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Article

Streamlining The Banking System and Private Sector Enterprise for The Promotion of Green Energy

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Abstract: The paper is particularly concerned with the strategic coordination of bank systems and private sector actions to increase green energy. It puts special emphasis upon financial institutions – as agents for change at every step in this area – needing structural adjustment in order to deal with all sort of green financing tools like green bonds, loans linked to sustainability, and environmental investment portfolios. Through analysis of policy structures, investment behavior, and the regulatory environment, the paper argues how vital public-private partnerships (PPP) are to speeding up modification from traditional sources of power over into renewable energy. The study uses methodological approaches such as literature surveys, comparative cases studies, and policy analysis.

Keywords: Green Energy, Solar Panels, Internet of Things (IoT) Technologies, Co-operation

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1. Introduction

Green energy comes under sustainable development. It refers to energy which does not cause a negative impact on the environment is produced. All energy is renewable, but in order to be regarded as being green it must not only be sustainable over time but have as nearly zero an environmental impact as possible in all its forms of usage. Thus not all forms of green energy employed by the renewable sector can be called eco-friendly or green [1]. For example, burning organic materials obtained from forests under managed conditions is renewable. Yet the CO_2 produced in this process nullifies any ecological logic claimed for such energy sources.

One such example is the refining of oil sands, where a significant amount of natural gas is burned during the extraction process. Some of the renewable energies, like solar and wind power, can be produced individually in the houses or in large-scale industries. A green energy strategy will get the world to its climate goals without inhibiting economic growth and prosperity, Mundaca stresses [2].

Green energy not only reduces air pollution and health hazards, but it also helps in keeping the environment clean. For instance, fossil fuels have devastating impacts on health and the ecosystem via carbon dioxide and other emissions. Long-term exposure to such pollution can result in severe health-related diseases. Some scientifically based data sci-entific data shows, each year, the square meter area of land surface of Uzbekistan receives more than an average of 1600 kilowatt-hours of solar energy [3]. In some of European countries like Yekaterinburg (Russia) this figure is 1044 kilowatt-hour. And if 15 percent of this solar energy is converted into electricity by means of modern photovoltaic stations, in the region of 200–240 kilowatt-hours of electricity may be

produced per each square meter of solar panel in Uzbekistan and 157 kilowatt-hours in the city of Yekaterinburg [4].

In the climatic conditions of Uzbekistan, 1 megawatt of electricity in the summer months can be generated only if we have installed 6,000 square meters of solar panels, while in the conditions of Yekaterinburg, we will need 12,000 square meters of a solar panel. This means that the construction cost of a solar photovoltaic power station in the southern part of our country can be less than half. In general, all kinds of solar devices are functioning with high efficiency in the territory of Uzbekistan [5].

While green energy is an important tool to realize sustainable development, to reach the desired outcomes, effective policies must be formulated which integrate economic and social issues along with environmental protection. In other words, green energy is crucial for sustainable development due to its capacity to decrease global conflicts in the social, political, economic, and environmental aspects of society. As such, very important to plan sustainable green energy strategies [6].

Concerning new energy solutions, footnote 31 impose necessary had been set forth in the Decree No. PF-165 of the President of the Republic of Uzbekistan dated July 6, 2022 on “Strategy for Innovative Development of the Republic of Uzbekistan for 2022–2026” which brings forward development of innovative technologies for the production, storage and use of alternative and environmentally friendly energy sources — “green” hydrogen in the energy of renewable sources spheres; wide introduction of renewable energy sources and “green” technologies in the “Smart Energy System”; creating innovative solutions based on “smart” technologies for the delivery and consumption of electric energy [7].

Literature Review

The nature of transitions to green energy also entails large-scale investments that can be difficult for a single country to shoulder. Collaborating with others can help a country work around financial limitations and similarly better experience fund limitations.

a. As a collective market, a country can negotiate with pro-coal partner states for further reductions in the costs of green energy deployment.
b. Promotes the usage of shared chances to exchange human & technological resources, which are significant factors in the generation of renewable source green energy.

The authors cited the following key factors limiting the use of renewable energy sources in Uzbekistan:

a. The lack of developed long-term strategy for the development.
b. Low incentives.
c. Country recently has adopted the “Law on Renewable Energy Sources”, but regulatory/ legal framework is not completely in place.
d. Our electric utility company that is still state-owned and will not be unbundled.
e. Lagging energy grid.
f. Insufficient capital and investments in energy. Low electricity prices.
g. Intellectual Competence Gap in Renewable Energy Technologies
h. Clear mechanisms for the development of renewable energy sources are lacking.

Green energy has huge problems to be developed in our country. Only one of the most positive aspects of the transition towards green energy for both developed and developing countries is the new job creation [8].

These job displacements could have a negative impact on employment as many will lose their jobs.SpaceX’s AI ambitions could also result in job losses during the transition period. However, the positive impacts of green energy on employment are far more than the negative impacts. Research by Frondel et al. [9] [Barbier [10] the "Global Green New Deal" could generate over 34 million jobs in the long run in sectors like low-emission transport and its related industries.

In addition, the operation of a green energy system requires qualified personnel who have received specialized training (Martinot,). Moreover, skilled human beings are still the major barrier for developing countries, such few options that people can get trained [9].

Barriers to information and awareness also exist due to a lack of in-depth knowledge about green energy sources, a shortage of qualified personnel, and limited technical expertise. Clean and green energy has been acclaimed as the most feasible energy source (Ucar and Balo, Akdag and Guler).

In this sense, the green energy, which do not involve any combustion or firing process, create much less pollution than fossil fuels and, consequently, can preserve the essential sectors of sustainable development [10].

In our understanding group different approaches to solving the strategic objective of global energy development can be divided into two viewpoints — political and economic, with the first, to a greater degree, looking at ways to resolve it as a political ideology of the future of energy that is, at least for now, close to the representatives of the real sector. Then one of the representatives from the economic sector usually does talk about sustainable energy [11].

2. Materials and Methods

The research methodology employed in this study is rooted in a cross-disciplinary approach that integrates theoretical, empirical, and comparative elements to investigate the role of banking systems and private sector enterprises in promoting green energy in Uzbekistan. The methodology comprises a structured literature review, policy analysis, and comparative case studies to ensure a comprehensive evaluation of both domestic and international experiences in green financing and sustainable energy transitions.First, the literature review phase involved analyzing over 40 scholarly and policy-oriented publications from reliable databases such as Scopus, ScienceDirect, and government policy documents, which provided a foundational understanding of global green finance mechanisms and their applicability in emerging economies like Uzbekistan.Second, the study utilized comparative case studies to examine successful models from countries such as Germany, China, and India, where strategic partnerships between financial institutions and private enterprises have significantly accelerated renewable energy adoption. These comparisons were used to extract best practices and assess their relevance to the Uzbek context.Third, the policy analysis segment examined the legal and institutional frameworks within Uzbekistan, such as the “Law on Renewable Energy Sources” , Decree PF-165 and recent public-private partnership (PPP) initiatives. The regulatory environment was assessed to understand the incentives, barriers, and structural gaps in fostering green energy investment.In addition, a SWOT analysis was conducted to evaluate the strengths, weaknesses, opportunities, and threats in the green energy sector specifically within service enterprises of the Bukhara region. This multi-faceted approach not only allowed the identification of technical, economic, and policy-related challenges but also led to evidence-based recommendations for strengthening cooperation among stakeholders. Data visualization in the form of figures and tables (Figure 1, Table 1, and Table 2) supports key findings derived from this analysis.

3. Results and Discussion

As a result of the research, it was concluded that cooperation mechanisms need to be strengthened to develop green energy in Uzbekistan. Based on the following factors, the importance to strengthen cooperation relations can be justified:

First, the high initial investment costs. A great deal of green energy solutions — like solar panels, energy-efficient heating, ventilation and air conditioning systems, and electric vehicle fleets — call for large capital expenditures [12]. Service businesses, especially small

businesses, can be hesitant to spend money on such improvements due to the payback period lasting many years.

Second, "limited access to green energy infrastructure. In particular, service businesses tend to frequent urban areas that may not have ready access to renewable energy infrastructure. For instance, a hotel or shopping center in a crowded area simply cannot find enough space to deploy solar panels or wind turbines to generate renewable energy on-site.

Thirdly, reliance on external energy suppliers. A lot of service companies depend on a local utility for their energy needs [13]. If these companies do not, then businesses will have little say over where they source their energy. These dependencies can also delay green energy adoption, especially in places where fossil fuels dominate the energy landscape.

Fourth, functional integration of energy management compact. Enabling energy-efficient management strategies with IoT devices or smart technologies can be complicated and expensive. Subjecting these systems for integration into existing operations demands technical knowledge, and may disrupt business activities in the interim. Moreover, training staff to use and maintain such technologies can add an extra layer of complexity [14].

Fifth regulatory and policy barriers. In certain areas, there may be a scarcity of supportive policies or incentives to encourage the adoption of green energy in the service sector. Absence of tax incentives, subsidies, or favorable regulations disincentivizes most businesses against investing in renewable energy. Additionally, companies operating in different regions could find themselves having a more difficult time with varying regulations.

Sixth, resistance to change. Green energy solutions are often a change in operational practices, which may meet resistance from employees or management. Some businesses may be reluctant to move away from conventional energy sources, due to worries about reliability or the risk of disruption to service provisions.

Seventh, operational complications [15]. Renewable energy systems like solar panels and wind turbines need regular maintenance to work well. Service enterprises, particularly with respect to specialized green energy equipment, may not have the skill set or capacity to meet these demands.

Seventh, lack of awareness and knowledge. Many businesses in the service sector may not be aware of or not completely aware of green energy options. This lack of information on potential solutions and the impact of these solutions frustrates organizations from understanding the criticality of investing in Renewable Energy.

Ninth, prioritize short-term profitability. Service businesses in particular typically have lean profit margins and are focused on short-term financial objectives. Green energy investments usually are intended to generate returns over a longer time frame, and companies will often wait with investing in sustainable solutions if it is not clear how they will lead to financial gain soon [16].

Comprising government incentives, industrial signing and socialization towards the profitability as well as practicality of green energy in the service sector, these are just some of the challenges faced. We suggest that the construction of cooperation mechanisms between service enterprises can effectively solve financial barriers in investing in green energy. Uzbekistan has a huge potential in the field of green energy. To incentivize the sector, the government launched the "Solar Homes" program that offers preferential loans and subsidies for the installation of solar panels and a guaranteed purchase of the electricity produced as a result of the installation. In just 2024, 50,000 households and entrepreneurs around the country installed solar panels. With over 7 million households in Uzbekistan, this is a large market for investors.

Depending the goal and area of the study, we conducted a SWOT analysis of the development of green energy in the service enterprises of Uzbekistan. **Table 1** presents the results of the analysis. The analysis of the potential for green energy development in service enterprises in Uzbekistan, shows that wind power plants can be built in a number of regions. For example, by 2026, it is planned to create wind power stations with a capacity of 1800 million kWh in Peshku and Gijduvan districts of Bukhara region. Among the most prudent efforts is the partnership with foreign corporations to build solar and wind power stations designed to widen green energy infrastructure.

In Uzbekistan, service enterprises are highly dependent on imported technologies for the production and storage of green energy. Additionally, one of the major challenges in the regions is the shortage of qualified specialists for the implementation and maintenance of these energy sources.

Table 1. SWOT analysis of green energy development in Bukhara region[1]

Strengths	**Weaknesses**
1. Abundance of Natural Resources • High levels of solar radiation (more than 300 sunny days per year) and significant wind energy potential in certain areas. • Availability of land for implementing large-scale renewable energy projects. 2. Government Support • Active policies promoting renewable energy sources, such as the "Law on Renewable Energy Sources" (2019) and relevant national programs. • Strong political commitment to reducing greenhouse gas emissions and transitioning to green energy. 3. Established International Cooperation • Partnerships with international organizations such as the World Bank and the Asian Development Bank (ADB), as well as private investors, to finance renewable energy projects. 4. Developing Renewable Energy Infrastructure • Plans to develop wind power stations with a capacity of 1800 million kWh in Peshku and Gijduvan districts.	1. Underdevelopment of Advanced Technologies • Dependence on imported technologies for the production and storage of renewable energy. • Limited local expertise in the implementation and maintenance of renewable energy systems. 2. Insufficient Financing Mechanisms • High initial costs for green energy projects and limited financial incentives for private investors. • Underdeveloped green financing systems and lack of domestic green bonds. 3. Infrastructure Challenges • Outdated electricity grid infrastructure that complicates the integration of renewable energy into the existing energy system. • Inadequate solutions for renewable energy storage. 4. Lack of Awareness and Education • Limited awareness among the population and business entities about the benefits of green energy. • Absence or underdevelopment of education and training programs in renewable energy technologies. 5. Shortage of Skilled Personnel • Lack of qualified specialists for the installation and maintenance of solar panels.
Opportunities	**Threats**

[1] Based on the author's research

1. Attracting International Investments • Opportunities to attract Foreign Direct Investment (FDI) for the implementation of large-scale renewable energy projects based on public-private partnerships. 2. Expanding Regional Markets • Potential to export green energy to neighboring countries, particularly within the framework of regional energy networks. 3. Technological Advancements • Global achievements in renewable energy technologies may reduce costs and increase efficiency in Uzbekistan. 4. Transition to a Green Economy • The development of green energy aligns with sustainable economic growth, job creation, and economic diversification. 5. Carbon Markets and Incentives • Participation in global carbon trading mechanisms to finance green energy projects and reduce emissions. 6. Development of Hydrogen Energy • Expanding the potential of hydrogen as a clean and innovative energy source within the national energy strategy.	1. Economic Constraints • Limited domestic funding and economic instability may hinder large-scale investments in renewable energy. 2. Climate Risks • The potential impact of climate change, such as extreme weather conditions, may affect renewable energy production. 3. Global Competition • Competition with other countries that have more developed renewable energy sectors for access to international financing. 4. Regulatory and Policy Risks • Delays in policy implementation and potential regulatory changes that may discourage investors. 5. Resistance to Energy Transition • Dependence on traditional fossil fuels and reluctance from industries and stakeholders to shift toward green energy.

To overcome these challenges and successfully develop green energy in Uzbekistan, it is essential to invest in the training of specialists and the development of the necessary infrastructure. Collaboration with specialized organizations and international partners focused on studying accumulated experience is also crucial. Considering that the current energy system is built primarily on conventional sources, it cannot fully transition to renewable energy in its present form.

As shown in Figure 1, Taking into account the analysis results mentioned above, it can be observed that the implementation of green energy solutions in service enterprises faces a set of specific challenges. As a solution to these problems, it seems appropriate to adopt the cooperative approach, which has been widely practiced and proven effective in many foreign countries. Considering the challenges outlined above, we believe that establishing the "Bank-Tadbirkor" Cooperative is necessary.

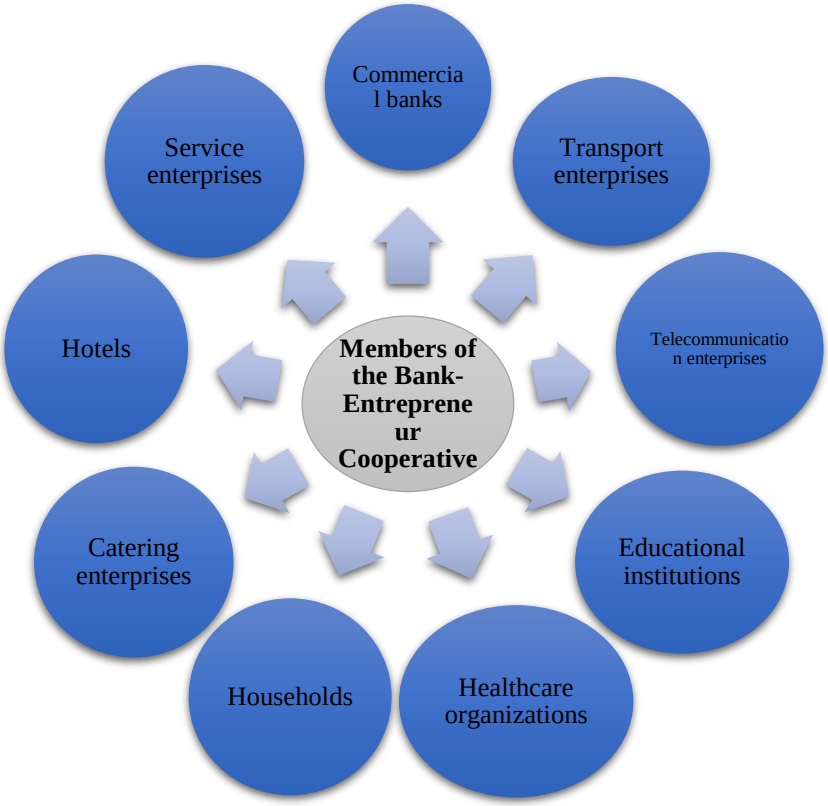

Figure 1. Service enterprise members of the "Bank-Tadbirkor" cooperative[2].

As presented in Table 2, the SWOT analysis of Bukhara region reveals key strengths and vulnerabilities. Moreover, it is recommended to promote the implementation of solar water heating systems in new buildings by introducing the appropriate amendments in the section "Construction Norms and Regulations." Having worked in this area, I know that installing a solar water heating system in the initial construction phase of a new building will bring down the cost massively. Unfortunately, the new technologies can only be properly applied if we have the right knowledge and skills. It is crucial to develop specialists in renewable energy, including engineers, technical staff and project managers.

Table 2. Advantages of establishing the "Bank-Tadbirkor" cooperative for service enterprises[3].

Offering green loans, bonds, and sustainability-linked credit lines.
Developing specialized insurance products to protect green energy projects from risks.
Accelerating the adoption of new technologies.
Conducting research and development activities and creating innovations in green energy projects.
Providing professional services during the implementation of projects.
Enhancing the transparency and efficiency of financial processes.

[2] Based on the author's research

[3] Based on the author's research

4. Conclusion

As green energy is a nascent sector in Uzbekistan, there is a lack of skilled specialists who are capable of professionally designing, constructing, and operating electrical facilities, and renewable energy infrastructure. The high variability in power output due to natural phenomena poses another challenge in assimilating high capacity green energy sources into the current energy systems infrastructure. The wind power plants have the challenge of predicting the strength of wind streams. In the case of solar power plants, electricity is only created during daylight. On the condition that energy usage does not change and the generation of renewables is insufficient, we need to use conventional energy sources like thermal power plants or hydroelectric stations to cover the deficit. Due to the inertia of thermomechanical processes, it is also difficult to quickly adjust the output of thermal power plants, and hydroelectric stations do not always have enough water flow or power at their disposal to compensate for the loss. This means that highly flexible generation capacities need to be kept in hot standby mode for the efficient replacement of decommissioned renewable sources.

On this front, the move towards renewable energy sources has been pretty sluggish. Cutting energy usage is crucial. This can be accomplished in two broad manners: organizational and technical. The organizational measures consist of engaging in energy audits and searching for energy-saving methods. (specific field, cover topic)Energy saving and conservationTraining of employees and workers regarding Energy conservation and energy Efficient utilization, can bring behavioral changes in operational activities, which cause reduction in wasteful Energy consumption in daily operations. An energy audit allows you to know how much energy you consume and where it can be reduced. Monitoring of energy usage on a regular basis allows tracking of progress and identification of further opportunities for improvement. Collaboration and knowledge-sharing programs with other organizations expose you to new ideas and best practices in the area of energy efficiency.

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