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Article

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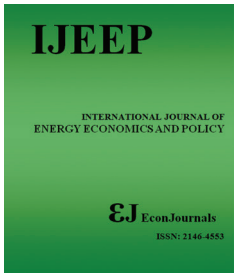

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International Economic Cooperation of Central Asian Countries on Energy Efficiency and Use of Renewable Energy Sources

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ABSTRACT

The purpose of this study is to identify priority areas for international cooperation of Central Asian countries to realize the potential of renewable energy sources (RESs) and increase the efficiency of energy systems. Such scientific methods as literature analysis, comparative analysis, retrospective analysis, as well as the expert assessment method have been used in the study. The results of the study show that the countries of Central Asia have significant potential for the development of renewable energy. In recent years, interest in energy efficiency measures in Central Asia has been growing. Kazakhstan, Uzbekistan, and Turkmenistan consider renewable energy as a way to increase their oil and gas exports, while Tajikistan and Kyrgyzstan hope to reduce their dependence on energy imports from neighboring countries. At the same time, despite the enormous potential of RESs, the actual deployment of renewable energy in the region remains low. The transition of the Central Asian countries' energy sector to new forms of energy production with a focus on renewable energy should be carried out in cooperation with countries with the best practices in the field of RES development. International cooperation will support the Central Asian countries in realizing their huge potential for RES and accelerating their pace of transition to renewable energy.

Keywords: Renewable Energy, Cooperation, Energy Resources, Program, Project
JEL Classifications: Q42, Q43, Q48, O19, R19, F59.

1. INTRODUCTION

The Central Asian region, which includes five countries – the former republics of the USSR – the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Tajikistan, Uzbekistan, and Turkmenistan, is a geopolitical and unified cultural and spiritual space, in which more than 100 million people live (Babazhanova et al., 2017; Omarbekova et al., 2017).

One of the key issues in the economic development of the countries of the Central Asian region is the problem of energy efficiency and power industry (Dyussembekova et al., 2019). The region is one of the most energy-consuming regions in the world, and technical losses of energy resources reach 20% of the volume of electricity production (Akhmetshin et al., 2018).

The energy prospects of the Central Asian countries are inextricably linked with the development of renewable energy. Central Asian countries have high potential for renewable energy production.

Wind energy in Kazakhstan, solar energy in Uzbekistan, small river energy in Kyrgyzstan, solar- and hydropower in Tajikistan, and solar energy in Turkmenistan have particularly great prospects. However, public awareness of the benefits of renewable energy remains low, and there are no institutional mechanisms that would facilitate investment in the sector (Babazhanova et al., 2017).

Despite the significant growth potential of renewable energy, its actual deployment in the region remains extremely uneven. Currently, the share of modern renewable energy source (RES)

in energy production varies from <1% in Turkmenistan to 43% in Tajikistan (IEA, 2019a).

High fossil fuel subsidies and low electricity prices significantly reduce the competitiveness of Central Asian countries.

For example, subsidies for fossil energy sources in Tajikistan make up 7% of the GDP, in the Republic of Kazakhstan – 11%, in Kyrgyzstan – 26.4%, in Turkmenistan – 23.2%, and in Uzbekistan – 26.3%. For comparison: in Canada, this indicator is at the level of 2.5%, in the USA – 3.8%, and in the UK – 1.4% (UNECE, 2017).

Electricity tariffs in Central Asian countries are significantly lower than in advanced economies. Thus, in the Republic of Kyrgyzstan, the electricity tariff is $0.01 per 1 kW/h, in Kazakhstan, it is $0.06 – 0.08, and in Tajikistan and Uzbekistan, it is $0.02 (IEA, 2019b). In Turkmenistan, households use free electricity but the tariff for over-limit use of electricity is $0.1. For comparison: the cost of 1 kW of electricity in Germany is $0.37, in Italy – $0.25, and in the United Kingdom – $0.23.

Due to limited access to low-cost bank loans, potential investors cannot afford the relatively high upfront investment costs. For example, the average credit interest rate in Kyrgyzstan in 2018 is 19.5%, in Tajikistan, it is 27.2%, which significantly exceeds the cost of credits in such countries as the United Kingdom (0.5%) and the United States (4.9%), China (4.3%), and Russian Federation (8.9%) (World Bank Group, 2018).

The region lacks local suppliers of technologies and technical specialists in sustainable energy, as well as feasibility studies and economic analyses in the energy development field.

One of the most effective mechanisms accelerating the development of renewable energy in the countries of the Central Asian region is international cooperation. As international practice shows, many developing countries, such as China, Russia, have benefited from international cooperation (Nezhnikova et al., 2018) in the field of renewable energy, in particular, with access to financing, advanced technologies, and human resources development related to RES.

This paper explores the prospects and current trends in the development of the renewable energy sector and energy efficiency in the Central Asian countries and provides recommendations on areas of international cooperation.

2. LITERATURE REVIEW

Research in the field of RES is becoming increasingly important as the world strives to resist climate change and decarbonize its energy system (Sheikh et al., 2016). Renewable energy is a commonly used term that describes certain types of energy production (Harjanne and Korhonen, 2018).

A significant part of the research is devoted to studying the role of RES in ensuring the sustainable development of energy, water, and ecological systems (Aberilla et al., 2019; Anda et al., 2014; Espécie et al., 2019; Kalogirou et al., 2019; Rusu, 2019). Renewable energy technologies are seen as one of the ways to decarbonize the energy sector and reduce dependence on fossil fuels (Ozcan, 2017; Taylor et al., 2014). Many researchers note that traditionally RES play a vital role as an energy source in rural areas of developing countries (Blum et al., 2013; Sovacool, 2013).

The issues of creating integrated systems of RES are considered in the works of Palombo (2019), Tomar et al., (2019), Chemisana et al. (2019) and others. In recent years, a sufficient number of publications have appeared on the problems of controlling and optimizing renewable energy systems (Allman and Daoutidis, 2017; El-Farra and Panagiotis, 2017; Ng and Maravelias, 2017; Wang et al., 2017a; Wang et al., 2017b; Xiao et al., 2017).

There are a number of studies confirming that the achievement of individual targets for RES faces various obstacles (Blum et al., 2013; Byrnes et al., 2013; Dulal et al., 2013; Erdinc et al., 2015; Masini and Menichetti, 2013; Nepal and Jamasb, 2015; Sovacool, 2013), as a result of which developed and developing countries are reacting differently. Developed countries attract investment in renewable energy through policies, such as the entry tariff (FIT) and fossil fuels carbon tax (Dannenberg et al., 2008). On the contrary, such a policy cannot be easily implemented in many developing countries, which are usually overloaded with subsidizing fossil energy (Zyadin et al., 2014).

Studies of international organizations show the enormous potential for generating electricity from the sun, wind, biogas, and small hydropower plants in the Central Asian countries (UNDP in Europe and Central Asia, 2014).

However, the scientific literature and the mass media focus on the potential of RES in Central Asia compared to fossil fuels and hydropower. Throughout Central Asia, despite the huge reserves of traditional energy in the regions, seasonal shortages of energy are common, which makes the implementation of renewable energy projects crucial for solving the region's development problems and achieving environmental goals (The Carnegie endowment for international peace and the foundations of regional policy, 2008).

At the same time, it is noted in the scientific literature that the mechanisms of international cooperation in the field of RES are insufficiently investigated (Zhao et al., 2011). The lack of a multilateral mechanism for international cooperation between the countries of the Central Asian region and countries with developed renewable energy is a pressing problem.

The hypothesis of this study is the assumption that international cooperation is an effective mechanism for attracting the investments necessary to achieve progress in the development of renewable energy in the countries of the Central Asian region.

3. METHODS

The research information base is documentary and electronic sources of scientific information. Literary sources are selected using an information query for keywords. The main criteria for choosing information sources are the trustworthiness of the

publication indexed in international scientometric databases, the reputation of the authors in this subject area, the relevance, and the completeness and reliability of the information presented.

An analysis of literary sources, a comparative analysis of indicators characterizing the potential of renewable energy, methods of analyzing the dynamics of energy power indicators, as well as an expert evaluation method through interviewing representatives of interested organizations both in person and by sending out questionnaires on the Internet were used as research methods.

The expert survey was conducted in March-June 2019. 82 questionnaires were sent out for interviews and 57 responses were received from renewable energy experts.

The expert group consisted of specialists from government bodies, national and regional branches of international organizations with at least five years of practical experience in implementing projects in the energy sector.

4. ANALYSIS OF THE RENEWABLE ENERGY DEVELOPMENT IN CENTRAL ASIAN COUNTRIES

Central Asia has vast renewable energy resources, including solar energy, wind, and water. Wind energy in Kazakhstan, solar and biogas energy in Uzbekistan, small river energy in Kyrgyzstan, solar- and hydropower in Tajikistan, and solar energy in Turkmenistan have particularly high prospects.

The technical potential for RES development in Central Asia is presented in Table 1.

Kazakhstan is a vast but thinly peopled country, rich in natural resources, and located in the center of the Eurasian land. In recent years, it has begun building a green economy, taking a leading position among its Central Asian neighbors.

About 70% of the potential of RES in the countries of the Central Asian region is concentrated in the Republic of Kazakhstan. According to UNDP estimates (UNDP Kazakhstan, 2008), the potential of wind energy alone by 2030 will exceed more than ten times the required electric power generation capacity for Kazakhstan.

However, the share of RES in the electricity production of the Republic of Kazakhstan is currently 17.8%, while the share of wind and solar stations in electricity production is only 0.5% (Yearbook Enerdata, 2019). Since Kazakhstan is thinly peopled, the decentralized electricity production can be especially beneficial in remote villages of the country with limited access to traditional energy sources.

Currently, Kazakhstan has 83 RES facilities with an installed capacity of 936.8 MW, including 18 wind, 27 solar, 35 hydroelectric power stations, and three bioelectric power stations. In 2019 alone, 15 of those facilities with the capacity of 405.17 MW were commissioned.

Uzbekistan is potentially the largest market for RES. Currently, more than half of the population of Uzbekistan lives in rural areas (The State Committee of the Republic of Uzbekistan on Statistics, 2019), where electricity outages and blackouts often occur due to illegal pumping of electricity and the poor state of energy infrastructure.

The main components of RES in Uzbekistan include solar, hydraulic, wind, and geothermal energy, as well as biomass energy. According to the results of the studies conducted by Uzbek scientists (Matchanov, 2019), the technical potential of RES in Uzbekistan is 269 million tons of standard fuel, which is more than three times the annual demand for energy.

The continental and dry desert climate of Turkmenistan offers enormous potential for solar power plants. Especially in the regions of Kuli, Hasan and the capital, Ashgabat, the surface receives the most useful sunlight in the CIS region. Due to the fact that natural gas is practically the only source of electricity production, as well as there are low subsidized retail electricity tariffs and the lack of a legislative framework, the share of RES in the total installed capacity of Turkmenistan is the lowest among the countries of Central Asia and is only 0.18% (UNECE, 2013).

The Republic of Tajikistan does not have significant explored reserves of oil and natural gas – the main modern energy sources. The country has large coal reserves; the main mines are located in remote mountain areas. The extraction of coal and its transportation by road, along with high production costs, significantly increase the final cost for the population. Almost 75% of the Tajik population living in remote villages accounts for only 8-11% (Ministry of

Table 1: Technical potential for RES development in Central Asia

Types of RES	Kazakhstan (The office of the UNO, 2012)	Uzbekistan (International Institute of Solar Energy, 2019)	Tajikistan (The Ministry of Energy and Water Resources of the Republic of Tajikistan, 2018)	Kyrgyzstan (UNIDO, 2018)	Turkmenistan	Total, thousand MW
Solar power	3,760	593	195	267	655	5,470
Wind power	354	1.6	2	1.5	10	369.1
Small hydropower	4.8	1.8	23	1.8	1.3	32.7
Biomass energy	0.3	0.8	0.3	0.2	0	1.6
Total	4119.1	597.2	220.3	270.5	666.3	5873.4

Economic Development and Trade of the Republic of Tajikistan, 2019) of the electricity consumption in the country. The most accessible sources for them are nontraditional RES: small rivers, solar, geothermal water, wind, and bioenergy.

At the same time, Tajikistan has substantial reserves of RES. The main renewable energy source in Tajikistan is hydropower, and the electricity generated by hydropower stations is the most affordable energy source in Tajikistan. The country has 4% of the global hydropower potential; the reserves of renewable hydropower resources that can potentially be developed and used exceed 3.5 times the current level of consumption in Central Asia.

The potential of RES in the Republic of Kyrgyzstan is estimated at 840.2 million tons of standard fuel (Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic, 2018).

Unfortunately, the authors, for objective reasons, could not calculate the potential of RES in Kyrgyzstan. Approximately, the potential of RES in Kyrgyzstan is about 180.6 billion US dollars, but these data are only approximate estimates of the authors. The authors believe that this issue is the topic of a separate study.

The main types of RES in the republic are solar energy, hydropower of small rivers and streams, wind energy, geothermal waters, and biomass.

For the period of 2010-2018, the total installed capacity of renewable energy facilities in the countries of the Central Asian region increased by 19.1% and amounted to 14,268 MW (Table 2).

Table 2: The total installed capacity of renewable energy facilities in the countries of the Central Asian region in 2010-2018 (International Renewable Energy Agency, 2018)

Countries	2010	2018	Change 2010/2018	
			+/−	%
Kazakhstan	2,364	3,088	724	30.6
Kyrgyzstan	3,064	3,689	625	20.4
Tajikistan	4,802	5,632	830	17.3
Turkmenistan	1	1	0	0.0
Uzbekistan	1,746	1,858	112	6.4
Total	11,977	14,268	2,291	19.1

Tajikistan and Kyrgyzstan have the highest installed capacity of renewable energy facilities among the countries of Central Asia: in the total supply of primary energy, the share of renewable sources is 49% and 30%, respectively.

The above analysis of the conditions and potential for using RES shows that RES can play a significant role in the fuel and energy infrastructure of Central Asian countries and will not only contribute to solving energy problems but can also provide a successful solution to socio-environmental problems.

However, despite the high potential for the deployment of any renewable energy technologies, in comparison with the indicators of global progress in the development of RES, the countries of the Central Asian region have not achieved any significant success. Thus, today it is extremely important to pay serious attention to the development of this energy sector and the promotion of its environmentally friendly technologies.

However, a survey of experts revealed a number of barriers to the wider use of RES in the Central Asian region (Figure 1).

One of the biggest barriers to deploying renewable energy in Central Asia, mentioned by many experts, is the lack of regulatory framework and financial incentives for potential local and international investors. Most countries (with the exception of Turkmenistan) have already introduced primary legislation on RES and energy efficiency but there is no secondary legislation that would include guaranteed financial incentives, such as preferential tariffs and tax incentives.

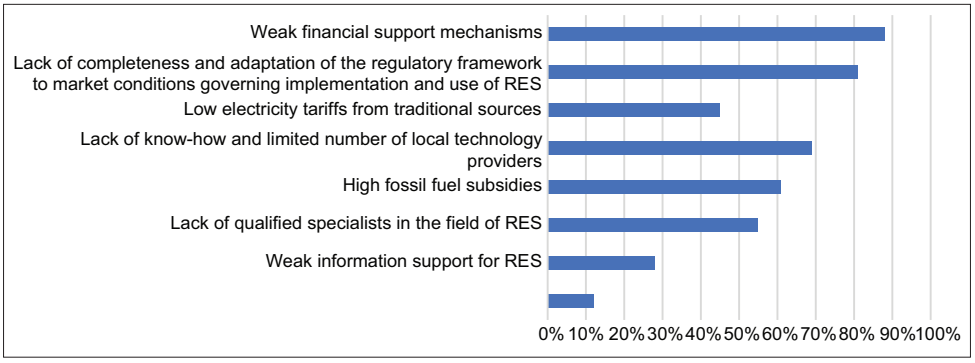
5. DISCUSSION

In the course of the study, the experts identified the main factors stimulating the growth of RES in the Central Asian region:

- Modernizing the region's aging energy infrastructure and using it to implement RES
- Increased obligations of Central Asian countries' governments to phase out fossil fuel subsidies; and
- Socio-economic benefits of using RES, including improving public health and the environment.

Most experts (89.5%) say that the existing potential of renewable energy in Central Asia makes it necessary to attract investment in this region.

Figure 1: Expert assessment of RES development barriers in the Central Asian region



One of the main ways to attract investment in the development of renewable energy is regional cooperation of the countries of the Central Asian region and participation in joint international projects.

The main donors supporting RES and energy efficiency projects in Central Asia are the Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), Eurasian Development Bank, International Finance Corporation (IFC), World Bank and Global Environment Facility (WB&GEF), UNDP country offices, Central Asia Regional Environmental Center (CAREC), and local nongovernmental organizations, which often act as implementing agencies on site.

The flagship international energy cooperation program is the Central Asian Regional Economic Cooperation (CAREC) Program, which was established in 1997 by the ADB and covers, in particular, Azerbaijan, Georgia, Tajikistan, Turkmenistan, and Uzbekistan. The CAREC Strategy and the Work Plan for 2016-2020 provide support for RES.

The EBRD has repeatedly allocated funds for implementing RES development projects in the countries of the Central Asian region and continues to support these decisions, for example, the implementation of the Burnoye solar project in Kazakhstan, where the EBRD funded its first project in the region on RES with a capacity of 100 MW. In 2015-2017, the EBRD invested more than €100 million in the construction of a solar power plant of Burnoye (European Bank for Reconstruction and Development, 2019).

In the Republic of Kyrgyzstan, the EBRD is implementing a sustainable energy financing program with a credit line of $20 million. The program offers grant support in the range of 10-35%, which is provided at the expense of the EU Investment Facility for Central Asia (EU IFCA) (Coordination Council of Development Partners in the Kyrgyz Republic, 2019).

In 2013-2016, Central Asian countries became beneficiaries of the "Central Asia Sustainable Energy Program: RES and Energy Efficiency" (CASEP), which was part of the larger INOGATE regional energy cooperation program between the EU and 11 countries of Eastern Europe, the Caucasus, and Central Asia.

The experts note that the main results of the three-year program (2013-2016) with a total budget of 4 million euros are the following:

- Improved access to energy resources as a result of the use of alternative and sustainable practices in energy production and more efficient use of the existing capacities and networks
- The use by Central Asian countries of European practices in the development and maintenance of energy efficiency and RES policy, and
- Improving understanding among the populations of Central Asian countries on energy efficiency and RES.

According to the experts of the CIS Electric Energy Council, within the framework of this program, the countries developed relevant political documents for promoting RES and identified priority sectors for improving energy efficiency and promoting RES, which were supported by the proposed and developed tools and mechanisms from the Central Asian countries.

Regional cooperation is based on the interregional electricity trade. Investments in electricity transmission are ancillary and necessary conditions for expanding the integration of RES in electric networks. The Central Asia and South Asia Electricity Transmission and Trade Project (CASA-1000) is a flagship project implemented jointly by Kyrgyzstan, Tajikistan, Afghanistan, and Pakistan and cofinanced by the World Bank and the EBRD.

Under this project, investments in the energy infrastructure of Tajikistan and Kyrgyzstan will amount to $314 million and $233 million, respectively (SNC-Lavalin, 2011).

The majority of the experts (73% of the respondents) say that further efforts should be directed to the development of cooperation in the field of consulting and transfer of know-how on the legal basis and financial incentives. This will provide guarantees to potential investors that implement RES projects. This cooperation may include bilateral consultations of countries with a developed renewable energy sector with the governments of Central Asian countries and discussions within parliamentary groups.

More than half of the experts (50.3%) believe that in a situation where the production of electricity from RES is largely uncompetitive due to high fossil energy subsidies and high initial costs, countries need to implement mechanisms to reduce financial risks.

About 20% of the experts noted that the governments of advanced countries in the renewable energy sector could facilitate the provision of affordable credits through international development banks. Another key area of international cooperation is the support of the Central Asian countries in the development and implementation of microcredit schemes (with low or zero interest rates) for farmers, families, and small and medium enterprises, similar to the EBRD sustainable energy development mechanism in the Republic of Kazakhstan. International cooperation can be crucial in developing educational and exchange programs for bank employees and investors in Central Asia.

In Kyrgyzstan and Tajikistan, the deterioration of energy supply infrastructure and insufficient access to energy sources in remote rural areas are strong arguments for investing in decentralized production of energy from renewable sources outside the network (small hydropower, solar energy, and biomass). To a lesser extent, this applies to other countries of Central Asia. The vast majority of experts (about 75%) agreed that decentralized solutions in the field of RES could provide environmental and socio-economic benefits by providing energy to households, hospitals, and schools during a shortage of energy or fuel. Thus, the countries of the Central Asian region need to expand the portfolio of cooperation with leading countries in the field of RES development for projects that support sustainable energy supply in residential, industrial, and production areas.

6. CONCLUSION

The obtained results confirm the proposed hypothesis on the need for international cooperation in attracting investment in the development of renewable energy in Central Asian countries. The study shows that, despite the significant potential of RES, the countries of Central Asia are still not able to achieve the significant successes that have been achieved globally through RES.

In order to increase the share of renewable energy in the future energy systems of the countries of the Central Asian region, additional efforts in integration as part of a complex approach, multistakeholder dialogue, and collaboration with countries of the best practice in the field of RES are needed. Such cooperation includes improving understanding of the characteristics of renewable energy resources and their availability, investing in appropriate infrastructure and strengthening the political, institutional, normative, and regulatory framework.

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