbon-free" energy sources.

While some countries rely heavily on large hydroelectric power plants, others, like Turkmenistan, Belarus, Uzbekistan, Moldova, and Azerbaijan, primarily operate natural gas-fired thermal power plants. Armenia's generating capacities include hydroelectric, nuclear, and natural gas-fired thermal power plants. Despite progress, there remains a need for greater diversification of sustainable energy sources. The adoption of renewable energy technologies and investments in future sustainable energy systems are crucial steps forward.

In conclusion, the pursuit of renewable energy sources is essential for achieving energy sustainability, reducing environmental impact, and ensuring long-term energy security for nations in the CIS region and beyond. Further research and concerted efforts are required to address the challenges and capitalize on the opportunities presented by this transformative energy landscape.

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