



Renewable Energy Sources and Ways of their Implementation in the Republic of Uzbekistan

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ABSTRACT

In this scientific article, the foreign experiences of using renewable energy sources (RES) are studied and the ways of their implementation in the practice of the Republic of Uzbekistan are shown, the economic advantages of using renewable energy sources in the production of electricity and future forecast indicators are analyzed.

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INTRODUCTION. The development of the country's economy depends on the amount of its natural resources and raw materials base. If we take gas, oil and coal as natural resources and raw materials - all these are non-renewable resources. The role of the source of electricity is important in the development of the economy of any country. Gas, oil and coal are mainly used in the production of electricity in our republic today. However, the electricity produced cannot fully supply the economic sectors. There is a growing need to use alternative and renewable energy sources to fully meet the demand for electricity.

In the field of electricity production, additional electricity is produced in the field by using renewable

energy sources. In addition, effective use of energy resources in the future will allow to reduce the amount of harmful gases released into the environment, while saving underground resources and reserves. Therefore, in developed countries, using alternative and renewable energy sources, economic growth is achieved in all sectors of the economy.

The use of renewable energy sources in the development of the energy sector is becoming a component of the overall strategy of the sector. One of the most important characteristics of renewable energy sources is their energy potential - an indicator that determines the amount of energy specific to the respective type of renewable energy sources.

Therefore, taking into account the existing technical capabilities of renewable energy sources, it is necessary to determine their place in the current and future energy balance of the country. Until now, there is a lack of sufficient theoretical and scientifically based information on renewable energy sources in the production sector, including experiences on the use of solar, wind and organic waste energy.

Our republic is a country with unique experience in the field of energy. Our country ranks among the ten largest producers of natural gas in the world. 50% of the power generating capacity of the combined energy system of Central Asian countries and South Kazakhstan is located here.

Taking into account the high demand for electricity, the presence of unmet needs and the increasing demand for electricity every year, our state is carrying out a number of reforms in this regard.

All over the world, non-renewable resources are mainly used in the production of electricity. As a result, it leads to very high levels of air, water and soil pollution in many parts of the world. This is causing environmental imbalances around the world that harm human health and biodiversity.

The countries of the world are divided into the following groups according to the production of electricity:

- the countries of the first group mainly producing electricity through thermal power plants - the Russian Federation, the USA and Western European countries. They mainly use natural gas, fuel oil and coal in the production of electricity;
- the second group includes the countries of China, Australia, Mexico, Romania, the Netherlands and Poland, which mainly use natural gas in the production of electricity;
- the countries of the third group include Honduras, Colombia, Kenya, Brazil, New Zealand, Austria and Paraguay. They mainly produce electricity through HPS (hydroelectric power stations).
- the fourth group of countries includes Japan, France and Belgium. They produce electricity mainly using nuclear energy.

Today, China, the USA, the Russian Federation and Brazil are leading the world in terms of electricity production.

Analysis of literature on the topic. The advantage of renewable energy sources in the production of electricity is the creation of hydrocarbon resources from them, that is, the possibility of using them as raw materials in the petrochemical industry without burning them completely. It is possible to achieve economic efficiency by using renewable energy sources and residential areas located in remote and distant regions of the republic.

The types of energy resources that can be used in the field of electricity production are non-renewable and renewable energy sources. There are more types of renewable energy resources than non-renewable

energy resources. But today, non-renewable energy resources are used mainly in the field of electricity production in our country.

In the world's experience, the need for widespread use of alternative and renewable energy sources is determined by the rapid growth of the demand for electricity, which will increase by 1.5 times by 2030 compared to 2010, that is, by 2050, it will increase by 3 times.

RES is an option both to ensure energy security and for sustainable development. Renewable energy is commonly defined as energy generated from solar, wind, geothermal, tide and wave, wood, waste, and biomass. The energy produced from RES plays an important role in decreasing energy insecurity, contributing to energy security, and diversifying energy consumption. Used principally by the electricity sector to decrease shortages and lack of access, a significant expansion in renewable energy has been encouraged by technological advances and the reduced costs of transportation and communication [1].

Renewable energy already supports thousands of jobs in the United States. In 2016, the wind energy industry directly employed over 100,000 full-time-equivalent employees in a variety of capacities, including manufacturing, project development, construction and turbine installation, operations and maintenance, transportation and logistics, and financial, legal, and consulting services [2]. More than 500 factories in the United States manufacture parts for wind turbines, and wind power project installations in 2016 alone represented \$13.0 billion in investments [3].

The use of renewable energy sources is especially relevant for Alaska. Over the past two years, 66 projects have been implemented, thanks to which about 30 million gallons of diesel fuel have been saved. As you know, the electricity costs of rural Alaska residents are among the highest in the United States. In just three years, the wind farm eliminated the need to use 3 million gallons of diesel fuel in Kodiak. The development of renewable energy occurs only thanks to state support. In the future, it is planned to receive 50% of electricity from renewable energy sources by 2025 [4].

China is the world's largest emitter of greenhouse gases, sulfur dioxide, nitrogen oxides and particulate matter, as it consumes the world's largest amount of energy, including 67% of primary energy and 73% generated from coal. To cope with energy security and environmental issues, China has been actively developing renewable energy sources since 2000 and has made rapid progress (the average annual growth rate was 62.5% over the past decade). By 2030, China plans to use at least 16% of renewable energy sources from the total energy consumption [5].

There have been relevant studies on China's energy transition. Literature [6] researched and put forward the decision-making ideas for China's high proportion of renewable energy development goals, and considered that high proportion of electrification and high proportion of non-fossil energy power generation are two major characteristics of the future energy system. Literature [7] analyses some challenges faced by China's energy transition in terms of synergistic value of carbon reduction and haze control, system construction, and development awareness. Literature [8] thought that to achieve the strategic goals of efficient, safe, clean, and low-carbon energy development, it is necessary to accelerate the reform of the energy system and market mechanism, change the development concept, conform to the trend of world energy reform, and enhance the competitiveness of low-carbon development. Literature [9] systematically analyses the historical role, practical role and future position of global fossil energy and clean energy, reveals the objective law of energy development, and deeply points out that clean energy replacement and electricity replacement will become the inevitable trend of global energy development.

The world needs energy to drive economic and human development as well as the sustenance of everyday lives. Worldwide, over 26 TW.h. of electricity was produced in 2019 [10]. This electricity was generated from different energy sources, mostly from fossil fuels but likewise nuclear and other renewable sources such as bioenergy, wind, hydro and solar. Globally, the principal source of greenhouse gas emissions is directly related to the system of production and consumption of energy. Greenhouse gases are conceived as the driving force responsible for climate change, and thus to ensure clean energy transition, most countries are working actively to diversify the means of energy production. This transition means a shift from producing energy from sources that releases a large amount of greenhouse gases to those with little or no emissions [11]. The global direction for transiting to clean energy was agreed by over 180 member countries of the United Nations Framework Convention on Climate Change in the Paris Agreement. One of the paramount objectives is to reduce greenhouse gas emissions by encouraging the use of low carbon energy sources in order to keep the average global temperatures increase well below 2 °C, relatively to the pre-industrial levels. According to IEA, presently around the world, two-thirds of electricity generated is from fossil fuels, hence attaining the climate goals by 2050 will entail producing at least 80% of electricity from low carbon sources [10].

Wind energy is indirectly related to solar energy. This is because energy from the sun drives the cyclical movement of air, water vapor as well as climatic pattern [12]. The conversion of air kinetic energy from the flowing air into electrical energy generates wind power. An electrical generator enables wind turbines to convert air kinetic energy into mechanical energy [13]. Wind energy is advantageous because it produces energy which is considered free from greenhouse gas emissions in the course of operation, but emissions could be significant during turbine production and maintenance. Wind energy can be widely distributed and requires a small surface area for installation. Thus, the energy produced is considered to be environmentally friendly [13]. The rate at which power is produced depends on the wind turbine's size and wind speed. Recently, onshore wind energy capacity has been widely developed as an alternative source of energy to fossil fuel [14]. In South Africa, many parts lie near the equatorial zone. However, there are overlaps in the northern and southern regions, with the wind regime in the temperate westerlies [12]. Wind energy is also considered as one of the greatest prospects for energy generation in the country. Theoretically, wind energy potential in the country is estimated at 6700 GW [15]. The average wind speed in the country ranges from 7.29–9.70 m/s which was recorded in the Cape Agulhas. Generally, the potential of wind energy is good along the entire coast lines of the country, with some areas like the coastal promontories displaying a strong potential. Moderately, the inland areas are potentially noted such as the Eastern Highveld Plateau, the Drakensberg foothills in KwaZulu-Natal and Eastern Cape. So far, the implementation of about 3.366 GW of wind power is underway, with an envisioned addition of 5.034 GW capacity to be included by 2030 [16,17].

The development of renewable energy is of utmost importance to the implementation of Poland's Energy Policy until 2030 [3]. The increase in the use of renewable energy sources results in a greater independence from imported supplies. Promoting the use of renewable energy sources enables greater diversification of supply sources and creates conditions for the development of distributed energy based on locally available resources [18,19].

Access to renewable energy is not only an environmental issue but also crucial in achieving development and reducing poverty. Multinational enterprises (MNEs), especially those operating in institutionally weak countries, have great potential in contributing to the economic and social development of economies through their corporate social responsibility (CSR) portfolio. [20] After

2015, with the launch of the 17 United Nations' Sustainable Development Goals (SDGs) [21], the governments of several countries oriented their national and regional development plans and a large number of companies aligned their corporate strategy to the SDGs. [22]

The development and adoption of renewable energy is one of the answers to the most unrelenting social and environmental challenges, especially those linked to climate change [23, 24, 25, 26, 27]. Good news is that around US\$300bn were invested in renewable energy worldwide in 2017, accounting for two-thirds of power generation spending. [28] In state policies scenario, investment in renewables will reach around US\$10tn between 2019 and 2040. [29] Nonetheless, after several years of growth in investment and the adoption of the use of renewable energy, in 2018, there was a slight decrease in global investment in renewable energy and energy efficiency. [28] This decrease was associated with changes in the incentive policies for the adoption of photovoltaic solar energy in China and had worldwide repercussions (idem). The International Energy Agency [28] warned that if the decline in global investments continues, there is a threat that the goals set for climate change, air quality and energy security will not be met. Nevertheless, different studies have found that renewable energy could power the world by 2050. [30, 31] Therefore, more research is needed to support actions that can solve important societal and environmental questions that are associated with climate change.

In the structure of energy consumption, renewable energy sources are increasing rapidly. The consumption of renewable energy sources in the world will grow very fast during 2012-2040, making an annual average of 2.6 percent [32]

The advantage of renewable energy sources in the production of electricity is the creation of hydrocarbon resources from them, that is, the possibility of using them as raw materials in the petrochemical industry without burning them completely. It is possible to achieve economic efficiency by using renewable energy sources and residential areas located in remote and distant regions of the republic.

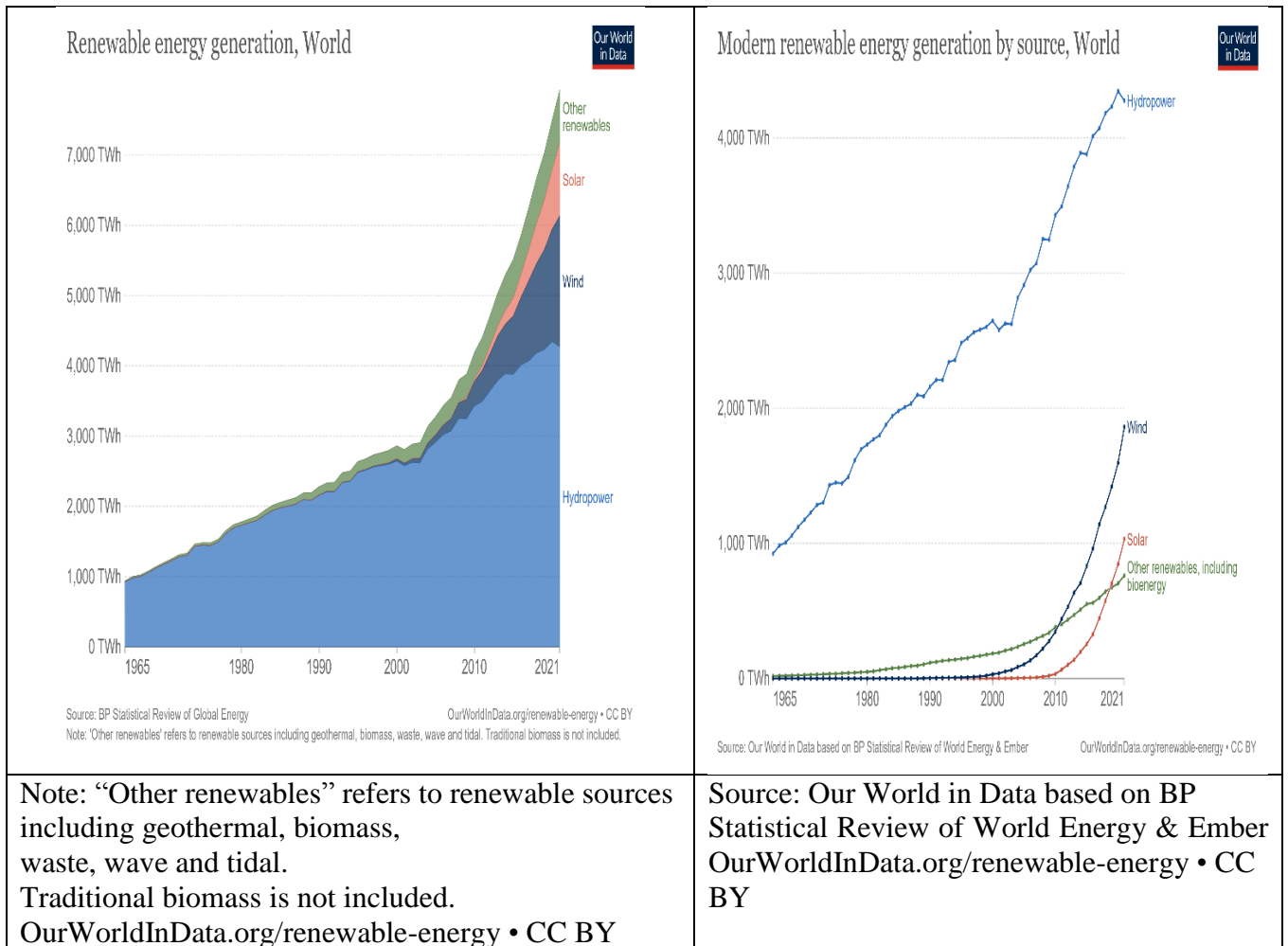
Research methodology. In this scientific article, the comparative comparison of the reforms carried out in the countries of the world on the use of renewable energy sources, the study of statistical data and economic comparison and analysis, logical thinking, scientific abstraction, analysis and synthesis, induction and deduction methods are widely used.

Analysis and results. When using renewable energy sources in the production of electricity, it has some disadvantages, that is, for most types of renewable energy sources, the energy flow is not dense and variable, as well as the high comparative value in the technological characteristics of production. But in the future, using modern innovative technologies in the use of renewable energy sources can have high economic efficiency.

Fossil fuels such as oil, natural gas, coal and uranium currently form the basis of the world's energy balance and will remain so for the near future. However, the resources of these fuels are decreasing due to their processing and use.

At the level of the current use of energy resources, the world reserves of oil - 45-50, natural gas - 70-75, coal - 165-170, lignite - 450-500 years, and nuclear fuel - relatively more years. [33].

Figure 1 shows the state of use of renewable energy sources in the production of electricity in the countries of the world.



Source: BP Statistical Review of Global Energy. <https://ourworldindata.org/grapher/modern-renewable-energy-consumption>

Figure 1. State of use of renewable energy sources in the world

In the charts shown here we look at the breakdown of renewable technologies by their individual components – hydropower, solar, wind, and others. The first chart shows this as a stacked area chart, which allows us to more readily see the breakdown of the renewable mix, and relative contribution of each. The second chart is shown as a line chart, allowing us to see more clearly how each source is changing over time. Globally we see that hydropower is by far the largest modern renewable source [since traditional biomass is not included here]. But we also see wind and solar power are both growing rapidly

We can see the state of use of renewable energy sources in the EU countries in Figure 2.

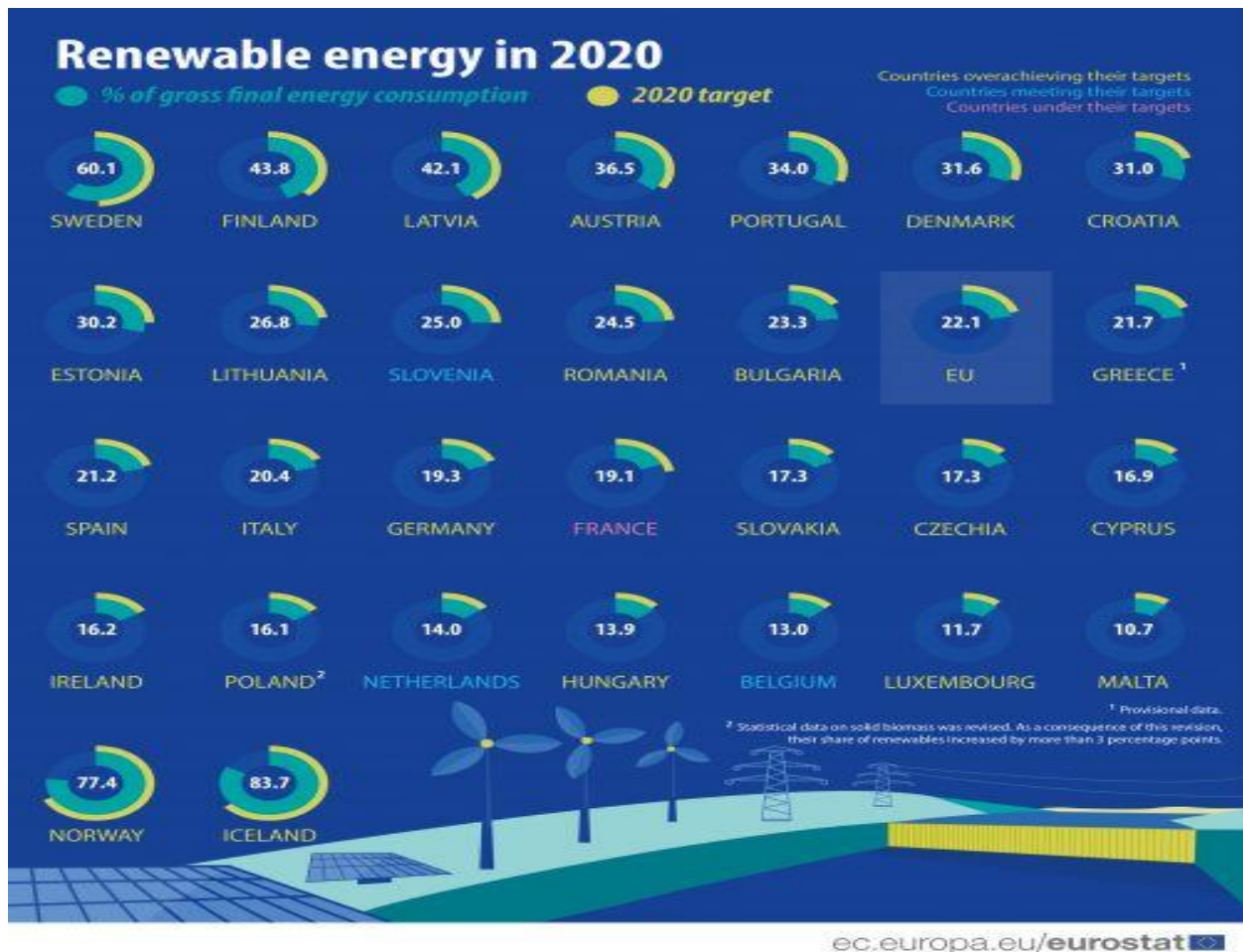


Figure 2. The state of use of renewable energy sources in the EU countries

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

Becoming the world's first climate-neutral continent by 2050 is the objective behind the European Green Deal (COM(2019) 640 final), the very ambitious package of measures that should enable European citizens and businesses to benefit from sustainable green transition.

The use of renewable energy has many potential benefits, including a reduction in greenhouse gas emissions, the diversification of energy supplies and a reduced dependency on fossil fuel markets (in particular, oil and gas). The growth of renewable energy sources may also stimulate employment in the EU, through the creation of jobs in new 'green' technologies.

This article provides recent statistics on the share of energy from renewable sources overall and in three consumption sectors (electricity, heating and cooling, and transport) in the European Union (EU). Renewable energy sources include wind power, solar power (thermal, photovoltaic and concentrated), hydro power, tidal power, geothermal energy, ambient heat captured by heat pumps, biofuels and the renewable part of waste.

We focus on the indicators of electricity production by countries of the world (Table 1).

Table 1. Electricity production by countries of the world (TW.t.hour)

| № | Countries name | 2000 year | 2010 year | 2015 year | 2020 year | The difference between 2020 and 2000 | The ratio of 2020 to 2000 |
|---|----------------|-----------|-----------|-----------|-----------|--------------------------------------|---------------------------|
| Countries that produce the most electricity | | | | | | | |
| 1 | China | 1,356 | 4,208 | 5,860 | 7,798 | 6,442 | 5,7 M |
| 2 | USA | 4,053 | 4,378 | 4,317 | 4,262 | 0,209 | 105,1 |
| 3 | India | 0,562 | 0,975 | 1,358 | 1,557 | 0,995 | 2,8 M |
| 4 | Russia | 0,878 | 1,038 | 1,068 | 1,096 | 0,218 | 124,8 |
| 5 | Japan | 1,068 | 1,171 | 1,059 | 1,011 | -0,057 | 94,7 |
| 6 | Canada | 0,606 | 0,603 | 0,658 | 0,648 | 0,042 | 106,9 |
| 7 | Brazil | 0,349 | 0,516 | 0,582 | 0,614 | 0,265 | 175,9 |
| 8 | Germany | 0,577 | 0,633 | 0,648 | 0,572 | -0,005 | 99,1 |
| 9 | South Korea | 0,290 | 0,500 | 0,553 | 0,571 | 0,281 | 196,9 |
| 10 | France | 0,540 | 0,569 | 0,580 | 0,533 | -0,007 | 98,7 |
| Countries that produce the least electricity | | | | | | | |
| 1 | Nigeria | 0,015 | 0,026 | 0,032 | 0,040 | 0,025 | 2,7 M |
| 2 | New Zealand | 0,039 | 0,045 | 0,044 | 0,044 | 0,005 | 112,8 |
| 3 | Portugal | 0,044 | 0,054 | 0,052 | 0,053 | 0,009 | 120,4 |
| 4 | Romania | 0,052 | 0,061 | 0,066 | 0,056 | 0,004 | 107,7 |
| 5 | Uzbekistan | 0,047 | 0,052 | 0,059 | 0,065 | 0,018 | 138,3 |
| 6 | Kuwait | 0,032 | 0,057 | 0,068 | 0,075 | 0,043 | 2,3 M |
| 7 | Colombia | 0,043 | 0,061 | 0,079 | 0,076 | 0,033 | 176,7 |
| 8 | Czechia | 0,065 | 0,086 | 0,084 | 0,081 | 0,016 | 124,6 |
| 9 | Chile | 0,040 | 0,060 | 0,067 | 0,084 | 0,044 | 2,1 M |
| 10 | Algeria | 0,028 | 0,048 | 0,052 | 0,088 | 0,06 | 3,1M |

Note: 1 terawatt (TW) = 1,000,000,000 kilowatts (kW) Source:yearbook.enerdata.ru/world-electricity-production-statistics.html developed by the author based on data.

This table shows the electricity production indicators of the countries of the world for the years 2000-2020. In particular, among the countries that produce the most electricity, China produced 1,356 TW of electricity in 2000, and by 2020, it has increased by 5.7 times and produced 6,442 TW of electricity. By 2020, India is generating 2.8 times more electricity than in 2000. USA – increased by 5.1%, Russia – increased by 24.8%, Japan – decreased by 5.3%, Canada – increased by 6.9%, Brazil – increased by 75.9%, Germany – decreased by 0.9%, South Korea - increased by 96.9%, in France - decreased by 1.3%. If we look at the countries producing the least amount of electricity, by 2020 compared to 2010, Nigeria will increase by 2.7 times, New Zealand will increase by 12.8%, Portugal will increase by 20.4%, Romania will increase by 7.7%, In Uzbekistan - increased by 38.3%, in Kuwait - by 2.3 times, in Colombia - by 76.7%, in the Czech Republic - by 24.6%, in Chile - by 2.1 times, in Algiers - by 3.1 times. It can be concluded from this that as much as the power production capacity has increased, their economy has also grown to the same extent.

Among the countries of Central Asia, the Republic of Kazakhstan ranks first in terms of electricity production potential and installed capacity, and the Republic of Uzbekistan ranks second. The potential of the Republic of Kazakhstan for the organization of the electricity market in Central Asia may be one-sidedly high, that is, the potential of electricity production is high. But in this regard, the possibilities of the Republic of Uzbekistan are wider. The energy resource potential of Central Asian countries is shown in Table 2.

Table 2. Energy resource potential of Central Asian countries

| Countries / year | | Coal* billion tons | oil* million tons | gas* billion m ³ | Uranus** a thousand T. | Hydro*** billion kW.s/y | RES**** billion kWh/y |
|------------------|------|--------------------------|-------------------------|-----------------------------------|---------------------------------|-------------------------------|-----------------------------|
| Kazakhstan | 2000 | 34,1 | 2760 | 1841 | 601 | 27 | 66 |
| | 2020 | 34,1 | 2760 | 1841 | 601 | 27 | 66 |
| Kyrgyzstan | 2000 | 1,34 | 11,5 | 6,54 | - | 52 | - |
| | 2020 | 1,27 | 1,2 | 6,2 | - | 99 | - |
| Tajikistan | 2000 | 0,67 | 5,4 | 9,2 | - | 317 | 18,4 |
| | 2020 | 1,0 | 10 | 10 | - | 317 | 18,4 |
| Turkmenistan | 2000 | - | 75 | 2860 | - | 2 | - |
| | 2020 | - | 75 | 2860 | - | 2 | - |
| Uzbekistan | 2000 | 2 | 350 | 2000 | 83,7 | 15 | - |
| | 2020 | 2 | 350 | 2000 | 83,7 | 15 | - |
| Central Asia | 2000 | 38,11 | 3261,9 | 6716,7 | 684,7 | 413 | 84,4 |
| | 2020 | 38,37 | 3205,2 | 6716,2 | 684,7 | 460 | 84,4 |

Note: * volume of proven recoverable reserves for coal, oil and natural gas is given; ** Proved uranium reserves with production costs of up to 30 dollars/kg have been estimated by the World Energy Council (WEC); *** hydropotential - economically efficient. Uzbekistan - technical hydropotential; **** RES - Renewable energy sources.

Source: <https://onlinelibrary.wiley.com/doi/full/10.1002/pa.2427#:~:text=Central%20Asian%20countries%20are%20rich,use%20of%20regional%20energy%20resource> by the author was developed.

Analyzing the data presented in Table 2, the largest coal reserves are in Kazakhstan - 34.1 billion. tons. Kazakhstan has the largest oil reserves - 2760 million. tons, Uzbekistan is in second place - 350 million. tons. Turkmenistan ranks first in terms of gas reserves - 2860 billion. m³, Uzbekistan is in second place - 2000 billion. m³, Kazakhstan is in third place - 1841 billion. m³. In terms of uranium reserves, Kazakhstan is in first place - 601 thousand tons, Uzbekistan is in second place - 83.7 thousand tons, and the rest of the republics have no uranium reserves. The Republic of Tajikistan on water-based electricity, that is, on hydroelectric power stations It ranks first with the production of 317 billion kWh of electricity, In 2020, the Kyrgyz Republic is in second place with the production of 99 billion kWh of electricity. In terms of renewable energy sources, the first place is in the Republic of Kazakhstan, 66 billion kW hours per year. of electricity is produced. In second place - in the Republic of Tajikistan - 18.4 billion. kW hours of electricity is produced.

Compared to other countries in the region, Uzbekistan consumes twice as much energy as Kazakhstan. The amount of electricity used by Kazakhstan's economy is twice as high as the average efficiency of

electricity use in the countries of the Commonwealth of Independent States (CIS).

Figure 3 shows the forecast of electricity consumption per capita in Uzbekistan, Turkey, People's Republic of China, Kazakhstan and Russia.

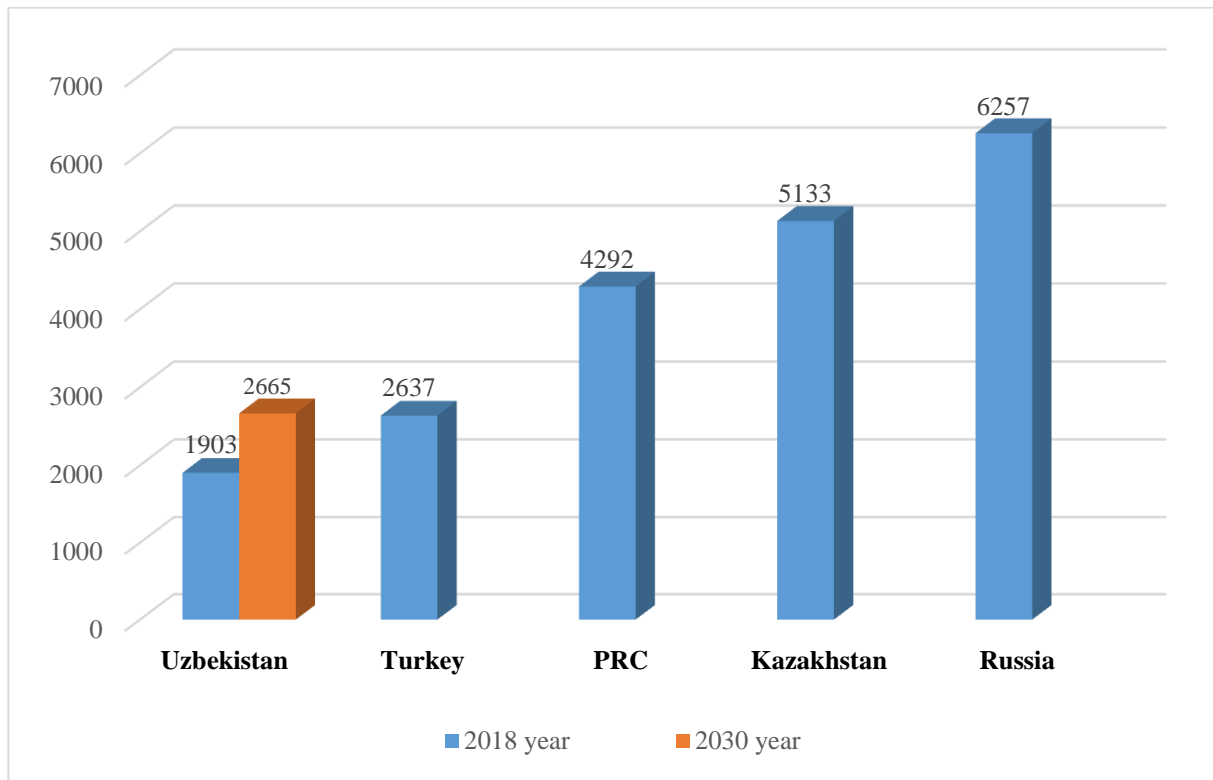


Figure 3. Annual electricity consumption forecast per capita, kWh. [34]

Figure 3 shows the per capita electricity consumption for Uzbekistan and other countries in 2018, electricity consumption per capita in Uzbekistan is 1903 kWh, in Turkey 2637 kWh, in PRC 4292 kWh, in Kazakhstan 5133 kWh, in Russia 6257 kWh. It is predicted that by 2030, it will be 2665 kWh in Uzbekistan.

If we focus on the foreign experience, after the introduction of wind energy production in Denmark, the retail price of electricity has been reduced by up to 85%. This has led to a significant increase in the volume of wind energy, and Denmark has become a major industrial center in the world for the development and production of modern innovative technologies in wind power plants.

In the production of electricity in our republic, the main reserves of natural gas are located in Shortan, Kokdumalak, Alan, and Adamtosh fields. A high amount of hydrogen sulfide in gas is observed in Ortabuloq (5 percent), Dengizkol-Khauzak (4.25 percent), Kandim (1.89 percent), and Oqqum (1.92 percent) fields. About 80 percent of the produced gas is used for domestic needs. Uzbekistan is slightly behind Russia in terms of gas consumption per capita (1600 m³/person/year), which is 3.5 times the world average.

Oil products are mainly produced in Fergana Valley and Bukhara Region. Oil fields were studied in Karakalpakstan and 6 regions: Kashkadarya, Bukhara, Surkhandarya, Namangan, Andijan and Fergana. Basically, 75% of the oil reserves in our republic are located in Kashkadarya region, 70% of which correspond to the Kokdumalak field.

The Angren, Boysun and Shargun mines of our country have coal reserves of up to 4.4 billion tons. Coal production is about 3 million tons per year. We can see the forecast indicators of energy production based on renewable energy sources until 2030 in Figure 4.

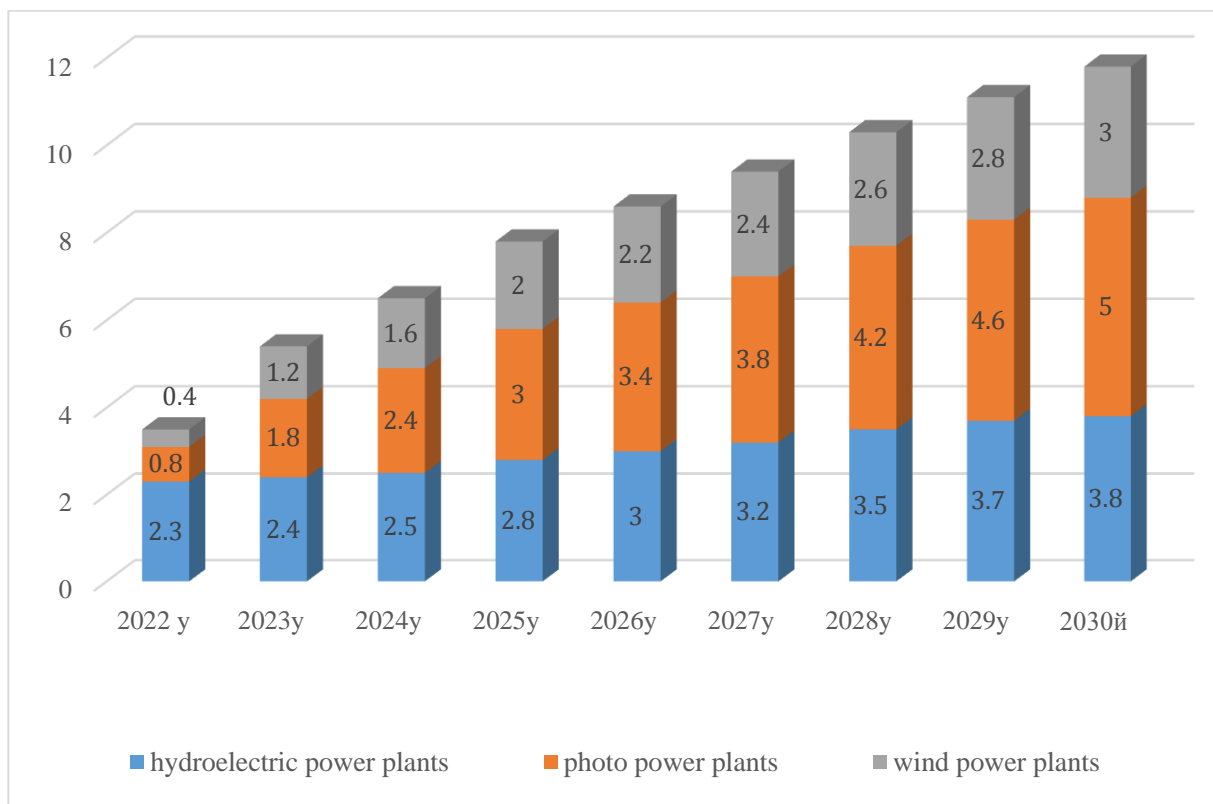


Figure 4. Forecast of energy production based on renewable energy sources until 2030, MW.t. [34]

It can be seen from the data presented in Figure 4 that in 2022, the production of electricity using renewable energy sources is planned to be 2.3 MW by hydroelectric power plants, 0.8 MW by photoelectric power plants, and 0.4 MW by wind power plants, by 2030, the production of electricity using renewable energy sources is projected to be 3.8 MW by hydroelectric power plants, 5 MW by photoelectric power plants, and 3 MW by wind power plants.

If we pay attention to the experience of foreign countries, in most developed countries, estimates of potential opportunities for traditional and renewable energy sources are kept. In this we can see:

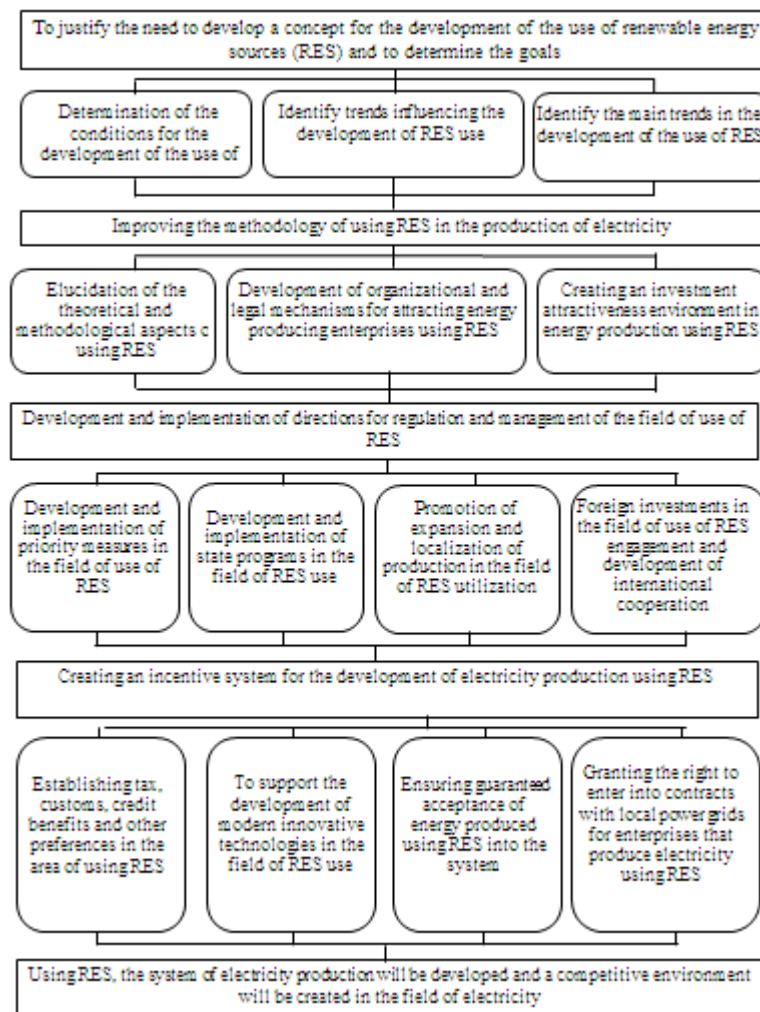
- ✓ solar energy - 2300 billion tons of conventional fuel;
- ✓ wind energy - 26.7 billion tons of conventional fuel;
- ✓ energy obtained from small river waters - 360 billion tons of conventional fuel;
- ✓ energy of secondary low-potential heat sources - 530 billion tons of conventional fuel;
- ✓ 40,000 billion tons of conditional fuel due to the heat of the earth;
- ✓ the energy of the seas and oceans is 30 billion tons of conditional fuel;
- ✓ energy obtained from biomass - 10 billion tons of conventional fuel are available.

In order to achieve the goal of implementing economic reforms, energy independence should be ensured in the country. For this, it is necessary to establish a base for attracting capital funds from foreign countries to the electric energy sector and to re-develop the laws on the procedure of taxation in the sector.

Organization of a wider use of non-conventional renewable sources in the field of electricity production will create additional energy capacities in the sector and lead to lower energy prices (tariffs).

The demand for electricity in our republic is increasing year by year. The reason is that the demand for electricity is increasing due to the increase in the number of the population in our country, the improvement of the lifestyle of the population from year to year, and the increase of enterprises and organizations operating in economic sectors. Therefore, it is important for today to increase the possibilities of using renewable energy sources in the field of electricity production.

A conceptual model for the development of the use of renewable energy sources (RES) is shown in Figure 5.



Source: Developed by the author.

Figure 5. Concept model for the development of the use of renewable energy sources (RES).

From a scientific point of view, using the renewable energy development concept model aims to transform the industry from an inefficient, loss-making industry to an economically efficient one.

As a result of scientific and technical progress and the development of modern innovations in the field of electric energy, the following are used in the production of electric energy: ecologically clean electric energy producers; users of renewable energy sources; nuclear power plants.

Summary. By increasing the availability of renewable energy sources in the field of electricity production, the following can be achieved:

- ✓ increasing energy capacity in electricity production and creating a healthy competitive environment in the industry;
- ✓ moderation of energy prices (tariffs) due to the increase of energy capacity using renewable energy sources in the field of electricity;
- ✓ to increase access to modern low-cost technologies produced in advanced foreign countries in the field of electricity production.

In the development of electricity in our country, it is necessary to effectively use our internal capabilities and implement the following:

- increasing natural gas production to a certain extent; development of lignite open pit mining;
- organization of energy production by gasification of coal underground;
- increase the production level of liquid carbohydrates;
- to raise the quality of produced energy products to the level of world standards;
- formation of private partnership relations in the production of electricity using renewable energy sources;
- development of mechanisms for attracting foreign investors as a reliable partner in the search for sources of energy resources.

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