IS AZERBAIJAN REALLY INTERESTED IN THE IMPLEMENTATION OF RENEWABLE ENERGY?

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Abstract

Azerbaijan's energy policy has historically prioritized the development of non-renewable resources, particularly oil and gas, which have been central to the country's economic growth and energy security. The "contract of the century" signed in 1994 catalyzed significant foreign investment, transforming Azerbaijan into a major global energy supplier. This policy focus led to substantial increases in oil and gas production, with proven reserves of approximately 7 billion barrels of oil and 30 trillion cubic feet of natural gas. Despite this, the government has initiated policies to enhance renewable energy contributions, aiming to diversify the energy mix and improve sustainability. Renewable energy's share peaked at 3.1% in 2010 but declined to 1.7% by 2022 due to variability in hydroelectric power. Azerbaijan has considerable potential in wind (3,000 mw) and solar energy (23,040 mw), yet financial constraints, including high-interest rates, have hindered investment. The state budget remains the primary funding source for renewable projects, with us$579.1 million allocated from 2010 to 2022. The government is now actively seeking to attract investment and implement policies to accelerate renewable energy development, aiming to reduce reliance on fossil fuels and promote sustainable energy practices, meanwhile they also continue heavily invest in oil ang gas industry and increase economic cooperation with EU. The objective of this article is to investigate which direction Azerbaijan is willing to take: investing in renewables or oil and gas industry. Desktop research approach will be followed to answer to this question.

Keywords: *energy sources, Azerbaijan, resource, consumption, economy*
JEL: *O13, P18, Q42*

Introduction

Since the end of 19th century, Azerbaijan has become an important energy partner in Caucasus region. For some time, they were in first place in the world when it came to exporting their oil to the world. However, by time Azerbaijan lost its importance relatively in global scale, but still they are an important energy partner in the region. Meanwhile, the change in the dynamics of energy market has diminished the importance of oil and gas. Currently, countries are more interested to achieve energy transition to renewable energy sources given the impact of environmental degradation and climate change. This change has a profound impact on the countries like Azerbaijan who is specialized in oil and gas industry. As a result, Azerbaijan has also started to focus on renewable energy strategy and achieve a smooth transition to renewables. One of the most important climate events COP29 will be hosted in Baku, Azerbaijan towards the end of 2024. Meanwhile, they still also invest heavily in oil and gas industry. It is also important to note that EU countries have increased their energy cooperation with Azerbaijan after the escalation of war between Russia and Ukraine. EU governance bodies are interested in decreasing their dependence on Russian oil and gas, therefore they look for new and reliable partners in the market and Azerbaijan is one of the most important substitutes. Now, the question arises whether Azerbaijan is interested to achieve renewable transition as soon as possible or they will produce more oil and gas given new opportunities. The main goal of article is to investigate which path Azerbaijan is

willing to follow to achieve renewable transition or to play a more important role in oil and gas industry. Basically, following research questions will be investigated:

Given the political climate, Azerbaijan is aiming to increase its oil and gas production and export more of these to EU and other countries in short-term.

Given the potential shortage of future resources and worsening environmental conditions, Azerbaijan is willing to proceed with transition to renewables as soon as possible.

Methodology

Our personal motivation in choosing this topic was the actuality of energy-related issues and change in dynamics of Azerbaijan's energy industry. The aim of this paper is to examine the current dynamics of energy sector in Azerbaijan. Another objective is to provide extensive information regarding both renewable and non-renewable energy development policies in Azerbaijan. Moreover, information regarding renewable energy sources is also given and the advantages and disadvantages of each current renewable energy are explicitly examined. Climate change is directly related to the usage of conventional energy resources in the majority of today's production sectors. Its hazardous and perilous impact is apparent, and our environment continues to be polluted every day. At present, most countries including Azerbaijan in the world aim to modify and improve their energy policies in order to tackle this global problem. The methodological basis of this study is a desktop research based on secondary data and statistics. Initially, the theme for this research was established. Afterwards, we collected relevant data regarding the energy sector of Azerbaijan from different sources to support the more objective conclusions. Data has been collected from official databases such as Official Statistics Committee of Azerbaijan. Afterwards, data is interpreted to reflect current Azerbaijani trends and consequences of energy policies of Azerbaijan. Afterwards, based on the data analysis, conclusion will be derived to what extent Azerbaijan has been successful in the implementation of its renewable energy policies.

Comparison and Analysis of the Data

Azerbaijan's Renewable Energy Strategy

Azerbaijan is becoming an important and reliable supplier of renewable energy to the European Union, aligning its gas collaboration with climate responsibilities, including methane emission reductions. A memorandum includes commitments to cut methane emissions across the gas supply chain. Azerbaijan's renewable energy potential, especially in wind and solar power, is being harnessed, with initial investments already made. The Garabagh district has been designated a "green energy" zone, boasting a 4500-megawatt capacity in solar and wind energy (Ministry of Energy of Azerbaijan, 2020c).

On March 1, 2024, the Azerbaijan Renewable Energy Agency signed a Memorandum of Understanding (MoU) with WindEurope to develop Azerbaijan's wind energy sector and explore exporting this energy to the EU via the Caspian-EU Green Energy Corridor. Azerbaijan has agreements with Georgia, Romania, and Hungary to establish this corridor, and the Black Sea Energy Project, launched in December 2022, includes laying a 1-GW underwater cable

(Mammadov, 2024). Each new wind turbine generates 13 million EUR annually, creating economic benefits and encouraging the exchange of best practices (WindEurope, 2024).

Furthermore, Azerbaijan signed another MoU with Kazakhstan and Uzbekistan in May 2024 in Tashkent, aiming to produce green energy and transport it to Europe via the Trans-Caspian and Middle Corridors. These countries are working on deep sea cables in the Caspian Sea, such as the Trans Caspian Fibre Optic (TCFO), to connect energy markets in China and Central Asia with Azerbaijan and Europe (Mammadov, 2024).

Currently, renewable energy sources are not significantly contributing to Azerbaijan's total final energy consumption, even though there are various energy policies aimed at improving the renewable energy sector. The share of renewables peaked at 3.1% in 2010 but fell to 1.7% by 2022. This decline is partly due to the variability in hydroelectric power production, which was 3,446 million kWh in 2010 and decreased to 1,746 million kWh in 2022. The use of renewable energy in non-energy applications has remained consistently low, representing just 0.4% of the total final energy consumption in 2022 (Mustafayev, F. et al., 2022). Table 1 provides further information regarding power plants in Azerbaijan.

Table 1: Installed electricity generation capacity, MW, 2022

State electricity producers /autonomous electricity producers /independent electricity producers	Power plants					
	General	Heat	Water	Sun	Wind	Boycott
"Azerenergy" JSC	6 935	5 881	1 055	-	-	-
Nakhchivan State Energy Agency	237	147	68	22	-	-
Self-producers of electricity (BP, SOCAR, Azersun Holding)	722	722	-	-	-	-
"Clean City" OJSC	37	-	-	-	-	37
"Azerishiq" JSC	52	-	-	-	52	-
"Azalternativenerji" LLC	16	-	-	13	3	1
Private wind and hydropower plants	17	-	9	-	8	-
Total, MV	8 017	6 750	1 132	35	62	38
Share, %	100	84.2	14.1	0.4	0.8	0.5

Source: IRENA, 2019

Table 2 provides potential of renewable energy sources in Azerbaijan. As we can see, the most prevalent renewable energy source in Azerbaijan is sun. Therefore, investment should be focused on the sun and wind in Azerbaijan.

Table 2: Potential of renewable energy sources

Renewable energy sources	**Technical Potential, MVT**
The wind	3000
Sun	23 040
Bio/Waste	380
Small SES	520

Source: IRENA, 2019

On Table 3 we can see Azerbaijan's ten priority directions when it comes to their energy sector.

Table 3. Ten priority directions for the energy sector

Preparation of the country's energy sector development strategy for the next 25-30 years.
Development of a 15-20-year state program on efficient use of energy resources, improvement of energy efficiency of end consumers and use of alternative energy sources.
Development of a 5-year state program for the development of the energy sector (the 1st five-year Strategic Development Plan).
Preparation of the draft law on the regulation of the domestic electricity market.
Preparation of the draft law on the regulation of the domestic natural gas market.
Preparation of the draft law "On the Network Code" in the field of electric energy.
Drafting a draft law on an independent energy regulator to regulate domestic energy (electricity and gas) markets.
Draft law on "Network Code" for natural gas.
Restructuring of energy system structures (Azerenergy, Azerishik) on the basis of new market entities provided for in the legislation.
Creation of a flexible tariff system based on the cost of goods and services that reflect and supply the interests of end consumers and other market participants (X-Factor).

Source: IRENA, 2019

Market reforms aim to harness competitive market dynamics to establish prices for energy carriers that accurately reflect their genuine costs, thereby enhancing economic efficiency on a national scale. Support from international development partners has been instrumental in achieving six of these ten strategic objectives. In below table 4 further information is provided regarding these energy projects.

Table 4: Technical assistance projects in the renewable energy sector

OBJECTIVE OF THE PROJECT	DONOR	BENEFICIARY
Supporting the development of Azerbaijan's long-term energy strategy (initial stage).	**European Commission, EU4ENERGY, Energy Charter Secretariat**	Ministry of Energy
Supporting the drafting of the electricity market law in line with the EU's Third Energy Package.	**USAID**	Ministry of Energy
Development of the regulatory and legal framework for the expansion of the Renewable Energy Sources sector.	**European Commission**	Ministry of Energy

Development of the regulatory and legal framework for the expansion of the renewable energy sector.	**SHAME**	Ministry of Energy
Supporting the holding of auctions for renewable energy sources in Azerbaijan.	**SHAME**	Ministry of Energy
A regional TA (Transportation Alternatives) project to improve energy statistics and policy in Eastern Europe, the Caucasus and Central Asia.	**European Commission, BEA**	State Statistics Committee, Ministry of Energy
TA project "Azerbaijan: preparation of the financial recovery plan of the energy sector".	**AIB**	Ministry of Energy, Ministry of Finance
Supporting the creation of an independent energy regulator to regulate domestic energy (electricity and gas) markets and drafting a draft law on "independent energy regulator".	**SHAME**	Ministry of Energy, Energy Regulation Agency
Preparation of the Network Code.	**AIB**	Ministry of Energy

Source: IRENA, 2019.

Below, more information will be provided specifically about each renewable energy source in Azerbaijan.

Hydropower Energy Sources

Hydropower plays a predominant role in Azerbaijan's energy portfolio, holding significant promise with a potential capacity of 1,131 MW as of 2017, compared to thermal energy's 6,750 MW potential. Resources are distributed across various locations including irrigation canals, the Caspian Sea, the Araz River, and the Kura River and its tributaries. Alongside independent electricity producers in Azerbaijan, the small hydropower sector is thriving, encompassing plants in Sheki, Mugan, Zeykhur, Gusar, Nügadi, Chinarli, Balakan, Guba, and Zurnabad. These independent producers generate electricity primarily for their own consumption at their respective facilities. The addition of the 1.5 MW Balakan HPP in 2017 aimed to further bolster output in this niche hydropower industry, which is significantly influenced by seasonal factors. *(Ministry of Energy of Azerbaijan, 2024*)

Wind Energy

Another important renewable energy resource comes from wind. Azerbaijan possesses excellent wind resources, particularly along the coastline of the Caspian Sea. Investigations by ABOEMDA indicate a wind potential of approximately 3,000 MW. In alignment with this potential, the government set a target in 2020 to add 350 MW of new wind power capacity. By the end of 2017, a total of 62.4 MW of wind power was generated, with "Azerishiq" OJSC contributing 51.7 MW, "Azalternativeenergy" LLC contributing 2.7 MW, and the private sector contributing 8 MW. Several projects are currently under development, including the recently commissioned "Yeni Yashma" Wind Power Plant and the "Absheron Wind" project in Azerbaijan.(*Malikov, 2016*)

Solar Energy Sources

Azerbaijan can generate the most abundant energy from sun. Azerbaijan has a significant solar energy potential estimated at 23,040 MW, with annual sunshine hours ranging from 2400 to 3200. Most regions experience global horizontal radiation between 1,387 kW/m² and 1,534 kW/m². Direct normal radiation varies from 1,095 kW/m² to 1,534 kW/m², with the majority receiving less than 1,387 kW/m². Currently, Azerbaijan hosts four solar photovoltaic plants each with a capacity exceeding one MW. Additionally, the Nakhchivan Solar Power Plant has a capacity of 24 MW, with plans underway to construct five 2.8 MW and one 4 MW solar power plants. As of the end of 2017, the country had installed 34.6 MW of solar power capacity, including installations on public buildings and social enterprises' roofs. For instance, the sports complex in Masalli operates a 70 kW photovoltaic system owned by the public entity "Azalternativenerji," with oversight from ABOEMDA for financial and administrative processes. (*IRENA, 2019*)

Bioenergy sources

Another renewable energy source can come from bioenergy. Azerbaijan has an estimated capacity of 380 MW for generating electricity from garbage and biomass. Currently, traditional biomass is predominantly used for cooking and heating in rural areas. The Baku Solid Waste Plant (Block 4) exemplifies the government's initiative to tap into the significant potential for energy production from biodegradable household waste.

The main funding for Azerbaijan's development of renewable energy sources comes from the state budget. ABOEMDA reports that a total of US$579.1 million (987.4 million AZN) has been allocated from 2010 to 2022 for various energy initiatives including waste, biomass, wind, small hydropower, solar photovoltaics, and heat pumps. Of this amount, the state contributed US$480.9 million (820 million AZN), accounting for 83%. However, due to high interest rates, financing for renewable energy and energy efficiency projects is currently not favorable in the investment climate. The interest rate set by the Central Bank of Azerbaijan increased from 4% at the beginning of 2019 to 14% by the end of the year.

Azerbaijan primarily funds the development of renewable energy sources through its state budget. ABOEMDA reports that between 2010 and 2022, a total of US$579.1 million (987.4 million AZN) will be allocated to various energy projects including waste, biomass, wind, small hydropower, solar photovoltaics, and heat pumps. Of this amount, the state contributed US$480.9 million (820 million AZN), which accounts for 83%. However, due to high interest rates, financing for renewable energy and energy efficiency projects is currently not advantageous in the current investment environment. The interest rate set by the Central Bank of Azerbaijan rose from 4% at the beginning of 2019 to 14% by the end of the year (Moller M.C., Krauter S., 2022).

Azerbaijan's Non-renewable energy strategy

It is equally important to investigate Azerbaijan's non-renewable strategy alongside renewable policies which create a clearer picture. Having gained independence from Soviet Union in 1991, to become modern and powerful state, former president, Heydar Aliyev implemented new oil projects, which paved the way for appealing foreign investors in the progress of the oil fields of Azerbaijan, expansion of transportation routes of crude oil and efficient management of oil revenues. One milestone agreement in the history of 20th-century Azerbaijan was signed in

September 20, 1994, named as "the Contract of the Century". It created a chance for Azerbaijan to discover new prospects for the country and rendered it to become one of the major worldwide energy providers (President.az 2020).

The Contract of the Century reflected the involvement of thirteen companies (Amoco, BP, McDermott, Unocal, SOCAR, LukOil, Statoil, Exxon, TPAO, Pennzoil, Itochu, Ramco, Delta) from eight states (Azerbaijan, USA, Great Britain, Russia, Turkey, Norway, Japan, Saudi Arabia) once signing it on September 29, 1994. Having implemented this contract, Azerbaijan experienced a great development by using revenues coming from oil (AAY 2020).

Oil and Gas Journal stated that Azerbaijan was proved to own approximately 7 billion barrels crude oil reserves in late 2017 (EIA 2019). After independence, oil production in Azerbaijan declined sharply between 1992-1997, hitting the low point of 9.1 million tons in 1997. Production reached 14 million tons in 2000, later it reached at 22.4 million tons in 2005 and 44.3 million tons in 2008. Oil production exceeded 50 million tons for the first time in the history of the country in 2009, with a 14 percent increase in 2008. 83.3% of Azerbaijan's total oil production in this period was provided by high ACG with average of 847,500b / d. For the first time in 2009, oil production had an average of 1.02 million barrels (b/d) per day. Domestic crude oil usage has experienced a significant decline from 12 million tons in 1991 to 4.2 million tons in 2007 following the dissolution of the Sovet Union (Ciarreta, Nasirov 2011**)**.

With the agreement which is named as "the Contract of Century", Product Sharing Agreement (PSA) was signed on 20th of September 1994 between Azerbaijan and eleven international oil companies. This agreement created a condition for the country to get through considerable development process and turned the country into main worldwide energy supplier which sets the new energy map of Europe. Basically, this contract encompassed three core oil fields of Azerbaijan in Caspian Sea, namely, Azeri, Chirag and Deepwater Guneshli which is run by BP. Furthermore, this agreement underwent to some changes and signed again for the development of Azeri-Chirag-Guneshli on September 24, 2017 so that co-exploitation of this oilfield is expected to be applied by 2050. Apart from that, allocation of the profit coming from hydrocarbons is presented as following: 75% for Azerbaijan and 25% for the contractors (Ministry of Azerbaijan, 2020a). On Figure 1, we can see the share of the companies based on the production sharing agreement.

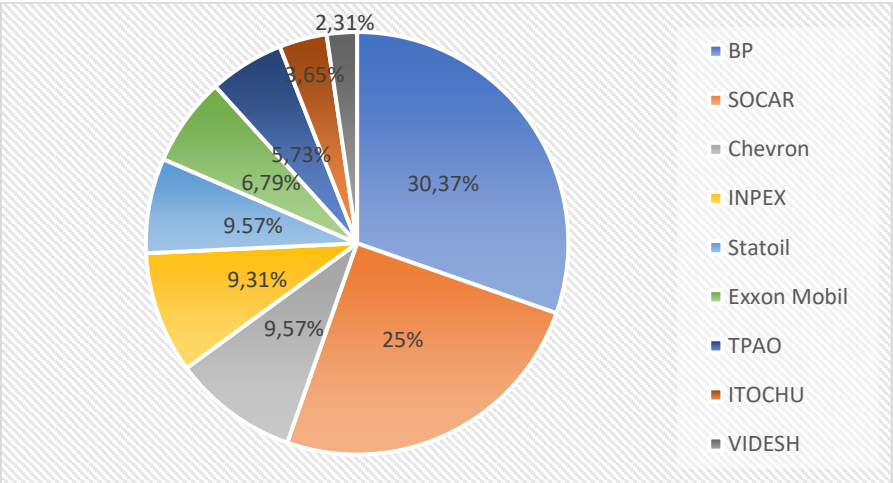

Figure 1. The Production Sharing Agreement (PSA), the shares of companies in the block of fields

Source: Own construction by BP Azerbaijan, Azeri-Chirag-Deepwater Gunashli (ACG) field

According to the data from CEIC, crude oil production in Azerbaijan amounted at 34,580 tonnes in December 2021.

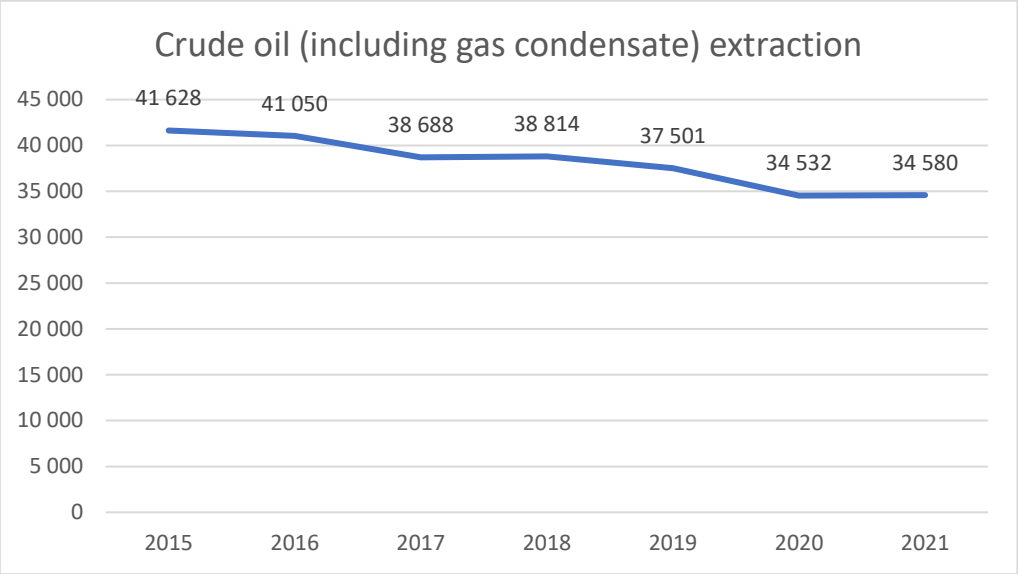

Figure 2. Azerbaijan's Crude oil production, in tonnes

Source: Own construction Azerbaijan Statistics 2024. Azerbaijan Energy Production: Crude oil

Figure 2 demonstrates historical information regarding Azerbaijan's crude oil production which is in decline. With the reputation of producing crude oil and natural gas, Azerbaijan owns the one of the highest energy self-sufficiency level in the globe. Despite the fact that renewable energy field was not invested sufficiently, the government is currently willing to attract and direct some investment in order to speed up the installation of renewables. The government is also preparing a new energy plan which will pave the foundations for more policy changes (IEA 2018).

Oil and Gas Journal reported that Azerbaijan has approximately 30 trillion cubic feet proven gas resources, and it is anticipated to find possible 100 and 200 trillion cubic per feet. Azerbaijan gets most of its natural gas from offshore fields. It is important to note there was a steady decrease in the production of gas from eight billion cubic meters in 1991 to 4.5 billion cubic meters in 2005. Due to gas shortage in the country, Azerbaijan imported gas from Russia until 2007. However, after increasing gas production, Azerbaijan did not any longer rely on Russia for the satisfaction of domestic demand and became a gas exporter in the region. The production of gas rose to 23.3 billion cubic meters and there is an expectation that this number would reach to 28.5 billion cubic meters. 66 % of this gas was used to satisfy domestic demand while the remaining amount is exported to Russia, Georgia and Turkey (Ciarreta, Nasirov 2011).

Foreign companies set out to progress Azerbaijani gas fields such as Shah Deniz, Shafaq Deniz, Asiman, Umid, Nakhchivan, Absheron, Dan Ulduzu and Ashrafi. The one which stands out due to its volume of gas resource among the others is Shah Deniz gas field.

Azerbaijan owns Shah Deniz natural gas and condensate field which is one of the biggest in the globe and it was discovered in 1999. It gives a way to provide Europe's South Gas Corridor (SGC). It possesses majority of Azerbaijan's gas reserves. Besides, it will supply Europe with gas via Baku-Tbilisi-Erzurum (BTE). Azerbaijan has started playing a vital role by means of SGC. Not only does it capture great importance due to being shipped to Europe, it also makes up around two-thirds of

total energy consumption domestically, which is mainly exploited in power generation (EIA 2019). Shah Deniz stage 1 gas field started being drilled from 2006. Production potential of this field amounts to about ten billion cubic meters of gas per annum and roughly 50,000 barrels a day of condensate. According to the record in 2017, this field generated 10.2 billion cubic meters of gas. Up to todays, production of the field reached at 89.5 billion standard cubic meters of gas and approximately 22.2 million tonnes of condensate (MERA 2020b).

According to the data presented by State Statistical Committee of Azerbaijan Republic on Figure 3, the graph below sheds a light on natural gas production of Azerbaijan over a period. It presents the fact that the highest amount of production within this period of time was observed at 43,867 million cubic meters in 2021, hence consistent rise in the amount of natural gas.

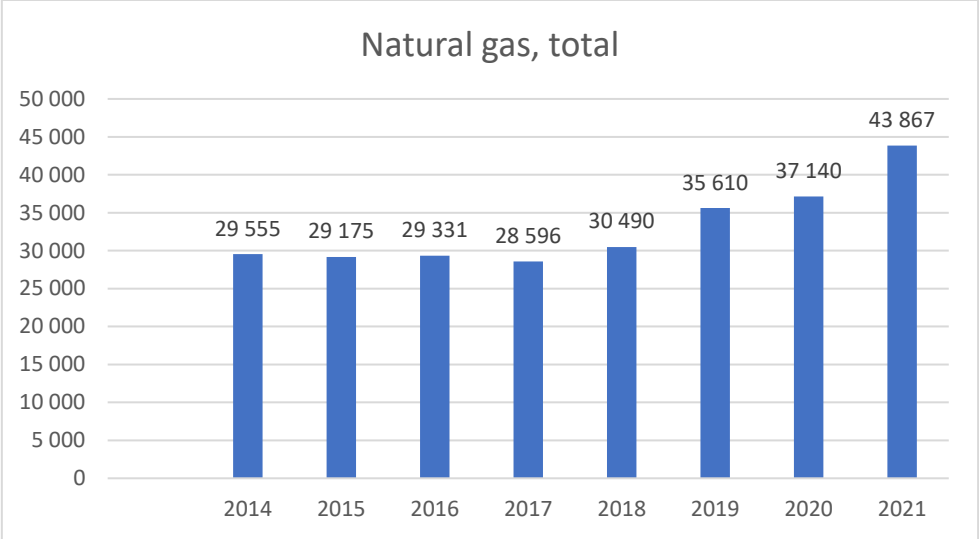

Figure 3. Azerbaijan's natural gas production in million cubic meters

Source: Own construction by Azerbaijan Statistics, 2024

According to the data of USA Energy Information Administration, in 2017, crude oil export of Azerbaijan was recorded to be 700 b/d which is displayed via the figure below. Apart from that, the pie chart throws a light on the proportion that Azerbaijan's crude oil export partners capture in Azerbaijan's crude oil export. Delving into the figure below reveals the fact that the largest proportion of crude oil exports is received by OECD Europe with 66 percent, which is followed by Asia and Oceania with 19 percent, meanwhile Americas takes hold of 19 percent outpacing Non-OECD Europe and Eurasia with seven percent. To illustrate it further, the figure is to be interpreted from countries' perspectives, thus it grants the right to point out Italy due to holding a lion's share in Azerbaijan's crude oil exports by hitting the significant figure at 32 percent. The other European countries such as Germany, Czech Republic, Portugal, France amounts to very little proportion, former two with seven percent, yet latter two with five percent. In the meantime, Other OECD Europe and Non-OECD Europe and Eurasia make up ten percent and seven percent, respectively, whereas Canada accounting for seven percent dominates the other respective countries such as Taiwan, China, United States and other Asia & Oceania countries

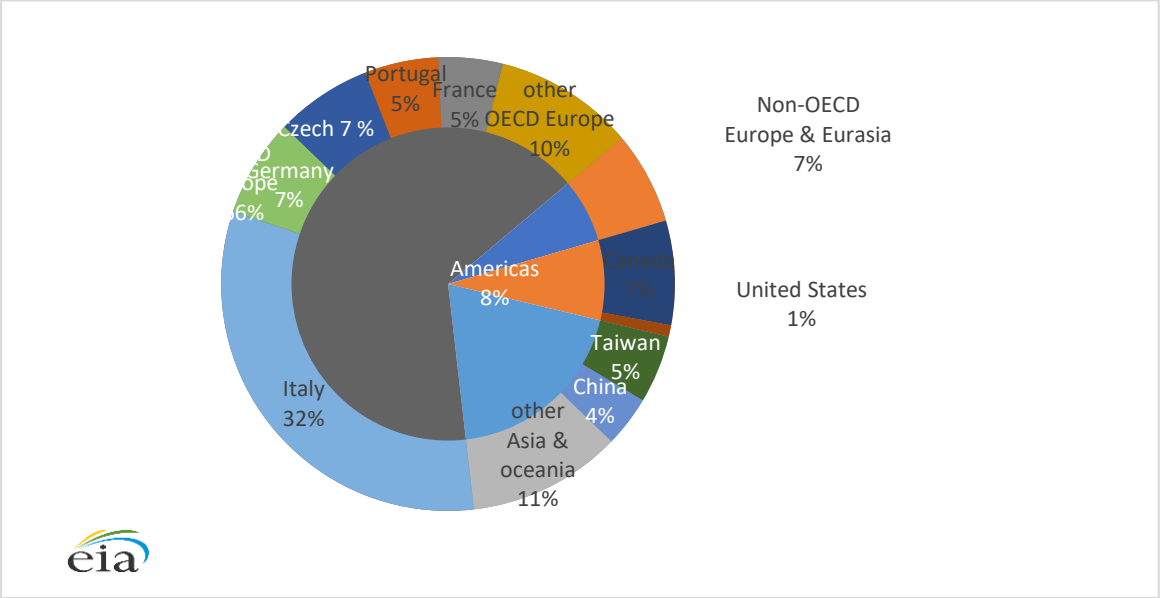

Figure 4. Azerbaijan crude oil exports by destination, 2017

Source: Retrieved from U.S. Energy Information Administration, based on Azerbaijani partner country import statistics, Global Trade Tracker

Figure 4 demonstrates Azerbaijan's top crude oil exports destinations. A new Memorandum of Understanding on a Strategic Partnership was signed between Azerbaijan and EU Commission in the Field of Energy, committing to double the Southern Gas Corridor's capacity to supply at least 20 billion cubic meters of gas annually to the EU by 2027. This initiative aligns with the REPowerEU Plan's goals to diversify energy sources and reduce Europe's reliance on Russian gas. As part of this enhanced cooperation, Azerbaijan is set to increase its natural gas deliveries to the EU from 8.1 billion cubic meters in 2021 to an anticipated 12 billion cubic meters in 2022 (European Commission, 2022).

The Southern Gas Corridor (SGC) has been operational since 2020, serving as a crucial supply route for natural gas from the Caspian Sea to European markets. This system includes the South Caucasus Pipeline, the Trans-Anatolian Natural Gas Pipeline (TANAP), and the Trans-Adriatic Pipeline (TAP), facilitating the transportation of gas from Azerbaijan to Italy. In 2023, the SGC delivered around 12 billion cubic meters of natural gas to the EU, representing an increase of over 45% compared to 2021 (Ali, 2024).

In 2023, Azerbaijan started supplying natural gas to two more European countries - Hungary and Serbia. Currently, Azerbaijan supplies gas to a total of eight countries which are Georgia, Turkey, Italy, Greece, Bulgaria, Romania, Hungary, Serbia (Ali, 2024).

We can experience that Azerbaijan is becoming a key energy partner for EU given the conditions, thus Azerbaijan is willing to invest on these gas projects.

Conclusion

Based on this analysis, the answer to our research question is a bit ambiguous. It will be better if we finalize our analysis based on time scale. In the short-term, Azerbaijan is not interested in

making sharp energy transition to renewables, because from economic perspective it does not look positive and opportunistic. The share of renewables are still significantly low, despite all efforts. At the moment, renewables do not look like most proficient and productive energy resource in Azerbaijan. Therefore, Azerbaijan also continues to develop and invest in its oil and gas industry to generate more revenue while they continue to split some part of these revenues for the development of the renewables.

While Azerbaijan has made a lot of efforts to develop its renewable energy sector, significant challenges remain. Variability in hydroelectric production, financial constraints, and a historical focus on non-renewable energy sources have limited the growth of renewables. However, with substantial potential in wind and solar energy, and ongoing policy and project developments, there is a pathway for Azerbaijan to enhance its renewable energy contributions in the future. It is highly likely that Azerbaijan will be interested to achieve energy transition rather in long term. Further researches will be beneficial after considering the impact of these new oil and gas agreements between Azerbaijan and EU. It is an interesting question that where Azerbaijan will stand in near future on their renewable energy approach given political and economic clout. Addressing financial barriers and continuing to diversify the energy mix will be crucial for achieving long-term sustainability and energy security.

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