

Study of Uzbekistan’s Experience in Developing Projects of Electricity Production from Renewable (Alternative) Sources

Yulia Rastopchina
 Department of World Economy
 Belgorod State National Research University
 Belgorod, Russia
 rastopchina@bsu.edu.ru

Azima Primova
 Department of Management
 Bukhara Institute of Engineering and Technology
 Bukhara, Republic of Uzbekistan
 rastopchina@bsu.edu.ru

Natalya Solovjeva
 Department of Economic Innovation and Finance
 Belgorod State National Research University
 Belgorod, Russia
 solovjeva@bsu.edu.ru

Abstract—The article examines the development processes of the alternative energy sector in the Republic of Uzbekistan. The key areas for the development of the sector and the general strategic directions of Uzbekistan’s industrial policy have been analyzed. The legal aspects and aspirations of the state to stimulate the development of the alternative energy sector and the implementation of projects to produce electricity from renewable sources have been addressed. An overview of current projects to produce electricity from renewable sources, implemented in the Republic of Uzbekistan with or without the participation of foreign investors, is presented. Barriers and difficulties in the development of alternative energy in the Republic of Uzbekistan have been identified, including high cost of production and low capacity of renewable energy compared to traditional energy sources, the low cost of traditional energy sources, lack of specific financial support mechanisms for business, technical deficiencies in energy production technologies, lack of public awareness of modern forms of energy, especially renewable energy, innovative lag of the industry. The article also presents comments and opinions of the leaders of the energy companies of the Republic of Uzbekistan on problems and prospects of development of the alternative energy sector in the country.

Keywords—energy sector, electricity production, alternative energy, renewable energy, renewable energy sources, Republic of Uzbekistan.

I. INTRODUCTION

Modern Uzbekistan is a country oriented towards large-scale market economic reforms. The strategic goal of the Republic of Uzbekistan in 2035 is to enter the top 50 economies of the world [4]. The country's economic growth is projected to increase to 6 per cent in 2021, supported by market reforms aimed at eliminating production bottlenecks and liberalizing the economy [10].

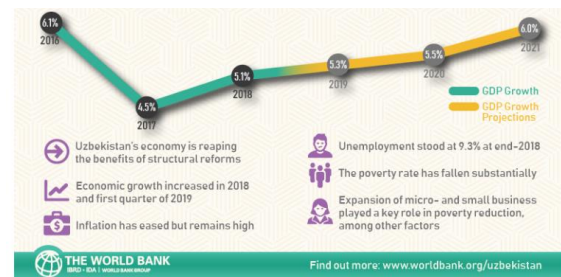


Fig. 1. Projections of economic growth in Uzbekistan (according to the World Bank)

In the medium term, Uzbekistan’s policy is aimed at strengthening economic potential and modernizing infrastructure, particularly energy, transport and logistics, as well as improving access to quality higher education.

The main objectives of industrial development in Uzbekistan, approved by the Concept of Industrial Development up to 2025, are “creating the basic conditions for the formation of an innovative, high-tech industrial structure; securing the necessary level of investment in industrial modernization; ensuring the sustainable position of industrial enterprises in domestic and global markets; lifting of internal infrastructure and resource constraints, maintaining a balance between economic and social development goals” [4].

At the same time, the priority of modern industrial policy is to support and develop the alternative energy sector, in particular to launch equipment and technology in new popular areas, such as renewable energy (solar, wind, biogas energy, mini hydroelectric power plants), electric vehicles, etc.

The overall objective of the electricity sector in Uzbekistan is to provide a stable and reliable supply of energy to the economy and the population and thereby improve the quality and standard of living of the population.

II. MAIN PART

In 2018, Uzbekistan ratified the Paris Agreement (Paris, 12 December 2015) and made a national commitment to reduce greenhouse gas emissions per unit of GDP by 10 per cent compared to 2010 level by 2030. According to the “Strategy for the transition of the Republic of Uzbekistan to a “green” economy for the period 2019 – 2030”, it is envisaged to increase the share of renewable energy sources to 25% or more of the total volume of electric energy generation by 2030. A twofold increase in energy efficiency and a reduction in the carbon intensity of gross domestic product is also planned, as is access to modern, affordable and reliable energy services for 100% of the population and industries [2].

Over the past few years, Uzbekistan has witnessed a great increase in the popularity of alternative sources of energy, and there have been many reports from state bodies and individuals about new measures to implement green energy plans [5].

In accordance with the Presidential Decree No. UP-5646 of 1 February 2019 “On Measures to Radically Improve the Management System of the Fuel and Energy Industry of the Republic of Uzbekistan” the Ministry of Energy was formed, which is the designated authority for the implementation of the single state policy on renewable energy sources (RES).

In May 2019, the Laws of the Republic of Uzbekistan “On the Use of Renewable Energy Sources” and “On Public-Private Partnership” were adopted, which create a legal and regulatory basis for accelerating the implementation of RES projects.

In addition, resolution of the Cabinet of Ministers of 22 July 2019 No. 610 approved the Regulations on the interconnection of enterprises producing Electrical Energy, including renewable energy sources, to the unified electric power system, defining the main technical aspects of the integration of RES facilities into the energy circuit of Uzbekistan.

At the same time, pursuant to a Presidential Decision of 23 October 2010 No. PP-3981 “On Measures to Accelerate Development and Ensure Financial Sustainability of the Electric Power Industry” entrusted the following:

- “to develop modern schemes for organizing the production of electrical energy, while attracting a wide range of private (in particular foreign), direct investment in the production of electrical energy, including through public-private partnerships and to work with potential investors on new investment projects in the field of electricity conditions of public-private partnership, based on the available resource base, modern technological trends and the use of alternative sources of electricity” [3].

The current situation regarding the use of different types of energy resources is still not in favor of alternative energy (Figure 2, Table 1).

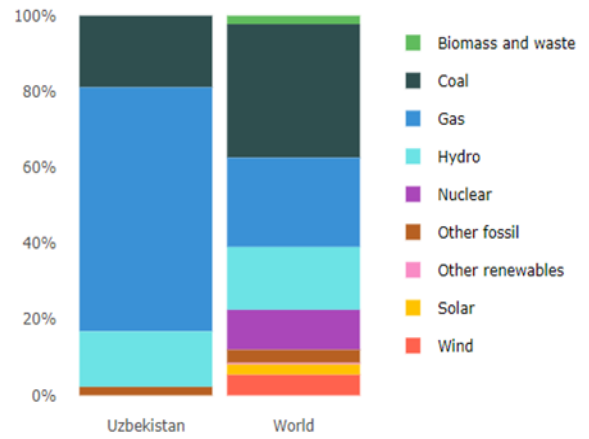


Fig. 2. Types of fuels used for electricity generation in Uzbekistan in 2019 compared to the world average

TABLE I. FUEL-FIRED ELECTRICITY PRODUCTION (TWH) IN UZBEKISTAN, 2000-2019

| Fuel | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Coal | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 12 | 11 | 9 | 9 | 9 | 9 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Gas | 26 | 26 | 27 | 26 | 26 | 25 | 26 | 27 | 24 | 28 | 28 | 29 | 28 | 34 | 34 | 36 | 37 | 38 | 38 | 39 |
| Other fossil | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hydro | 6 | 6 | 6 | 8 | 9 | 9 | 5 | 5 | 4 | 6 | 8 | 6 | 7 | 6 | 6 | 7 | 7 | 8 | 8 | 9 |
| Biomass and waste | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other renewables | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nuclear | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Production | 44 | 45 | 47 | 47 | 47 | 47 | 44 | 45 | 40 | 45 | 47 | 45 | 45 | 52 | 53 | 55 | 56 | 59 | 59 | 60 |
| Net imports | 1 | 0 | -0 | -0 | -0 | -0 | 1 | 0 | -0 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -0 |
| Demand | 46 | 45 | 47 | 47 | 47 | 47 | 44 | 46 | 40 | 45 | 45 | 45 | 45 | 51 | 52 | 53 | 55 | 58 | 58 | 60 |

Given its geographical characteristics, however, Uzbekistan had a high potential for renewable energy projects. Taking into account the length of sunny days in the country, the gross potential of the solar power industry is estimated to be between 525 terawatt-hours and 760 terawatt-hours per year, and the projected wind power capacity is more than 520 gigawatts with an annual production of more than 1,000 terawatt-hours of electricity.

The great potential of renewable energy sources in Uzbekistan can give a serious impetus to the development of ecologically clean and “green” economy. The total potential of Uzbekistan for renewable energy is 117,984 million toe (tonnes of oil equivalent). Its technical potential is 179.3 million toe.

TABLE II. RENEWABLE ENERGY SOURCES (RES) POTENTIAL IN UZBEKISTAN [2]

| Renewable energy sources | Gross capacity | Technical capacity |
|--------------------------|--------------------|--------------------|
| Hydropower | 9.2 million toe | 2 million toe |
| Wind power | 2.2 million toe | 0.4 million toe |
| Solar energy | 50,973 million toe | 177 million toe |
| Geothermal energy | 67,000 million toe | 0.3 million toe |

Solar energy accounts for up to 99 per cent of the total renewable energy potential in Uzbekistan, with an average of 270 to 300 solar days per year. The regions of Uzbekistan rich in solar energy potential - Karakalpakstan, Navoi, Bukhara and Surkhandarya - are mostly desert areas with relatively few

settlements and thus have prospects for the development of alternative energy.

Hydropower potential: 6,550 rivers, a number of irrigation canals and reservoirs in Uzbekistan offer great potential for the development of small and mini hydroelectric power plants in the country. In the 1960s, there were about 250 small and mini hydroelectric power stations operating in Uzbekistan.

Geographical conditions are not conducive to the large-scale development of wind energy in Uzbekistan. The country is totally landlocked and consists of 25 per cent of mountainous land and 75 per cent of desert land with an average wind speed of no more than 2-2.5 metres per second. The most favourable areas for the construction of wind turbines are Bukhara, Navoi, Kashkadarya, Tashkent regions and Karakalpakstan.

Uzbekistan’s large agricultural sector (one of the largest cotton producers in the world) provides considerable potential for biomass energy development. For 65 per cent of the country’s rural population, cotton stems are the main source of biomass energy, producing 2-3 million tons per year.

The development of alternative energy in Uzbekistan will proceed apace. The state sets a goal to increase the share of renewable energy sources in total electricity production to 25 per cent by 2030, which is now 10 per cent. In order to achieve these results, the Ministry of Energy is taking active measures to implement major projects in renewable energy [6].

Despite the challenges posed by the COVID crisis, the basis for the expansion of renewable energy sources has not changed, either in the global trend or in Uzbekistan.

Renewables are not protected from the COVID-19 crisis, but they are more resilient than other fuels. The International Energy Agency’s Global Energy Outlook 2020 forecasts renewable energy will be the only source of energy that will grow this year compared to 2019, unlike all fossil fuels and nuclear energy [5].

The annual Ember Global Electricity Outlook, published in March 2020, examined the quantitative characteristics of electricity production in 48 countries (83% of the world’s electricity production) and presented the following results:

- “wind and solar power production have grown by 14% in the first half of 2020 compared to the first half of 2019, generating almost one tenth (9.8%) of the world’s electricity;
- the share of wind and solar in world electricity production has increased from 8.1 per cent in 2019 to 9.8 per cent in the first half of 2020;
- wind and solar energy produced almost as much CO2-free energy as nuclear power plants, which generated 10.5% of the world’s electricity in the first half of 2020, and the share of which has not changed since 2019;
- many key countries currently generate about a tenth of their electricity from wind and sun: China (10%), USA (12%), India (10%), Japan (10%) and Turkey (13%). The EU and the United Kingdom rates are significantly higher - 21% and 33% respectively; in the EU the share of Germany has increased to 42%” [1].

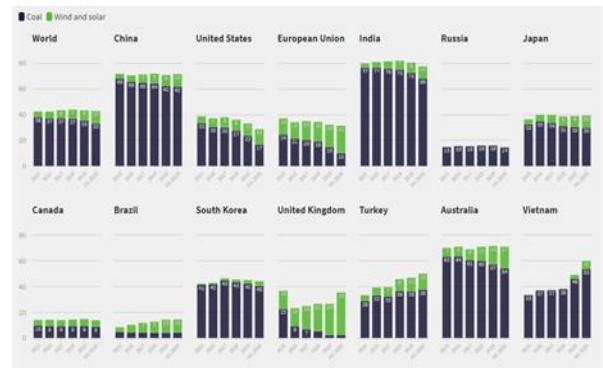


Fig. 3. Orientation of key world countries on RES - sun and wind (% of total electricity generation) [1]

Returning to the situation of alternative energy in Uzbekistan, we note that the Ministry of Energy, together with the ministries and departments concerned and with the technical assistance of international financial institutions (World Bank, Asian Development Bank) have developed the concept of fuel and energy supply of Uzbekistan for 2020-2030.

In addition, an international consultant, Mott Macdonald (United Kingdom), has devised a Master Plan for the long-term development of the electricity sector in Uzbekistan, including renewable energies.

Mott Macdonald, a consulting company, has identified significant and largely unused renewable energy sources in the country that can provide reliable and inexpensive electricity.

Paul Tucson, Mott Macdonald’s project manager, said, “Alternative, clean energy will play an important role in the future of Uzbekistan’s energy industry” [10].

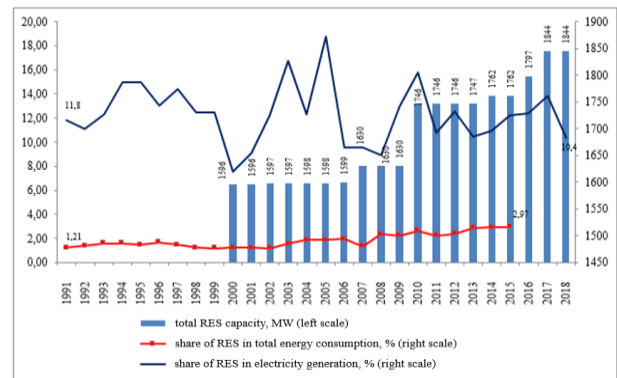


Fig. 4. Share of RES in total energy consumption and electricity generation in Uzbekistan

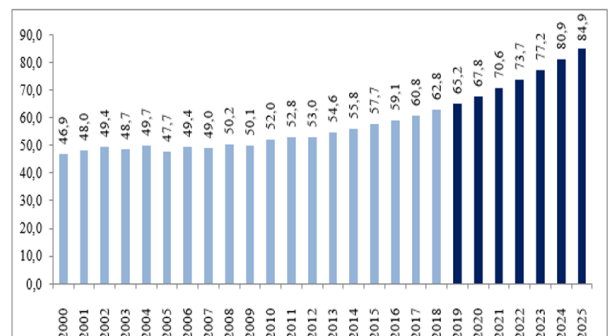


Fig. 5. Forecast of electricity production in Uzbekistan up to 2025 (billion kWh)

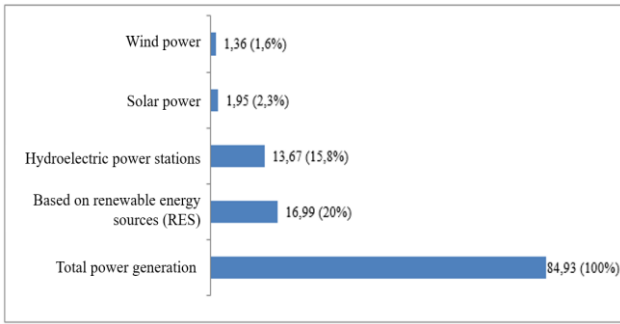


Fig. 6. Forecast of electricity production sources in Uzbekistan up to 2025 (billion kWh)

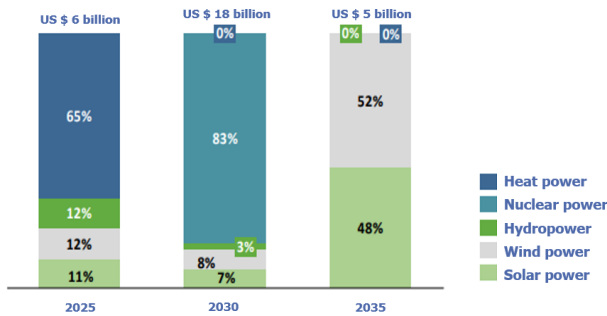


Fig. 7. Forecast for investment in electricity production in Uzbekistan up to 2035 (billion dollars)

The country’s available capacity is now 12 GW. With plans to decommission an additional 6.7 GW of obsolete units over the next five years, there is a significant need to construct new flexible units with a total capacity of more than 26 GW.

The construction of 2,700 km of high-voltage transmission lines, together with the construction of 9 new substations, will also be required to ensure a stable electricity supply.

In 2019, a Presidential Decision No. PP-4422 “On Accelerated Measures to Improve the Energy Efficiency of the Economic and Social Sectors, the Introduction of Energy-Saving Technologies and the Development of Renewable Energy Sources” was adopted in Uzbekistan (22 October 2019), which stated the long-term target parameters for the development of RES and the plan of the organizational and Practical measures for the further development of RES.

In order to stimulate the use of renewable energy, the Law of the Republic of Uzbekistan “On the Use of Renewable Energy Sources” provides a number of privileges and preferences:

- “exemption for producers of RES installations from the payment of all types of taxes for a period of five years from the date of their state registration;
- exemption for RES power producers from property tax on RES installations and land tax on sites occupied by these installations (rated at 0.1 MW and above) for a period of 10 years from the date of their commissioning;
- the property tax of individuals is not levied on property owned by persons using RES in residential premises with complete disconnection from the existing energy

networks, for a period of three years starting from the month of using RES;

- persons who use RES in residential premises with complete disconnection from the existing energy networks are exempt from the land tax, for a period of 3 years starting from the month of using RES;
- RES energy producers and RES plant manufacturers are granted the right to establish local networks (electric, thermal and/or gas) and to conclude contracts with legal entities and individuals for the sale of electrical, thermal energy and (or) biogas produced from renewable energies supplied through the local network” [3].

Since 2020, certain measures have been financed from the state budget of the Republic of Uzbekistan within the limits of annually approved parameters:

a) Compensation to individuals of 30 per cent of the cost of solar photovoltaic plants, solar water heaters and energy-efficient gas-fired appliances, but not more than:

- 3 million so‘ms for solar photovoltaic stations;
- 1.5 million so‘ms for solar water heaters;
- 200,000 so‘ms for gas-fired appliances;

b) Compensation to individuals and legal entities for interest on loans from commercial banks for the purchase of RES installations, energy-efficient gas-fired appliances and boilers and other energy-efficient equipment:

- to individuals on loans not exceeding 500 million so‘ms in part exceeding the refinancing rate of the Central Bank of the Republic of Uzbekistan, but not more than 8 percentage points;
- to legal entities on loans not exceeding 5 billion so‘ms, in part exceeding the refinancing rate of the Central Bank of the Republic of Uzbekistan, but not more than 5 percentage.

To date, the main companies in Uzbekistan involved in the implementation of RES projects are:

TABLE III. OVERVIEW OF KEY COMPANIES IN UZBEKISTAN IN THE FIELD OF ALTERNATIVE ENERGY [7]

| Company | Production/products |
|--------------------------|--|
| Erasolar | Inverters and controllers for the RES-based power supply system, solar panels and collectors, wind turbines, transformer substations, SGS-standard power-efficient greenhouses, solar water heaters (solar collectors) |
| Kuchlanish va quvvat | Solar panels and collectors, wind turbines, hybrid systems |
| All Solar | Solar panels, solar collectors and their accessories, lights integrated with solar panels |
| Solar Nature | Solar panels and collectors, wind turbines, light and acoustic production |
| Mir solar | Production of solar cell equipment, sale and installation of boiler equipment, solar hot water systems, pool equipment |
| Temipro | Boilers, boiler equipment. Pumps. Heating equipment and systems. Circulating pumps |
| Intellect-dialog | Development and implementation of alternative energy equipment into production. Products: wind energy units with a capacity of 1,000 to 3,000 W, Solar-electric units with a capacity of 1000 W and more |
| Sn Invest | Development and implementation of alternative energy equipment into production. Products: solar panels; gel storage batteries; controllers and inverters; wind fans; solar water heaters |
| Chag‘atay Invest | Solar power plants, micro hydroelectric power stations; wind turbines; heating pumps |
| Engot‘amir, SRP JSC | Power equipment |
| Sharktchenergotamir, LLC | Solar modules |
| O‘zbekenergota‘mir, JSC | Power equipment |

To date, Uzbekistan has invested \$1,510.6 million in 57 investment projects in the fuel and energy sector, of which foreign investment amounts to \$330.8 million. [9].

In particular, during the implementation of 11 investment projects of the Uzbekneftegaz, JSC within the Presidential Decision “On Measures for the Implementation of the

Investment Programme of the Republic of Uzbekistan for 2020-2022” (9 January 2020), the investments in the amount of 1410,5 million dollars are forecasted. From January to July 2020, 942.5 million dollars was spent.

The official website of the Ministry of Energy of Uzbekistan contains information on investment projects related to RES:

- in accordance with to the Decision of the Cabinet of Ministers No. 633 (8 August 2010) International Finance Corporation tendered for a pilot investment project for 100 MW solar photoluminescent evacuation systems (PES) in Navoi region based on PPP. According to the results (4 October 2019), the winner is “Masdar Energy” (UAE) company with a tariff of 2,679 US cents/kW*h.

We should also note that project for the construction of wind power plants in Uzbekistan will be realized with the participation of the “Masdar” company. It is planned to build wind turbines with a total capacity of 500 MW near Zarafshan.

Masdar is a subsidiary of the Mubadala Investment Company of the Government of Abu Dhabi and one of the leading international renewable energy companies in the world. The company’s portfolio of realized investment projects includes more than 4000 MW of installed capacity for generating electricity from renewable sources.

The EBRD is also providing effective support to the Government of Uzbekistan in developing wind power projects with a total capacity of 1,000 MW. The Karakalpakstan 100 MW tender will be announced soon:

- based on the Memorandum of Understanding (14 January 2019) signed between the European Bank for Reconstruction and Development, the State Investment Committee of Uzbekistan and Uzbekenergo, JSC, agreements with companies “Juru Energy” (United Kingdom) and “Synergy Consulting” (India) have been concluded to provide advisory services and relevant technical studies for auction tenders for the construction of a 100 MW wind farm in the Republic of Karakalpakstan at the expense of donor funds.
- on 16 August 2019, a Memorandum was signed between the Ministry of Energy, the Ministry of Investment and Foreign Trade and the Asian Development Bank on the provision of consulting services as part of the implementation of investment projects of solar PES power stations with a total capacity of up to 1 GW in 2019-2025.

By the end of 2021, Uzbekistan plans to have two photovoltaic (solar) power plants with a capacity of 100 MW each [6].

Photovoltaic solar power (PV) plants with a total capacity of 5,000 MW and wind farms with a total capacity of 3,000 MW are planned to build in the next 10 years.

At the same time, the Government of Uzbekistan is actively engaged in direct negotiations with major companies that have offered good conditions for their participation in RES projects.

In particular, the “TOTAL Eren” Company (France) will build a photovoltaic station in the Nurabad district of the

Samarkand region. A corresponding agreement for the construction and operation of 100 MW PES was signed in September 2019. The legal basis for this project was the agreement and the relevant decision during the official visit of the President of the Republic of Uzbekistan to France in October 2018.

Another large company, ACWA Power (Saudi Arabia), has signed an agreement to build a 500-1000 MW wind farm. The investment will amount to 550-1.1 billion dollars. The wind farm is expected to be operational in 2023.

ACWA Power is a developer, investor and operator of power plants and desalination plants. The company currently operates in 12 countries in the Middle East, Africa, and South-East Asia, and has a portfolio of 56 assets with an investment value of 45.5 billion dollars, producing 31 GW of electricity and 5.2 million cubic meters of desalinated water per day.

Founded in 2004 in Riyadh, ACWA Power now co-owns nine Saudi conglomerates, including the Vision International Investment Company, the Public Investment Fund (PIF), and the Saudi Arabian Government Pension Agency.

However, as any developing industry, alternative energy in Uzbekistan faces barriers that hinder its development.

One of these barriers is the high cost of producing renewable energy sources and their low capacity, compared to traditional energy sources, as well as the low cost of traditional energy sources, compared to other countries. The average cost per kWh of electricity in Uzbekistan averages 2.4 cents (for comparison, 3.5 cents in Kazakhstan, 0.7 cents in Turkmenistan, 4.8 cents in Russia, 13 cents in China, 33.8 cents in Germany, 18.6 cents in the UK, 33.3 cents in Denmark, 31.8 cents in Belgium).

The lack of specific financial support mechanisms (tariffs and taxes) needed to promote the use of renewable energy sources also hampers the overall development of the sector under study.

One of the main reasons for the low rate of development of renewable energy sources is the technical inadequacy of energy production technologies, lack of public awareness of modern forms of energy, especially renewable energy, and innovative lag of the industry.

The development of nuclear energy is one of the factors affecting the use of renewable energy sources and hindering the development of the energy sector. Research shows that clean energy from renewable energy sources is about 20 times more expensive than from nuclear power plants. Experts estimate the world’s coal reserves will last for 270 years, oil for 50 years, gas for 70 years. Uranium reserves used in nuclear power plants amount to 5,718,400 tons. It is supposed to last 2,500 years. In some countries, the share of nuclear power in electricity production is high, and in 12 countries the share is above 30 per cent. In particular, 75 per cent of electricity in France, 54 per cent in Slovakia, 51 per cent in Belgium and 46 per cent in Ukraine is produced by nuclear power plants [2].

Eliminating all these problems, as well as creating an effective system with traditional and alternative power stations, is a rather complicated process, which will take Uzbekistan more than a dozen years (about 25-30). Uzbekistan is moving in the right direction [9].

Comments and opinions on problems and prospects of development of alternative energy sector of Uzbekistan are of interest. Ilhom Sadykov, director of Erasolar, proposes developing and testing of green tariff as the main direction of development of RES in Uzbekistan. The state may initiate the regulation and introduction of energy service contracts under which enterprises will be able to pay for the installation of RES equipment from savings in energy efficiency.

III. CONCLUSION

A state is also able to support businesses by permitting or regulating the tariff for the sale of electricity generated from RES. Thus, private business will start to develop this area itself and sell energy to the people and the state. For this purpose, it is necessary to reduce bureaucratic processes in the Ministry of Finance of Uzbekistan and in “Uzbekenergo”. It is also possible to market energy from solar panels and open a power station for the population.

Abdulfafiz Kuchkarov, founder of the “Kuchlanish va quvvat” company, identifies the main factors inhibiting the sphere of alternative energy, including “high prices for solar panels and batteries (while solar panels last for 25-30 years, batteries last only for 5-6 years, after which they begin to lose the ability to accumulate energy)”.

Muzaffar Tilavov, founder of “All Solar” says, “In Uzbekistan, renewable energies cannot yet compete with traditional forms of electricity because of the high cost of equipment, the almost total ignorance of the population and the lack of sufficient support from the state. The customer often prefers Chinese products, considering they are better than Uzbekistan-produced ones, which is not correct. Uzbekistan has no legal and regulatory framework governing such kind of activities. Producers have no preferences; it is difficult to obtain a loan from the bank. We are waiting for concessions that would give impetus to the development of the sphere”.

In general, despite the presence of significant obstacles and problems, the number of projects in the field of renewable energy, gradually implemented in Uzbekistan, is constantly increasing. Investors' proposals for these projects, none of which imply the provision of state guarantees, testifies to the growing interest of major players in the energy market in serious work in the country.

REFERENCES

- [1] Ember Global Electricity Outlook 2020, URL: <https://ember-climate.org/project/global-power-2020/> (accessed 09.02.2020).
- [2] Renewable energy for Sustainable development, URL: <https://review.uz/post/voznovlyaemaya-energiya-dlya-ustoychivogo-razvitiya/> (accessed 09.02.2020).
- [3] Information about RES in Uzbekistan, Official website of the Ministry of Energy of Uzbekistan, URL: <http://minenergy.uz/ru/lists/view/32/> (accessed 09.02.2020).
- [4] Concept of the Development Strategy of the Republic of Uzbekistan up to 2035, URL: <https://uzbekistan2035.uz/wp-content/uploads/2019/05/%D0%9A%D0%BE%D0%BD%D1%86%D0%B5%D0%BF%D1%86%D0%B8%D1%8F-%D0%A0%D0%B0%D0%B7%D0%B2%D0%B8%D1%82%D0%B8%D1%8F-%D0%A3%D0%B7%D0%B1%D0%B5%D0%BA%D0%B8%D1%81%D1%82%D0%B0%D0%BD%D0%B0-RUS.pdf> (accessed 09.02.2020).
- [5] Review of the energy market in Uzbekistan on the issues of historical dynamics, structure, trends, legislation and forecasts up to 2030, URL <https://www.rbasia.uz/rynok-energetiki-uzbekistan/> (accessed 09.02.2020).

- [6] Development of RES in Uzbekistan – an overview, URL: <https://eenergy.media/2020/03/15/razvitie-vie-v-uzbekistane-obzor/> (accessed 09.02.2020).
- [7] What is happening in the alternative energy market of Uzbekistan, URL: <https://www.spot.uz/ru/2018/06/13/alternative-energy/> (accessed 09.02.2020).
- [8] Expert: the path to alternative energy in Uzbekistan may take 30 years, URL: <https://uz.sputniknews.ru/radio/20200605/14298679/Ekspertput-k-alternativnoy-energetike-v-Uzbekistane-mozhet-zanyat-let-30.html> (accessed 09.02.2020).
- [9] Energy of Uzbekistan in the context of a pandemic (09/07/2020), URL: <https://cer.uz/ru/post/publication/energetika-uzbekistana-v-usloviah-pandemii/> (accessed 09.02.2020).
- [10] Uzbekistan's electricity master plan commits to using clean energy, URL: <https://www.mottmac.com/releases/uzbekistans-power-sector-masterplan-commits-to-clean-energy/> (accessed 09.02.2020).
- [11] Uzbekistan energy profile, URL: <https://www.iea.org/reports/uzbekistan-energy-profile/> (accessed 09.02.2020).
- [12] Uzbekistan: Electricity exports, URL: https://www.theglobaleconomy.com/Uzbekistan/electricity_exports/ (accessed 09.02.2020).
- [13] Uzbekistan increases electricity production by 0.6%, URL: <https://uzdaily.uz/en/post/53281/> (accessed 09.02.2020).
- [14] Uzbekistan - Electricity Transmission Network, URL: <https://datacatalog.worldbank.org/dataset/uzbekistan-electricity-transmission-network-2016/> (accessed 09.02.2020).