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ANALYSIS

OVERVIEW OF RENEWABLE ENERGY SOURCES AND THE CASE OF AZERBAIJAN

Renewable energy sources (RES) constitute a vital part of sustainable energy policy. The recent COVID-19 pandemic and volatile energy prices have once again confirmed the importance of RES in the world energy sector. The development of RES is a key component of the modern energy system, which will lead to clean, sustainable energy, as well as reduced GHG emissions.

Talking about RES, one can note that RES had been known in the world since the 1970s when wind turbines and solar panels were promoted for electricity generation. If one pays attention to the global share of total energy supply by sources in 1973, then we can see that the share of RES was around 12.3 %. New projects for the development of RES became important primarily because of the risks associated with the energy security of countries.

Traditional energy resources such as oil, gas and coal come from depleting sources, and future sustainable development needs RES. Additionally, with the global energy crisis, access to traditional energy resources became difficult, and the economies of developed countries began to feel this burden. Moreover, the energy issue with various sanctions and price wars, for instance, the recent Saudi Arabia and Russia oil price war, has become an increasingly geopolitical factor, as well as tools of pressure on countries, factors for new crises. Therefore, a new and sustainable energy policy may form an efficient mechanism to prevent such cases, ensure the energy security of countries and the sustainable demand of the economies for energy resources.

It should also be noted that the energy crisis is not the only reason for RES development because the world developed economies understand that they will face the problem of depletion of traditional energy sources. In this regard, the more we use traditional energy sources, the less and the more expensive they become. According to the BP Statistical Review of World Energy, the world's proven oil reserves at the end of 2019 amounted to 1734 billion barrels. In terms of regions, South and Central America have the highest rates, while Europe has the lowest rate.

OPEC accounts for about 70.1% of global reserves. In 2019, world coal reserves amounted to 1,070 billion tons. The United States with 23%, Russia with 15%, Australia with 14% and China with 13% have the largest reserves. As for natural gas, the proven gas reserves in 2019 amounted to 198.8 Tcm. In 2019, natural gas reserves increased, and in this process, China showed the largest increase of 2 Tcm and Azerbaijan 0.7 Tcm. Russia, with 38 Tcm, Iran with 32 Tcm and Qatar with 24.7 Tcm, have the largest natural gas reserves. As one can see, there are depleted energy sources in the world, but according to various reports, at today's rate of exploitation, energy sources can be depleted in 100-200 years.

It is worth highlighting that RES have the fastest growth in the power sector compared to the heat and transport sectors. According to International Energy Agency's forecasts, the share of RES in the power sector is expected to be more than 70% of the global electricity generation growth, led by solar PV, followed by wind, hydropower and bioenergy by 2023. So, it is very obvious that the future share of RES in the modern energy system will be higher, and many energy companies will be interested in investment opportunities in renewable energy.

The use of renewable energy sources by different countries is based on two important conditions:

- Location;
- And regional characteristics.

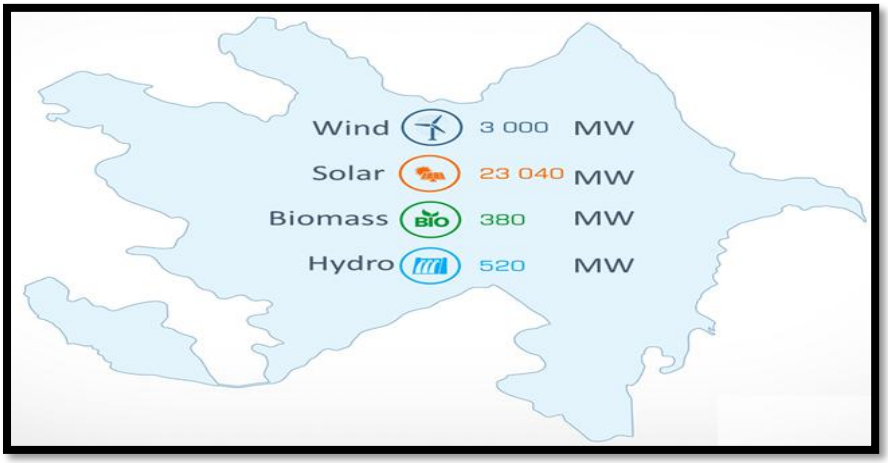
Depending on the location and regional characteristics, various types of RES may dominate in their structure. For example, in Iceland, Denmark and some US states, geothermal sources are preferred for alternative energy production. In Norway, low-power hydropower plants are mainly used. In contrast, countries such as Israel and Germany are widely using photovoltaic panels. In 2019, Germany met about 54% of its electricity needs from alternative energy sources. In 2019, solar panels in this country transported 46.5 trillion watts of electricity to the electricity grid.

Another key point is the additional benefit of RES for countries. Towards this end, RES is obtained from local sources; thus, there is no need for energy imports, which decreases the dependence on it. Now, it is true that the weight of hydrocarbons in the world energy balance is still quite high. According to BP's 2019 report, 33.1% of the world's primary energy consumption comes from oil, 27% from coal, 24.2% from natural gas, 11.4% from renewable energy sources, including hydro and 4.3% nuclear. However, it is also a fact that 40% of the global growth in primary energy in 2019 was due to renewable energy sources. So, one can see that significant investments are made in the use of RES every year, and the share of RES in the world energy system is growing rapidly. According to the International Renewable Energy Agency (IRENA), China, the United States, Brazil, Germany, India, Canada, Japan, Italy, Russia and France accounted for about 70% of the world's 2,350,756 GWh of installed energy in 2019.

It should be underlined that RES is clean, and the use of such sources reduces both traditional energy use and its damage to the environment. Although the production of RES is expensive at the present stage, the use of such energy sources will be gradually increased, and the production process will be economically viable. The European Union's Green Deal is also an important strategy to make the EU's economy sustainable. The main aim of the strategy is to boost the efficient use of resources by moving to a clean, circular economy and decarbonizing the energy sector.

The energy sector plays an important role in Azerbaijan's economy. Having rich oil and natural gas reserves, the country's energy production and consumption strongly depend on traditional energy resources. However, the country has huge potential for RES development and use. The country's geographical location and conditions are favorable for that purpose. Toward this end, one can note that the number of windy and sunny days in Azerbaijan are appropriately high to generate energy from wind and solar powers.

Map 1: Alternative energy sources potential



Source: Ministry of Energy of the Republic of Azerbaijan

As one can see from the map above, the potential for solar and wind power generation in Azerbaijan is very high. The possibilities for wind power development are significant, especially on the Absheron peninsula, the Caspian coastline, the Western region (Ganja-Dashkesen) as well as Nakhchivan AR (Sharur, Julfa) have ideal weather conditions for the efficient operation of wind turbines.

Another significant potential for the production of electricity is solar power. It is worth noting that the efficiency of solar stations depends on a country's climate and geography. In this context, the solar power potential is especially great in the Absheron peninsula, Nakhchivan AR and the Mil-Mugham region. All the

aforementioned means that the wind and solar power potential could decrease the use of traditional energy in the country, support sustainable development as well as increase export of these energy resources.

It is worth mentioning that Azerbaijan signed the "Energy Charter Treaty" in 1994, which it ratified in 1997. In 2018 the country signed the "International Energy Charter", which is a declaration of political intention aiming at strengthening energy cooperation. Towards this end, Azerbaijan takes important steps to accelerate the energy transition in the country by making RES a priority with an ambitious target of 30% RES in installed capacity of electricity generation by 2030. The Ministry of Energy of the Republic of Azerbaijan is working on a new strategy and drafting a Law on "Renewable Energy" that is expected to accelerate the deployment of RES and attract foreign investment. An important fact is that the government is attempting to increase private investment in the renewables sector through supportive policies and incentives.

It should be especially underlined that there were some barriers to the development of RES in the country. Such barriers include – weak legal frameworks and supporting instruments. Existing laws and measures did not attract foreign and private investors. Insufficient financial and credit mechanisms for purchase and installation of RES technologies, poor public awareness, the competitiveness of the industry, and last but not least, shortage of experienced specialists in this sector were among key challenges. Therefore, the government is very interested in overcoming all challenges to develop RES.

Recently, after successful measures in this sector along with public investment, private and foreign investments are also being attracted to this sector. To support the above mentioned, we can note Order No. 1209, dated May 29, 2019, on "Accelerating Reforms in the Energy Sector of the Republic of Azerbaijan". According to it, the Ministry of Energy has been instructed to prepare and submit proposals on measures to promote the use of renewable energy resources, create a favorable investment climate in this area and support private entrepreneurship.

In addition, the draft law "On the Use of Renewable Energy Resources in the Production of Electricity" was prepared to develop a legislative framework for the use of RES. The main aim of the draft law was to identify government policy, the duties of the government, incentive mechanisms and other key issues. The important factor is the representatives of international companies also participated in this process.

Another important aspect is the cooperation with international companies to develop RES use, as well as promote investment in the future. Several companies have signed a memorandum of understanding on cooperation in the RES sector. In addition, the cooperation with international consulting companies continues successfully, and the European Bank for Reconstruction and Development (EBRD) supports "Strengthening the Network to Support Renewable Energy Projects in Azerbaijan" and "Support for Renewable Energy Auctions in Azerbaijan". It should be noted that cooperation with international organizations strengthens market

development and conditions in the RES sector.

Also, major financial institutions like the Asian Development Bank are also cooperating with the Azerbaijani government to develop the RES sector in the country. For instance, the pilot project "Knowledge Exchange and Technical Assistance on the Development of Floating Solar Panels System" was implemented with the support of ADB. In the framework of the project, renewable energy technology - PV systems installed with a capacity of up to 100 kW on Boyuk-Shor Lake to transform the energy from the sun into electricity. Cooperation between BP and the Ministry of Energy in the RES sector aims to also improve the operation of small hydroelectric power plants, as well as the efficient use of hydroelectric power potential of rivers in the country.

In the framework of cooperation with international companies, ACWA Power energy company of Saudi Arabia and the Masdar Company of the United Arab Emirates will invest around $400 million to build wind and solar power plants in the country. According to the agreement, ACWA Power will implement the construction of wind power plants (240 MW) and Masdar – solar power plants (200 MW). Such pilot projects are very important to identify potential and key challenges in this direction. It should be noted that all RES projects in the country aim at diversifying the energy mix and reducing the use of traditional energy resources.

It is clear that the potential of Azerbaijan to use RES is quite high. For instance, power plants running on RES, including hydroelectric, total 1,278 MW, which is 17% of the total capacity. Hydroelectric power capacity is 1,135 MW (22 stations, 12 of which is small hydroelectric power plants), wind power capacity is 66 MW (5 stations, one of which is hybrid), bio-energy capacity is 38 MW (2 stations, one of which is hybrid) and solar energy capacity is 37 MW (9 stations, one of which is hybrid). In addition, one hybrid power plant (Gobustan) is equipped to generate 2.7 MW of wind energy, 3 MW of solar energy and 1 MW of bio-energy.

Analyzing the electricity production in the country in 2019, we can underline that electricity production has amounted to 26.1 billion kWh, of which 1.9 billion kWh was the share of RES. From this capacity, 105.4 million kWh of electricity was generated in wind power plants, 44.2 million kWh in solar power plants and 195.9 million kWh in solid household waste incineration plants. Electricity generated from renewable energy resources made up 7.3% of total production. It was 53.6 million kWh at small hydroelectric power plants (out of a total capacity of 25.3 MW). Electricity produced from renewable energy resources, excluding large hydropower plants, was 399.1 million kWh in 2019, which made up 1.5 % of total electricity generation.

It is worth noting that another important region in Azerbaijan which uses RES very successfully is Nakhchivan AR. The installed capacity of RES, excluding large hydroelectric power plants, was 166.3 MW in 2019, which made up 2.2% of the total national electricity generation capacity. Being in a blockade, RES energy supported the region's diversification of energy mix so that the Nakhchivan region generated enough

electricity from this sector.

In conclusion, the government considers the development of RES as one of the key objectives of the energy policy. In 2020, the liberation of the territories from Armenian occupation will enable Azerbaijan to develop RES in the Nagorno-Karabakh region as well. For example, Fuzuli, Jabrayil and Zangilan regions have enough sunny days to develop solar energy, while other regions are rich with rivers, which will create favorable conditions to develop hydropower. Development of renewables in those regions will increase the share of RES in the power sector and respectively, support sustainable development.

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