

RENEWABLES
READINESS ASSESSMENT

REPUBLIC OF AZERBAIJAN



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About the RRA

A Renewables Readiness Assessment (RRA) is a holistic evaluation of a country's conditions that helps to identify the actions needed to overcome barriers to renewable energy deployment. This is a country-led process, with IRENA primarily providing technical support and expertise to facilitate consultations among different national stakeholders. While the RRA helps to shape appropriate policy and regulatory choices, each country determines the best mix of renewable energy sources and technologies to achieve national priorities. The RRA is a dynamic process that can be adapted to each country's circumstances and needs. IRENA has continually refined its methodology for the RRA process based on experience in a growing range of countries and regions.

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AZERBAIJAN**

S C O N T E N T S

FIGURES	IV
TABLES	IV
BOXES	IV
ABBREVIATIONS	V
EXECUTIVE SUMMARY	VII

01 INTRODUCTION

1.1 Country background	01
1.2 Renewables Readiness Assessment (RRA)	03

02 ENERGY CONTEXT

2.1 Energy sector	07
2.2 Electricity sector	09
2.3 Institutional structure	10
2.4 Strategic framework	11
2.5 Legal, regulatory and policy framework	13
2.6 Energy tariffs	

03 RENEWABLE ENERGY DEVELOPMENT

3.1 Drivers of renewable energy deployment	15
3.2 Current status and potential	17
3.3 Renewable energy related laws under preparation	21
3.4. Economics of renewable energy	21
3.5. Human and institutional capacity	22

04 KEY CHALLENGES AND RECOMMENDATIONS

4.1 Legal and regulatory framework	25
4.2 Policy support mechanisms	26
4.3 Renewable energy financing	27
4.4 Long-term energy planning	28
4.5 Grid regulation for renewable energy	29
4.6. Technical knowledge and raising awareness	30

REFERENCES	31
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Annex 1: Overview of entities in the energy sector	32
Annex 2: Technical assistance projects in the renewable energy sector	33

FIGURES

Figure 1	Share of energy products in TFEC, 2010–2017 (ktoe)	06
Figure 2	Share of electricity consumption by sector, 2017	07
Figure 3	Simplified scheme of electricity flow within the country's power system	09
Figure 4	Overview of existing renewable energy permitting procedures	12
Figure 5	Wind speeds at 100 m hub height (in m/s)	18
Figure 6	Annual global horizontal solar irradiation (GHI in kWh/m ²)	19
Figure 7	Overview of renewable energy investments (million USD), 2005–2015	21

TABLES

Table 1	Economic indicators	01
Table 2	Energy balance in 2010–2017 (ktoe)	05
Table 3	Share of final energy consumption by sector, selected years, 2010–2017	06
Table 4	Annual energy subsidies, 2015–2017	06
Table 5	Electricity generation by source (GWh)	07
Table 6	Imports and exports of electricity (GWh), 2015–2017	08
Table 7	Overview of ten strategic tasks for the energy sector	10
Table 8	Tariffs for electricity (28 November 2016)	13
Table 9	Installed power generation capacities (MW), 2017	17
Table 10	Renewable energy resource potential	17
Table 11	List of public buildings with small PV systems installed	20

BOXES

Box 1	Azerbaijani Service and Assessment Network	12
Box 2	Resilience and security of electricity supply	16
Box 3	Yeni Yashma wind park	18
Box 4	Baku Waste-to-Energy Plant	20
Box 5	Gobustan Experimental Polygon and Training Centre	22

ABBREVIATIONS

ADB	Asian Development Bank
CHP	Combined Heat and Power
FIT	Feed-in Tariff
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GW	Gigawatt
GWh	Gigawatt-hour
IRENA	International Renewable Energy Agency
km	Kilometres
ktoe	Thousand tonnes of oil equivalent
kV	Kilovolt
kW	Kilowatt
MoE	Ministry of Energy
MW	Megawatt
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
PPA	Power Purchase Agreement
PPP	Purchasing Power Parity
PV	Photovoltaic
RRA	Renewables Readiness Assessment
SAARES	State Agency on Alternative and Renewable Energy Sources
TFEC	Total Final Energy Consumption
toe	Tonnes of oil equivalent
TPES	Total Primary Energy Supply
TW	Terawatt
TWh	Terawatt-hour
VRE	Variable Renewable Energy
Wp	Watt peak



Caucasus mountain, Xinaliq (Khinalug)

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EXECUTIVE SUMMARY

Azerbaijan is a fast-developing economy, mostly driven by developments in the oil and natural gas sectors, with a GDP per capita that has risen from USD 1237 in 1990 to USD 4147 in 2017. However, GDP growth has slowed due to the substantial drop in oil prices in recent years, resulting in the devaluation of the national currency and a fall in GDP from USD 75 billion in 2014 to USD 41 billion in 2017. In the same year, the oil sector still accounted for about a third of GDP.

In recent decades, the country has undergone a steady diversification of its economy, with the share of secondary economic activities growing from almost 33% of GDP in 1990 to 52% in 2016, while primary activities decreased from 29% in 1990 to 6% in 2016. Considering the volatility of oil prices, there is a pressing need to further diversify the economy of Azerbaijan and move towards a modernised energy system.

The Strategic Roadmap on National Economic Perspectives (approved by Presidential Decree on 6 December 2016) calls for an increase in the share of non-oil sector foreign direct investment (FDI) from 1.5% to 4% by 2025, and an increase in the share of non-oil sector exports from USD 200 per capita in 2016 to USD 450 by 2025 and USD 1200 by 2035.

Renewable energy could play an important role in supporting this drive for economic diversification. Globally, the goal to limit the rise in global temperature to well below 2 degrees Celsius above pre-industrial levels requires that renewables provide for two-thirds of energy consumption and 86% of power generation by 2050. This transformation would also deliver a growth in global GDP of 2.5% and a 0.2% increase in global employment, compared to a business-as-usual scenario (IRENA, 2019).

Azerbaijan is a country with vast potential for renewable energy development. The country has excellent wind and solar resources and significant prospects for biomass, geothermal and hydropower. With a view to unlocking this potential, the government has already set a target of adding 420 MW of renewable energy capacity by 2020. Driven by this target, the country has proceeded to deploy projects using engineering, procurement and construction (EPC) contracts. Practical deployment has been limited, however, compared to the scale of the country's available resources and long-term ambitions.

A higher share of renewable energy in the energy mix can offer multiple benefits beyond economic diversification. Renewable energy can act as a catalyst for new employment opportunities in a country traditionally dominated by oil and gas, providing avenues for technological innovation and opening new sectors for economic value creation and associated GDP growth. Furthermore, the accelerated deployment of renewable energy, coupled with continuing improvements in energy efficiency, could decrease domestic consumption of oil and gas, providing opportunities to generate additional revenue through exports and reduce domestic subsidies.

Given the projected increase in energy demand in Azerbaijan, renewable energy also provides a technical solution to deploy power generation capacity more rapidly due to the relatively shorter lead times for project construction compared to conventional sources.

Renewables also offer the most prominent low carbon solution to meeting Azerbaijan's climate targets. The country has committed to reducing its GHG emissions by 35% by 2030, measured from the 1990 base year set in its Nationally Determined Contribution (NDC) under the Paris Agreement, which emphasises the use of alternative and renewable energy sources to achieve this target.

To support Azerbaijan in unlocking its renewable energy potential, this report presents nine recommendations that provide a solid basis for creating a more conducive investment environment for renewable energy:

Adopt a renewable energy law

A dedicated law could provide overall direction to the renewable energy sector in Azerbaijan and significantly contribute to the development of a local market for renewables. Such a law would serve as an important reference point for renewable energy market players by providing a clear and reliable long-term perspective. Currently, the Ministry of Energy of the Republic of Azerbaijan, with the support of an international consulting company, is developing a draft law on the use of renewable energy sources in power generation.

The law will cover all key elements of a sound legal and regulatory framework for renewable energy by defining the most appropriate sources and technologies based on the existing technical potential in Azerbaijan. In addition, the law could also allocate roles and responsibilities to relevant government entities.

Streamline permitting procedures for renewable energy

Permitting requirements and procedures could be streamlined under the renewable energy law to provide reference and direction for any future amendments. The overarching principles for the design of permitting procedures are simplicity, transparency and the flexibility to adapt to regulatory and market changes.

The establishment of a 'one-stop shop' system for renewable energy projects could be considered to simplify and streamline the permitting process. Publishing permit procedures online, alongside information on the different steps to take, would increase transparency for developers and investors.

Enhance the procurement of renewable energy

A holistic approach to the design of support mechanisms for renewable energy, encompassing power and non-power sectors, will be beneficial to the development of renewables in Azerbaijan. Given the country's varied renewable energy potential, tariff support could be tailored to different technologies and end-uses.

Azerbaijan is working towards conducting renewable energy auctions. In this regard, the Ministry of Energy is undertaking steps, including on-the-ground measurements, to define and prioritise zones with high renewable energy resource intensity,. Eight zones (five wind and three solar) with total capacity of 750 MW have already been identified. Preliminary assessments on ownership and designation of lands, potential environmental impacts and existing infrastructure have been conducted in these areas.

Set up a dedicated financing mechanism to address off-taker risk

Azerbaijan could benefit from creating facilitation mechanisms for financing renewable energy projects that will enable the development of the renewable energy market, especially in its initial phases. Dedicated financing facilities for renewable energy projects could alleviate some of the barriers to this development and enhance the country's attractiveness to both local and international project developers and investors.

One option is to create a dedicated fund to support renewable energy projects, which could be capitalised through a levy on conventional energy sources and disbursed through a robust off-taker arrangement. The Government of Azerbaijan could also consider creating a risk mitigation facility to encourage investment. Such a facility could provide guarantees for viable projects and collaborate with local banks to help build their knowledge of, and capacity for, renewable energy project financing.

Adopt a standard power purchasing agreement (PPA)

Drafting and publishing a standard PPA for renewable projects will help to reduce the risk perceived by the private sector and improve transparency and predictability in Azerbaijan's renewable energy market. Robust PPAs can improve the economics of renewable energy projects, while suboptimal PPAs, on the other hand, may increase the costs of procurement.

The Ministry of Energy, in collaboration with an international consulting firm, has developed a draft standard PPA that considers best practices and reflects close consultation with stakeholders. Negotiations with private sector companies are underway to start implementing pilot projects through the PPA.

Develop long-term energy scenarios

To identify the optimal energy mix and inform policy decisions accordingly, a detailed long-term planning exercise could be undertaken for energy demand in the electricity, industry, residential, commercial, agricultural and transport sectors.

If the potential for electrification, energy efficiency and renewable energy penetration is to be fully assessed, Azerbaijan's energy planning requires a deeper focus on non-power sectors, such as heating and cooling, and transport.

Such analysis will assess the costs and benefits of different renewable energy technologies (solar, wind, bioenergy, etc.), including their potential for market penetration and optimal scale of deployment. This requires an assessment of the technical and economic renewable energy potential by technology to outline future scenarios with increased shares of renewable energy. There is also a need to comprehensively assess current energy infrastructure, focusing on aspects such as the country's power grid and the investments needed for grid upgrades.

Adopt a long-term renewable energy target

Targets enhance the transparency of the policy-making process by providing a common information base to all stakeholders, thereby fostering public support. When backed by supportive policy and investment frameworks, targets can be instrumental in indicating the envisioned trajectory of market growth, thereby helping to anchor medium and long-term expectations. By giving a sense of trajectory and growth, they can contribute to lowering deployment costs and establishing a supply chain utilising local industry.

While Azerbaijan has already approved its renewable energy target for 2020, the government is considering a longer-term target to increase the share of renewable energy in power generation up to 30% by 2030. This could offer better long-term clarity for the private sector and investors, thereby encouraging the development of new projects. To realise the potential of renewables in multiple uses, targets would need to be set for the heating, cooling, transport and power sectors.

Develop and implement a grid connection code with standards for variable renewable energy integration

The Government of Azerbaijan could provide the mandate for relevant organisations to develop a grid connection code for variable renewable energy (VRE) in consultation with all relevant actors. The function of a grid connection code including VRE is to provide technical requirements for wind and PV plants when connecting to a country's electricity grid.

This helps to ensure the quality and standardisation of equipment, as well as the fair treatment of generators and operators with regard to grid connection, while also maintaining system stability and reliability.

The establishment of a country-wide grid code could improve overall grid management, which will have a positive impact on the development of renewable energy by reducing the perceived technical risks for investors and developers. The Ministry of Energy, with the support of the European Bank for Reconstruction and Development (EBRD) and the involvement of a consulting firm, has implemented a project, "Strengthening the grid to support renewable energy projects in Azerbaijan", to identify potential of renewable energy resources and opportunities for integrating them into the grid.

Raise awareness and develop a capacity building strategy

The government could devise a long-term programme of activities to increase general awareness of, and capacity for, renewable energy, targeted at state institutions, local enterprises and citizens. Such a programme could also integrate certifications in training curricula, with a focus on building local skills in operation and maintenance to enhance employment opportunities. Additionally, certification and training on various renewable energy applications and related technologies for both power and non-power uses may be beneficial.

Government institutions could benefit from specialised capacity building on renewable energy policy and regulation, and evaluation techniques for renewable energy projects. For the private sector, courses could be offered explaining opportunities for setting up renewable energy enterprises, including information on available government support schemes and partners. Increased understanding of the benefits of renewable energy and how they are relevant to the overall economic situation in Azerbaijan could be useful for the wider public.

Annually the Ministry of Energy and the State Agency for Alternative and Renewable Energy Sources (SAARES) implement activities to raise public awareness on the use of renewable energy and the production of carbon-free electricity.

Baku, Azerbaijan

Photograph: Shutterstock





I. INTRODUCTION

1.1. Country Background

The Republic of Azerbaijan is located in the southern Caucasus region. It is bordered by the Caspian Sea to the east, Armenia and Georgia to the west, the Russian Federation to the north and Iran to the south. The population was approximately 10 million in 2019 with about 45% still living in rural areas. Baku is the capital and the largest city, with a population of about 2.5 million.

Azerbaijan is a fast-developing economy, largely oriented toward developments in the oil and natural gas sectors, and achieved its highest economic growth at the beginning of the 2010s. Its GDP per capita (in current USD) increased from USD 1237 in 1990 to USD 4147 in 2017.

However, GDP growth has slowed since the plunge in oil prices in 2013. The subsequent erosion of oil prices has resulted in the devaluation of the national currency and led to a fall in the country's GDP from USD 75 billion in 2014 to USD 41 billion in 2017. The oil sector still accounted for about one third of GDP in 2017. The country's unemployment levels have remained stable; 5.63% of the population was unemployed in 2010, falling to 5.03% in 2017. In recent decades, the country's economy has undergone significant diversification (Table 1).the relevant opportunities and constraints.

Given both the current global economic slowdown and the fact that oil prices remain volatile and well below their mid-2008 peak, there is a pressing need to further diversify the economy of Azerbaijan, and therefore to move towards a modernised energy system. This is compounded by the fact that oil production has been progressively declining, having reached its peak in 2010 (IEA, 2015).

Table 1. Economic indicators

	2010	2015	2016	2017	2018
GDP per capita (current USD)	5 843	5 500	3 881	4 147	4 721
GDP growth (annual %)	4.79	1.05	-3.06	-0.28	1.41
Agriculture, forestry and fishing, value added (% of GDP)	5.54	6.18	5.61	5.61	5.25
Industry (including construction), value added (% of GDP)	59.99	44.89	47.56	49.70	52.21
Manufacturing, value added (% of GDP)	4.81	4.99	4.93	4.70	4.82
Services, value added (% of GDP)	28.22	40.65	39.32	38.12	35.24

Source: World Bank Development Indicators.

According to the Strategic Road Map on National Economic Perspectives (approved by Presidential Decree on 6 December 2016) the target Indicators are:

(I) increasing the share of non-oil sector's FDI from the current 1.5% to 4% by 2025; and (ii) increasing the share of non-oil sector exports from the current USD 200 per capita to USD 450 per capita by 2025 and USD 1 200 per capita by 2035.

Renewable energy could play a role in supporting Azerbaijan's drive for economic diversification. Globally, the transformation of the energy system that aims to limit the rise in global temperature to well below 2 degrees Celsius above pre-industrial levels requires that renewables provide for two-thirds of energy consumption and 86% of power generation by 2050, adding 2.5% to GDP and a 0.2% increase in global employment, compared to a business-as-usual trajectory (IRENA, 2019).

Azerbaijan's adoption of the Strategic Road Map for the development of utilities, approved by the Presidential Decree of 6 December 2016, which lays out a long-term roadmap for the development of renewables in the country (see section 2.6), therefore represents a timely step towards energy transformation.



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1.2. Renewables Readiness Assessment (RRA)

The International Renewable Energy Agency (IRENA) developed the Renewables Readiness Assessment (RRA) as a tool for carrying out comprehensive evaluations of the conditions for renewable energy deployment in particular countries. The RRA is a country-led, consultative process. It provides a venue for multi-stakeholder dialogue to identify challenges to renewable energy deployment and to devise solutions to existing barriers. Short and medium-term recommendations are presented to governments to guide the formation of new policies or the reform of existing policies to achieve a more enabling environment for renewable energy.

For Azerbaijan, the RRA process has been led by the Government of Azerbaijan, with technical support from IRENA, and has greatly benefitted from stakeholder input. These stakeholders include the Ministry of Energy, transmission and distribution utilities, power project developers, development partners, financial institutions, civil society and academia. The consultative process was initiated at an expert consultation workshop held in Baku on 31 May-1 June 2018. The workshop was based on a background paper describing the challenges and opportunities for renewable energy development.

During this two-day event, experts discussed the state of renewable energy in Azerbaijan, as well as various challenges and possible solutions. Their insights informed a draft report presented in the follow-up validation workshop held on 16 October 2018, which was jointly organised by the State Agency for Alternative and Renewable Energy Sources (SAARES) and IRENA. In addition, the analysis benefitted from bilateral interviews with key stakeholders and from the Renewable Energy Hard Talk in Azerbaijan organised by the United Nations Economic Commission for Europe (UNECE) in October 2017.

The RRA process in Azerbaijan has produced the following outputs:

- an analysis of the existing policy environment and renewable energy market;
- identification of the critical and emerging issues associated with renewable energy development; and
- a set of recommendations for taking advantage of the opportunities revealed by the policy analysis and extensive consultations with numerous stakeholders.

The co-ordinated approach employed to produce this RRA helps in setting priorities, in consultation with bilateral and multilateral cooperation agencies, financial institutions and the private sector, for implementing the recommended actions.





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2. ENERGY CONTEXT

2.1. Energy sector

Azerbaijan is a net energy exporter. The country exports oil, natural gas and electricity. Azerbaijan meets its energy needs through domestic production, which is currently largely reliant on the exploitation of the country's hydrocarbon reserves – namely oil and natural gas. Proven oil reserves in the Caspian Basin – which Azerbaijan shares with Russia, Kazakhstan, Turkmenistan and Iran – were reported at seven billion barrels in 2018 (OPEC, 2018) and are comparable in size to North Sea reserves several decades ago.

Table 2 illustrates that Azerbaijan exports five times its own total final energy consumption (TFEC). The decrease in the primary production of renewables and waste relates to fluctuating hydropower generation and reduced usage of wood as a feedstock for energy use. Reduced wood usage can be attributed to improvements in district heating and installation of gas-fired water heaters.

Table 2. Energy balance in 2010–2017 (ktoe)

	2010	2014	2015	2016	2017
Primary production, including:	68 254.6	61 132.0	61 084.2	59 977.6	57 036.0
Crude oil (with NGL)	52 312.5	43 295.9	42 835.5	42 240.9	39 810.4
Natural gas	15 555.6	17 565.1	17 947.3	17 463.5	16 967.6
Renewables and waste	386.5	271.0	301.4	273.5	258.0
Net imports of all energy products	- 54 300.2	- 45 869.5	- 45 747.4	- 44 693.0	- 40 789.6
Total energy supply	12 566.5	15 085.5	15 569.4	15 393.5	15 471.9
Transformation processes	-2 692.7	-3 491.3	-3 819.7	-3 731.0	-4 020.6
Energy industry own-use	931.1	1 188.2	1 167.0	1 133.0	1 147.7
Total final energy consumption	6 710.6	8 241.7	8 304.3	8 644.9	8 210.0

Source: State Statistical Committee of Azerbaijan (2018).



Energy consumption

As shown in Table 3, TFEC is concentrated in households, as well as the transport, industry, and construction sectors, in order of importance. The share of households decreased between 2010 and 2017 from 50% to 41%, while the share of the transport, industry and construction sectors increased from 37% to almost 45% over the same period. The decrease in the share of residential consumption is the result of a combination of factors – most notably the surge in energy consumption in the industry and transportation sectors. The growing energy consumption in these end-use sectors highlights their critical importance in Azerbaijan's transition to sustainable energy.

Heating has a major role in determining the country's energy mix, particularly in industry and households for space heating and cooking. Azerbaijan uses both individual and district heating solutions, the latter typically comprising small decentralised heat supply systems where each apartment block is connected to a central boiler using natural gas. Currently, the vast majority of households in Azerbaijan use gas-based central heating or stoves. District heating is managed by the state-owned supply operator Azeristiliktechizat, with only limited changes to its energy mix or infrastructure upgrades.

The share of the various energy products in TFEC is presented in Figure 1. Natural gas and petroleum clearly dominate the mix, representing more than 80% of the TFEC. Renewable sources and municipal waste remain below 3% of the TFEC.

Table 3. Share of final energy consumption by sector, selected years, 2010–2017

Economic sector	2010	2011	2014	2015	2016	2017
Industry and construction	12%	13%	16%	16%	18%	13.4%
Transport	25%	27%	31%	29%	26%	31.2%
Agriculture, forestry and fishing	6%	6%	6%	5%	5%	5.4%
Commerce and public services	7%	7%	8%	8%	7%	8.6%
Households	50%	47%	39%	41%	44%	41.3%

Source: State Statistical Committee of Azerbaijan (2018).

Table 4. Annual energy subsidies, 2015–2017

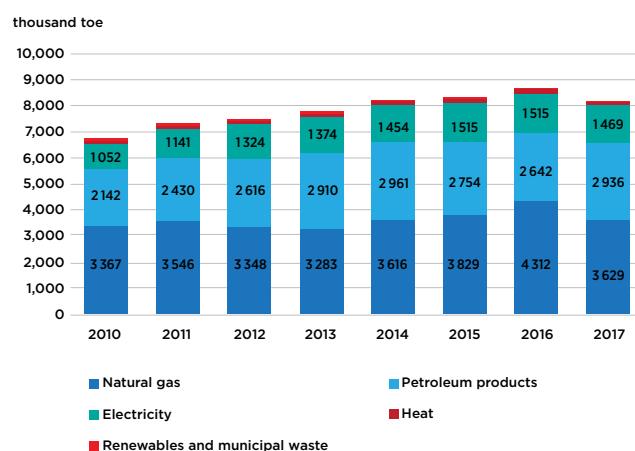
Energy type or technology	Subsidies per year, USD million		
	2015	2016	2017
Oil	25.0	244.5	603.1
Electricity	528.8	625.5	824.8
Natural gas	486.6	492.8	634.0
Total	1040.4	1362.8	2061.9
Average subsidisation rate (%)	•	•	47
Subsidy per capita (USD/person)	•	•	209
Total subsidy as share of GDP (%)	•	•	5.1

Source: IEA (2017).

Energy subsidies

Azerbaijan still has a sizable energy subsidy system in place. The cost of the energy subsidy was equivalent to almost 3.4% of GDP in 2016, with an average energy subsidy estimated at USD 130 per capita (see Table 4). The total value of subsidies almost doubled in the period between 2014 and 2016 from USD 751 million to USD 1 269 million. In 2015 and 2016, more than half of the subsidies were provided to the electricity sector through support to oil and gas energy sources, while subsidies to renewable energy were negligible.

Figure 1. Share of energy products in TFEC, 2010–2017 (ktoe)



Source: State Statistical Committee of Azerbaijan (2018).

2.2. Electricity sector

Azerbaijan has a 100% electrification rate. The country currently has about 7 141 MW of total installed capacity; this is dominated by thermal power, which constitutes about 60%. The Azerbaijan TPP – the largest power plant with a capacity of about 2 400 MW (oil-based) – is being refurbished to meet industry design requirements for reliability and economy. The remaining thermal power plants are modern, mostly operating on combined-cycle gas turbine technology. Among renewables, hydropower has the highest installed capacity (1 134 MW in 2019) followed by wind (66 MW), biomass (38 MW) and solar photovoltaic (33 MW).

Electricity generation

More than 80% of the total electricity produced by Azerenerji, the state-owned power generation and transmission company, comes from thermal power plants. Of these, combined-cycle power plants provide over 40% of total electricity production. Hydropower plants provide for about 6–10% of electricity generation demand. Table 5 presents electricity generation data by source.

The Azerbaijan electricity system has a substantial amount of overcapacity in the generation sector. The system peak load in 2017 was 3 509 MW, while the installed capacity, excluding the Shirvan TPP, is around 6 000 MW, which provides a considerable opportunity for electricity export.

Electricity consumption

An overview of the country's electricity consumption by sector is provided in Figure 2. Households, and commerce and public services, are the two largest consumers of electricity, with a combined share of 89% of total consumption in 2017. The third largest consumer is industry, driven by non-ferrous metallurgy, iron and steel metallurgy, and food processing industries.

The system has excess power generation capacity

Figure 2. Share of electricity consumption by sector, 2017

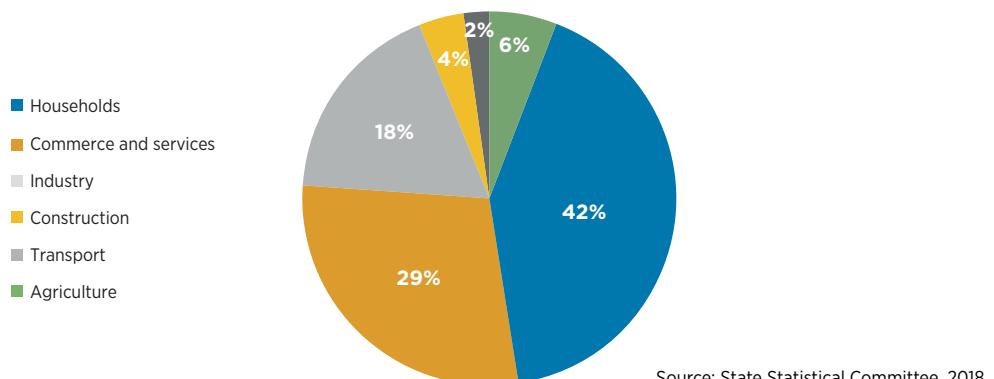


Table 5. Electricity generation by source (GWh)

Source	2010	2011	2012	2013	2014	2015	2016	2017
Thermal	15 262.7	17 618.0	21 167.1	21 729.6	23 249.3	22 859.9	22 761.0	22 344.9
Hydro	3 446.3	2 675.8	1 821.0	1 489.1	1 299.7	1 637.5	1 959.3	1 746.4
Wind	0.5	-	-	0.8	2.3	4.6	22.8	22.1
Solar PV	-	-	-	0.8	2.9	4.6	35.3	37.2
Biomass	-	-	-	134.1	173.5	181.8	174.5	170.3
Total	18 709.5	20 293.8	22 988.1	23 354.4	24 727.7	24 688.4	24 952.9	24 320.9

Source: State Statistical Committee of Azerbaijan (2018).

Electricity trading

Azerbaijan conducts cross-border electricity trading with neighbouring countries, mainly exporting electricity to Georgia and Turkey. Azerbaijan is a net exporter of electricity and exported about 1 billion kWh in 2016 and 2017, leveraging its excess electricity generation capacity.

Electricity exports account for approximately 5% of the country's electricity production. In general, electricity exports accounted for about 0.4% of the total exports of Azerbaijan in USD value in 2017, amounting to USD 51 million. The electricity trade with Iran is roughly balanced, while the export-import balance with Georgia, Russia and Turkey is positive.

The project was based on an analysis of the power systems of the three countries. Azerbaijan and Georgia have excess generating capacity, while Turkey has rapidly growing demand for electricity.

During the first year of Azerbaijan-Georgia-Turkey (AGT) project operations, Turkey was the main trading partner for Azerbaijan's electricity exports (totalling about 800 million kWh).¹ In 2017, Georgia took the lead with a purchase of 900 million kWh of electricity from Azerbaijan.

Table 6 shows Azerbaijan's electricity exports and imports.

Table 6. Imports and exports of electricity (GWh), 2015–2017

Country	2015	2016	2017
Import (GWh)			
Iran	52.6	49.4	42.7
Georgia	0	5.4	1.7
Turkey	0	0	0
Russia	54.8	59.6	63.4
Total	107.4	114.4	107.8
Export (GWh)			
Iran	54.9	52.4	42.6
Georgia	101.7	109.5	917.4
Turkey	0	813.4	205.3
Russia	108.4	120.1	117.3
Total	265	1095.4	1282.5

Source: MoE, (2017, 2016, 2015).

¹ The Azerbaijan–Georgia–Turkey Project (“AGT Power Bridge”) was initiated by Azerenerji JSC (generation and transmission system operator of Azerbaijan), GSE JSC (TSO of Georgia) and TEIAS (TSO of Turkey) in 2009 for electricity delivery from Azerbaijan to Turkey through Georgia.

2.3. Institutional structure

Azerbaijan's institutional landscape in the energy sector is still evolving. The energy sector has undergone several phases of restructuring since Azerbaijan's independence in the early 1990s, focusing mainly on the power sector.

Key institutions

The Ministry of Energy oversees state policy and regulation in the energy sector, including renewable energy. The Ministry also has control over state-owned enterprises. The main function of the Ministry of Energy is to ensure the country's energy security, participating in the formation of the state policy for energy sector development and its implementation. The Ministry of Energy is also responsible for the licensing of power generation, transmission, distribution and sale, as well as import and export activities. The Ministry has a dedicated department that is responsible for increasing the deployment of energy efficiency and renewable energy policies.

The State Agency on Alternative and Renewable Energy Sources (SAARES) was established by a Presidential Decree on July 16, 2009, and was subsequently tasked with driving the development of the country's renewable energy resources and related projects. The status of the Agency was altered by Presidential Decree No. 464 of 14 January 2019.

The Tariff Council determines and regulates retail and wholesale tariffs for electricity, gas, central heating services and refined petroleum products. The Council was established in May 2005 and implements state regulations on prices and service fees pertaining to public services and their collection in cooperation with central and local executive bodies as well as public organisations. The Council is chaired by the Minister of Economy; representatives of several ministries and agencies are also appointed members of the Council.

The Azerbaijan Energy Regulatory Agency (AERA) was created by Presidential decree on 22 December 2017 with the objective of pursuing energy sector unbundling and preparing tariffs for approval by the Tariff Council.

Structure of the power sector

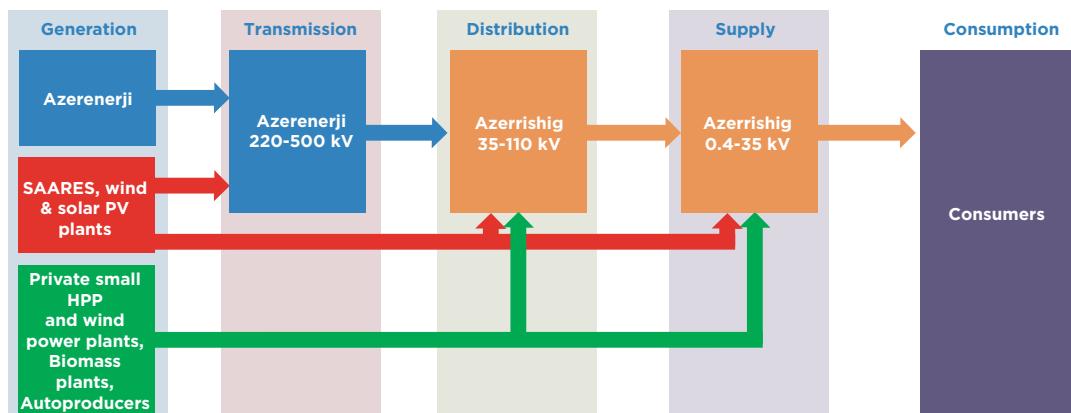
The power sector was originally a fully vertically and horizontally integrated monopoly, except for distribution and supply in the Baku region, which was a municipal entity managed by Baku Networks Company (Bakielektrikshebeke OJSC). On 10 February 2015, Azerishiq JSC was created to take over the responsibilities and roles of Bakielektrikshebeke OJSC, and later became the national power distribution company.

Azerenerji OJSC is responsible for generation and transmission of electricity in the country, including coordination of power substations controlled via a national dispatch centre, as well as high voltage power transmission lines of 110, 220, 330, 500 kV and their dispatch control tools. Azerenerji OJSC introduces new technologies to ensure extension of generation capacity and rehabilitation of high voltage power lines in the country. At the same time, it conducts energy exchange operations with foreign countries.

In recent years, Azerenerji has implemented a large-scale investment programme to add new – and upgrade existing – generation and transmission capacity. All investments in the distribution network are implemented by Azerishiq, which carries out large scale rehabilitation of infrastructure and works on the electrification programme for residential communities. An overview of power flows is detailed in Figure 3.

In addition, there are a few private companies operating small hydropower stations and wind power stations, as well as solar home systems. Azguntex LLC is a government-owned company that manufactures solar panels and LED lamps.

Figure 3. Simplified scheme of electricity flow within the country's power system



Source: INOGATE Technical Secretariat, 2016.

Structure of the district heating sector

Azeristiliktechizat is the national district heating operator. The district heating in Azerbaijan typically comprises small decentralised heat supply systems serving a number of apartment blocks from a single gas-fired boiler house.

The key actors involved in the electricity and natural gas sectors of Azerbaijan, with relevance to the purposes of the present analysis, are listed in Annex 1.

2.4. Strategic framework

In July 2015, the Minister of Energy of Azerbaijan approved a set of ten priority directions that aim to introduce market-based operations in the electricity and natural gas sectors, with a view to attracting private investment (Table 7). The market reforms aim to harness competitive market forces to achieve energy prices that reflect actual costs and thereby increase economic benefits for the whole country.

The development of six of these ten strategic tasks have been supported by international development partners (see Annex 2 for a list of projects implemented in support of these strategic priorities).

The strategic roadmap for the development of utilities (electricity, heating, water and gas) in the Republic of Azerbaijan was approved by the Presidential Decree of 6 December 2016, “About approval of the strategic roadmaps for the national economy and main economic sectors”.

The roadmap was outlined for short-term, including an Action Plan of measures, (up to 2020), medium-term (2020–2025) and long-term (post-2025) periods.

With regards to renewable energy, the strategy sets a target of 420 MW by 2020, which includes 350 MW of wind, 50 MW of solar and 20 MW of bioenergy. The strategy also includes a long-term vision for 2025 and beyond; however, no specific targets are set beyond 2020.

This long-term vision establishes a framework for a wide series of measures and sectoral reforms that include the development of a favourable climate for attracting investments in renewable energy (mainly wind and solar); distributed power generation by consumers for self-sufficiency and the installation of rooftop PV panels; and the development of bioenergy and geothermal resources.

The development of distributed generation is also planned, using solar PV, small combined heat and power (CHP) stations, and small wind turbines. At the consumer level, the long-term vision envisages improved energy efficiency in the industrial and commercial sectors, and the development of infrastructure for electric vehicles.

Table 7. Overview of ten priority directions for the energy sector

Ten strategic tasks for the energy sector
Preparation of a strategy for the energy sector development of the country in the next 25–30 years.
Development of 15–20 year state program for the efficient use of energy resources, the improvement of end-user energy efficiency and the use of alternative energy sources.
Development of a 5-year state program for energy sector development (1st Five-year Strategic Development plan).
Development of the draft law on the regulated internal market for electricity.
Development of the draft law on the regulated internal market for natural gas.
Development of the draft law on an ‘on-grid code’ for electricity.
Development of the draft law on an independent energy regulator governing the internal energy (electricity and gas) markets.
Development of the draft law on an ‘on-grid code’ for natural gas.
Restructuring of power system structures (Azerenerji, Azerishiq) based on the new subjects of the market provided by the legislation.
Creation of a flexible tariff system, reflecting and distributing the interests of end consumers and other market actors (X-factor), and based on the costs of products and services.

2.5. Legal, regulatory and policy framework

The legal and regulatory framework of the Azerbaijan power sector has evolved over the past 20 years. In that period, some elements of legal and regulatory frameworks have been updated to account for intended changes to their structure and administration, such as the drive to introduce a competitive power market through the unbundling of the vertically integrated market and greater private sector participation. The energy sector of Azerbaijan is governed by legislation that was drafted during the period 1998–2000. The key elements of the legislation are summarised below.

Law on Energy Resources Utilisation (30 May 1996)

The Law on Energy Resources Utilisation determines the legal, economic and social basis of state policy in the field of energy resource utilisation and regulates the relations between the state and the legal entities in this field. The Law includes provisions on the certification and standardisation of energy consuming installations, facilities, etc. It also states that independent electric and thermal power producers may use the state power supply system to transport produced energy under negotiated terms.

Law on Power Industry (3 April 1998)

The Law on Power Industry provides the legal background for the generation, transmission, distribution and sale of electricity and heating. It mainly aims to ensure rational utilisation of power resources as well as environmental protection. The Law appoints the Ministry of Energy as the authority responsible for licensing and regulating electricity generation, transmission, distribution, sale, and import-export activities.

Law on Heat and Electric Power Plants (6 March 2000)

This Law determines the legal framework for the design, construction and operation of power plants including independent power plants. The purchase of electricity generated by small power plants is guaranteed without limitations.² Any natural or legal entity has the right to construct, rehabilitate and operate power plants, and activities related to “industrial power plants” (i.e. excluding small power plants) must be licenced by the Ministry of Energy. The Law also provides for the process and conditions of negotiated access and connection of such licenced facilities to the grid.

Additional legal and regulatory documents

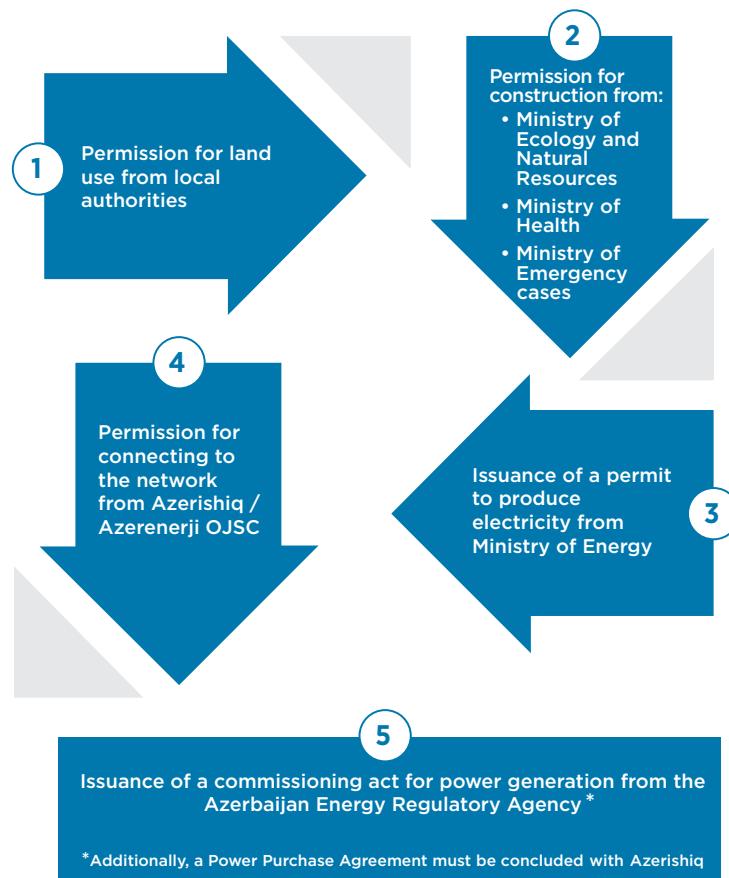
The power sector is also regulated by a number of byelaws (mainly the Cabinet of Ministries Decrees concerning various rules and procedures for operations). There are a number of bye-laws aimed at promoting the use of renewable energy through special concessions, including the following:

- The State Program on the Use of Alternative and Renewable Energy Sources, adopted in 2004, aims to: 1) determine the potential of alternative energy sources in the production of electricity; 2) increase the efficiency of national energy sources; 3) guarantee national energy security; 4) decrease CO₂ emissions; and 5) support job creation via renewable energy sector development.
- March 2014 amendments to the Cabinet of Ministers decrees: “Rates of custom duties on export-import operations in Azerbaijan Republic” and “List of goods exempted of VAT imported to Azerbaijan Republic territory”. The import of equipment, facilities, parts and tools used in the renewable energy industry and in achieving energy efficiency are exempt from customs duties and VAT.
- Decree of the Cabinet of Ministers “On determination of electricity production and power limits for the commissioning of electrical installations” – no. 482 of 24 November 2016. According to this decree, special permits for alternative and renewable energy power plants are required only for power plants with a capacity of more than 150 kW, and for hydropower plants and biogas power plants with a capacity of more than 500 kW.
- The permitting procedure for renewable energy remains complex, with a number of steps and fragmented division of responsibilities across Ministries and local administration. Figure 4 outlines this process.

The legal and regulatory framework has evolved to drive a more competitive power market

² A small power plant is defined in Azerbaijan as one with a capacity of between 50 kW and 10 MW for hydropower plants and between 10 kW and 100 kW for wind power plants.

Figure 4: Overview of existing renewable energy permitting procedures



Box 1: Azerbaijani Service and Assessment Network

The Azerbaijani Service and Assessment Network (ASAN) is a state agency for public services to the citizens of Azerbaijan. The agency's goal is to make services more easily accessible to citizens using modern technologies. The ASAN service is based around a 'one-stop-shop' principle, where ten government entities and about 30 private companies provide services in a public-private partnership.

The President of Azerbaijan has already approved the rules for the use of electricity through the Decree of 4 April 2017 "on simplification of procedures of electricity supply for existing or new constructed facilities of entrepreneurs". The decree sets out the rules for the preparation of technical specifications and design estimates for existing or under-construction facilities with the required capacity of up to 150 kW (including 150 kW from the existing 0.4 kV network) and connection to the power supply network. Consumers can easily request such connections through the ASAN service.



2.6. Energy tariffs

Tariffs for electricity and heating are regulated by the state in Azerbaijan, specifically purchase prices from producers; wholesale prices; retail prices and import-export prices (for electricity). There are no access tariffs for generation/retailing and transmission/distribution.

The Tariff Council has the power to set tariffs for any kind of renewable energy. Feed-in tariffs have been set for wind, mini hydro and other renewable energy technologies. There is no difference in tariffs between cogeneration and standalone power systems. The regulated entities (e.g. Azerenerji and Azerishiq) are required to provide economic justification for the expenses recovered by the tariffs. The calculated tariffs are reviewed by the Tariff Council and published upon approval.

Depending on the specification of the services, tariffs are determined on the basis of the expenses necessary to recover costs and generate profits. This is a methodology used for the calculation of prices (tariffs) for all services and goods regulated by state. There is no dedicated methodology for the calculation of tariffs for electricity. The latest tariffs were approved by Resolution of the Tariff Council no. 17 of 28 November 2016 on the Regulation of Electricity Price Rates in the Republic of Azerbaijan and are shown in Table 8.

The country has set specific tariffs for renewable energy, namely 2.94 US cents per kWh for small hydropower; 3.23 US cents for wind; and up to 3.35 US cents for other renewable energy technologies. Azerbaijan is contemplating the possibility of competitive procurement as a mechanism for the discovery of appropriate tariffs in this context.

Table 8: Tariffs for electricity (28 November 2016)

NAME OF SERVICE	TARIFFS FOR 1 KWH, AZN/US CENTS ³
Purchase from producer	
Private small hydropower stations	5.0 (2.94 US cents)
Wind power stations	5.5 (3.23 US cents)
Other renewable energy	5.7 (3.35 US cents)
Wholesale	5.7 (3.35 US cents)
Enterprises of the chemical and aluminium industry, mining ore based steel foundries, with direct energy supply from 35 kV and 110 kV lines and for production purposes, with average monthly consumption not less than 5 million kWh.	
Day (08:00-22:00)	5.8 (3.4 US cents)
Night (22:00-08:00)	2.8 (1.65 US cents)
Transit transmission	0.2 (0.11 US cents)
Retail	
Residential	
For monthly consumption less than 300 kWh	7.0 (4.1 US cents)
For monthly consumption more than 300 kWh	11.0 (6.5 US cents)
Non-residential	9.0 (5.3 US cents)

Source: Tariff Council of Azerbaijan Republic (2016).

³ Note: exchange rate of USD/AZN = 1.7.



Photograph: Shutterstock



3. RENEWABLE ENERGY DEVELOPMENT

Azerbaijan is a country with vast potential for the development of renewable energy. The country has excellent wind and solar resources and sizable potential for biomass, geothermal and hydropower. With a view to unlocking this potential, the government has set a target of adding 420 MW of renewable energy capacity by 2020. Driven by this target, the country has proceeded with the deployment of projects under engineering, procurement and construction (EPC) contracting arrangements for use of renewables. However, practical deployment has been limited compared to the scale of available resources and the country's long-term ambitions.

3.1. Drivers of renewable energy deployment

The country's leadership highlights the importance of diversifying the economy and decreasing its dependence on the oil and gas sectors in its Strategic Road Map on National Economic Perspectives. In this context, the increased share of renewable energy in the energy mix can offer multiple benefits, including improved welfare and job creation, energy security, economic diversification and associated increases in GDP.

Renewable energy can act as a catalyst for new employment opportunities in a country traditionally dominated by oil and gas by providing new avenues for technological innovation and new sectors for economic value creation. The country's rich experience in the oil and gas sector offers a good starting point for the introduction of renewable based technologies. For example, elsewhere, oil and gas industry experience has been used in the successful development of geothermal potential in Canada, while in Norway, the expertise gained from off-shore oil and gas infrastructure have been leveraged to develop the off-shore wind industry.

In the case of Azerbaijan, the State Oil Company of Azerbaijan Republic (SOCAR) – the wholly state-owned national oil and gas company – is an important actor in the country's energy sector. While it maintains its focus on conventional energy sources, SOCAR has already installed wind and solar PV in the Tagiyev oil and gas field and is considering renewable energy options for supplying power to off-shore facilities.

Furthermore, the accelerated deployment of renewable energy, coupled with continuing improvements in energy efficiency, could decrease domestic consumption of oil and gas, thereby providing an opportunity to generate additional revenues through exports and lower domestic subsidies.

Renewables also offer the most prominent low carbon solution to meeting Azerbaijan's climate targets. The country has committed to reducing its GHG emissions by 35% by 2030 compared to the 1990 base year specified in its Nationally Determined Contribution (NDC) under the Paris Agreement. The NDC already emphasises the use of alternative and renewable energy sources to achieve this target.

The development of renewable energy could also contribute to energy system resilience in Azerbaijan (see Box 2). For example, distributed renewable energy systems, combined with increased use of battery storage, can enhance security of supply. Given the projected increase in national energy demand, renewable energy also provides a technical solution to the need for rapid power generation capacity deployment, owing to relatively shorter lead times for project construction when compared to conventional sources.

Box 2: Resilience and security of electricity supply

Azerbaijan encountered a massive blackout during 3–4 July 2018, leaving large parts of the country without electricity and in some cases without water supply. Thirty-nine cities and districts across the country were affected. The blackout was associated with a significant heat wave and a parallel explosion at the sub-station of a thermal power plant in Mingachevir city.

The government has allocated significant amounts of investment in improvements to its electricity infrastructure over the past 15 years and activities related to energy security and system resilience are continuous. The July 2018 blackout highlighted the need to build a stronger, more resilient power system in Azerbaijan, in which renewables can play an important role. This provides an opportunity to further enhance the business case for renewable energy.



Photograph: Shutterstock

3.2. Current status and potential

At present, Azerbaijan has a modest share of renewable energy in its TFEC, fluctuating between a peak of 3.1% in 2010 to 1.7% in 2017. One explanation for this variance is the seasonal and year-on-year changes in hydropower production that have ranged from 3 446 million kWh in 2010 to only 1 746 million kWh in 2017.

The share of renewable energy in non-power uses has remained consistently low and represented 0.4% of TFEC in 2017.

As of 2017, Azerbaijan has 1 267 MW of installed renewable power capacity, of which 1 132 MW is hydro, 35 MW solar, 62 MW wind and 38 MW is biomass (See Table 9).

Azerbaijan has exceptional wind and solar resources and significant bio/waste, geothermal and small hydro potential. SAARES estimates of renewable energy technical potential are presented in Table 10.

Table 9: Installed power generation capacities (MW), 2017

State power companies /auto-producers/ independent power producers	Power plants					
	Total	Thermal	Hydro	Solar	Wind	Biomass
Azerenerji JSC	6 935	5 881	1 055	-	-	-
Nakhchivan State Energy Agency	237	147	68	22	-	-
Auto-producers (BP, SOCAR, Azersun Holding)	722	722	-	-	-	-
Tamiz Shahar JSC	37	-	-	-	-	37
Azerishiq JSC	52	-	-	-	52	-
Azalternativenergy LLC	16	-	-	13	3	1
Private wind and hydro power plants	17	-	9	-	8	-
Total (MW)	8 017	6 750	1 132	35	62	38
Share (%)	100	84.2	14.1	0.4	0.8	0.5

Source: MoE (2019a)

Table 10: Renewable energy resource potential

Renewable energy	Technical potential (MW)
Wind	3 000
Solar	23 040
Bio/waste	380
Small hydro	520

Source: MoE (2019b)

The share of renewable energy in non-power uses has remained consistently low

Hydropower

Hydropower has traditionally maintained a solid position in the country's energy mix. Among renewables, hydropower had the highest installed capacity of 1131 MW in 2017, compared to 6 750 MW of thermal power capacity. The resources are located alongside rivers such as the Kura and its tributaries, the Araz, streams terminating at the Caspian Sea, and irrigation canals.

Azerbaijan also has a well developed small hydropower generation sector (comprising the Sheki, Mughan, Zeykhur, Gusar, Nyugedi, Chinaly, Balakan, Guba and Zurnabad power plants) with the presence of independent power producers as well as autoproducers generating power for consumption in their own facilities. Small-scale hydro-power generation is still being added such as the 1.5 MW Balakan facility in 2017.

Seasonal conditions affect hydropower generation, which has fluctuated from a peak of 1959.3 GWh in 2016 to a low of 1299.7 GWh in 2014. While hydropower is subject to seasonal fluctuations, however, its substantial share in the country's electricity system offers a strong basis for supporting the integration of future solar and wind power generation capacity.

Wind energy

Azerbaijan has excellent wind resources, especially in coastal areas along the Caspian Sea (Figure 5). According to SAARES analysis, the potential for wind is estimated at 3 000 MW.

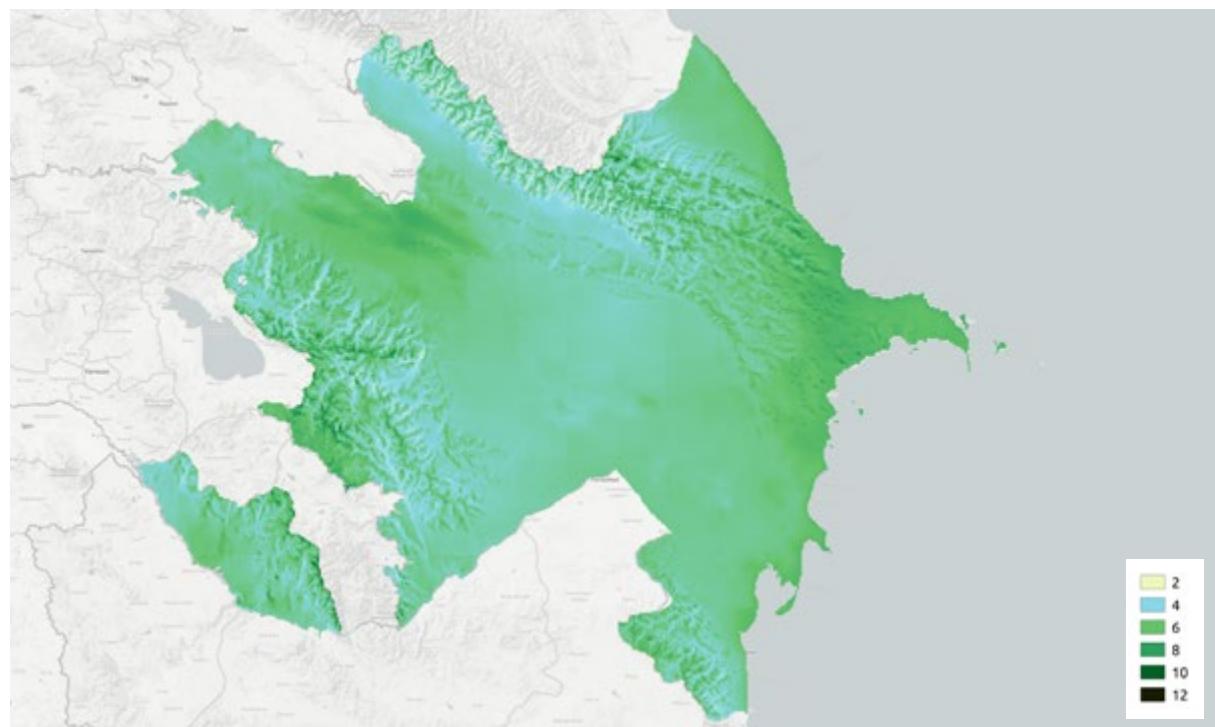
This potential is reflected in the government's target of 350 MW of new capacity by 2020. By the end of 2017, 62.4 MW were installed with 51.7 MW operated by Azerishiq JS, 2.7 MW by Azalternativenergy LLC, and 8 MW by the private sector. Azerbaijan continues to develop several projects including the ongoing Absheron wind project and the recently launched Yeni Yashma wind farm (see Box 3).

Box 3: Yeni Yashma Wind Park

The Yeni Yashma Wind Park is the first project of its kind demonstrating Azerbaijan's potential in this renewable energy technology. The Yeni Yashma park was constructed with 20 Fuhrlander FL 2500 wind power turbines with an installed capacity of 50 MW. The wind power park is located in the Khizi region, in the Yeni Yashma settlement north of Baku.

Ownership of the project was transferred from SAARES to Azerishiq OJSC, which was entrusted with responsibilities related to the commissioning of the project, and it began operating in October 2018. As of November 2018, Yeni Yashma is the largest operating wind park in the south Caucasus.

Figure 5: Wind speeds at 100-meter hub height (in m/s)



Source: IRENA (n.d.-a)

Disclaimer: Boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA.

Solar energy

Azerbaijan has an estimated solar energy potential of 23 040 MW. The annual number of sunshine hours varies between 2 400 and 3 200. Global horizontal irradiation (GHI) is in the range of 1 387 to 1 534 kWh/m² for most of the territory. The direct normal irradiation ranges from 1 095 to 1 534 kWh/m² with most of the territory under 1 387 kWh/m².

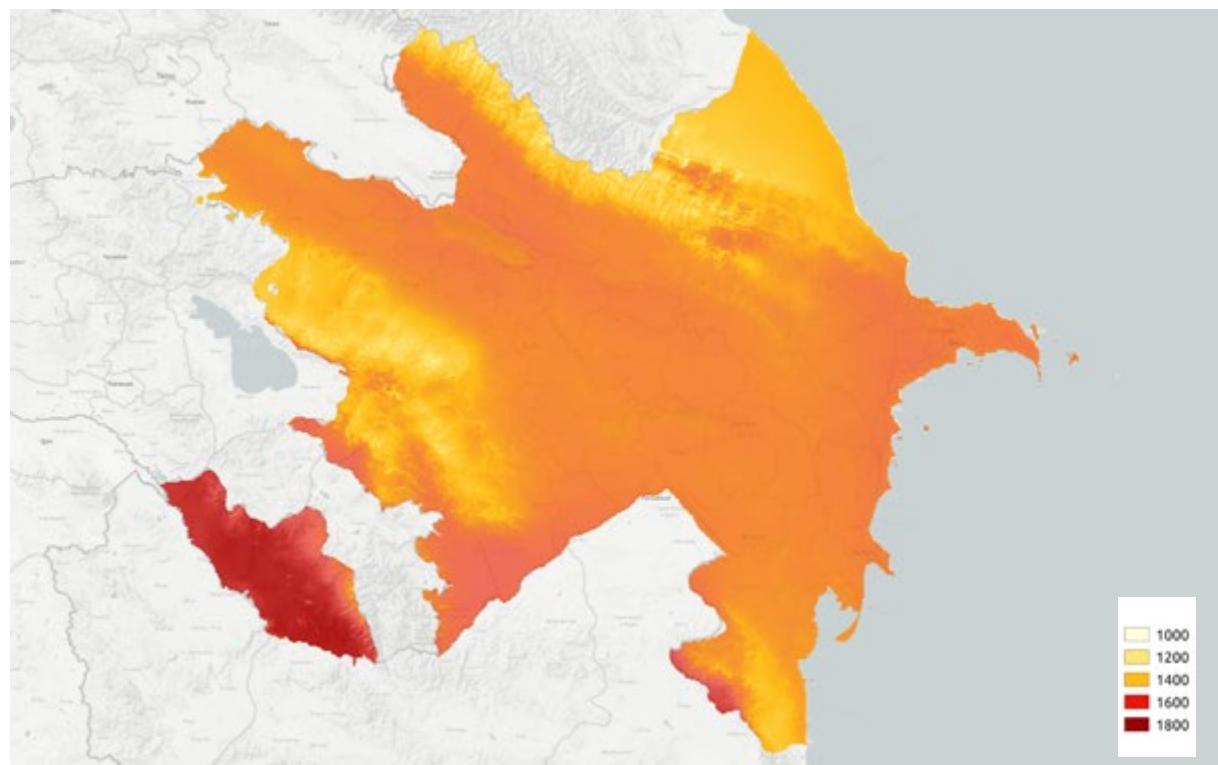
There are four solar PV installations with an installed capacity of more than 1 MW. Nakhchivan Solar Power Plant has a capacity of 22 MW. Additionally, plans call for the construction of five solar power stations at 2.8 MW capacity each and one solar power station of 4 MW.

As of the end of 2017, 34.6 MW of solar PV was installed across the country, including at social establishments and on the roofs of various public buildings. An example of such projects is the Sport Centre in Masally, which has a PV installation of 70 kWp. The system is owned by Azalternativenerji – a public company – and all related administrative and financial procedures have been developed within SAARES. Table 11 lists some additional examples.



Photograph: Shutterstock

Figure 6: Annual global horizontal solar irradiation (GHI in kWh/m²)



Source: IRENA (n.d.-b)

Disclaimer: Boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA.

Table 11: List of public buildings with small PV systems installed

	LOCATION	CAPACITY OF PV SYSTEM	STATUS
1.	Five schools and two medical facilities in Baku city.	130 kW	Completed
2.	Boarding school, the Turkan settlement.	132 kW	Completed
3.	Six schools and six kindergartens in settlements for internally displaced persons in Bilasuvar.	1 100 kW	Completed
4.	Sports centres in the Boradigah settlement of Masally region.	70 kW	Completed
5.	Sports complex in the Khojavend settlement of the Beylagan region.	70 kW	Completed
6.	Sports centre in the Goytapa settlement of Jalilabad region.	100 kW	Planned
7.	Sports centres in the villages of Bash Goynuk, Sheki region, and Zarat, Siyazan region.	100 kW each	Planned
8.	SOS children's village in Khatai district of Baku city.	82 kW	Completed
9.	Social building, Sabirabad city.	18 kW	Completed

Source: SAARES (2016a)

Bioenergy

Azerbaijan has an estimated technical potential of 380 MW for biomass and waste-to-energy. Currently, bioenergy is mostly utilised in the form of traditional biomass, largely for heating and cooking in remote areas. In addition, there is significant potential for generating energy from household biodegradable waste, and the Baku Waste-to-Energy Plant (Box 4) demonstrates ongoing government efforts to realise this potential.

Box 4: Baku Waste-to-Energy Plant

The construction of this plant is based on the framework of "The Comprehensive Action Plan about the improvement of ecological situation in the Republic of Azerbaijan for the years 2006-2010". It was constructed based on a design-build-operate arrangement with CNIM S.A., a French industrial engineering contractor and equipment manufacturer.

The total cost of design-build works for the plant is estimated at EUR 346 million. The plant design is based on 20 - year operation and 500 000 tonnes of municipal waste per year. The plant is located in the Balakhani settlement and features two incineration lines, each with a capacity of 250 000 tonnes and a power generation capacity of 231.5 GWh per year.

Plant construction was enabled by a Decree of the President of the Republic of Azerbaijan in 2008, which allocated responsibility for the collection and transportation of any solid household waste, regardless of its origin of generation, to Baku municipality. It was inaugurated in 2012 and complies with local and European environmental protection standards.

3.3. Renewable energy related laws under preparation

In accordance with Presidential Decree No. 1209 of 29 May 2019 “On the acceleration of the reforms in the energy sector of the Republic of Azerbaijan”, the development of the draft law on **“Use of renewable energy sources in power generation”** was initiated. The draft law defines the main principles of state policy relating to renewable energy power generation. It has been developed with the support of the Norwegian company DNV GL. The draft law provides for additional concessions on tax and duties, feed-in-tariffs, off-taker obligations and other support mechanisms, such as for foreign direct investment and scientific research.

- The draft law on **“Efficient use of energy resources and energy efficiency”** was prepared with technical assistance from the Energy Charter Secretariat, under the EU4Energy⁴ programme and was submitted to the Ministry of Energy in 2018. The draft law has subsequently been presented to the Cabinet of Ministers for review after co-ordination with related state agencies.

Also with assistance from the EU, drafting of a **standard PPA for renewable energy** was initiated in late 2018.

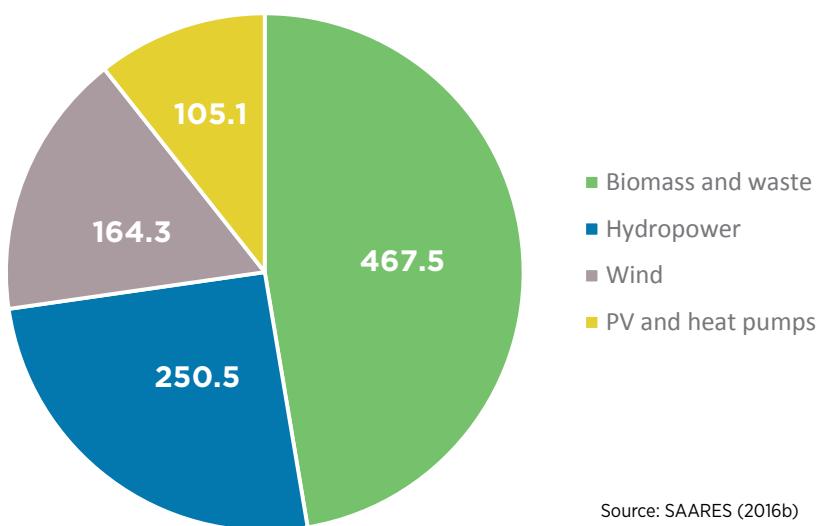
3.4. Economics of renewable energy

The state budget is the main financing source for the development of renewable energy in Azerbaijan. According to SAARES, between 2005 and 2015, AZN 987.4 million was invested in selected energy sources, including solar PV and heat pumps, wind, small hydro, biomass and waste (see Figure 7), of which AZN 820 million – or 83% – were from public investments.

The current investment climate is not favourable to energy efficiency and renewable energy lending because of high interest rates. The interest rate of the Central Bank of Azerbaijan spiked in 2016 from below 4% at the beginning of the year to more than 14% by the end of the same year. In October 2018, the Central Bank lowered the upper limit of its interest rate cap to 11.75%.

A number of international organisations are active in Azerbaijan, given its importance to regional and global energy markets. Partners actively pursuing projects in the country include the Asian Development Bank (ADB), the International Energy Charter, the European Bank for Reconstruction and Development (EBRD), the European Union (EU) and the United States Agency for International Development (USAID). However, development partners have so far contributed to the renewable energy sector mostly through technical assistance, with limited direct investments in renewable energy projects.

Figure 7: Overview of renewable energy investments (million AZN), 2005–2015



⁴ See: www.eu4energy.iea.org/about

3.5. Human and institutional capacity

SAARES is taking steps to create the basis for skills and expertise development. As part of these efforts, students of several higher education institutions in Azerbaijan – such as the Azerbaijan State University of Oil and Industry, and the Azerbaijan State University of Architecture and Construction – have the opportunity to conduct field studies at Azalternativenergy LLC,⁵ the Gobustan Experimental Polygon and Training Centre (see Box 5) and associated solar installations.

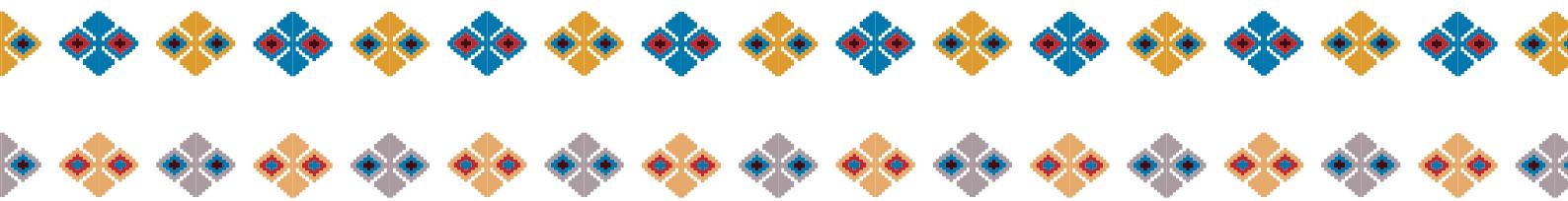
A renewable energy engineering training and research centre has been created within the Baku Higher Oil School. The main purpose of this centre is to develop recommendations for the efficient use of renewable energy, train qualified renewable energy specialists and participate in the dissemination of knowledge in this field.

Box 5: Gobustan Experimental Polygon and Training Centre

The Gobustan Experimental Polygon and Training Centre (GELTC) owns and operates the first hybrid-type renewable energy power plant built in Azerbaijan that includes wind, solar and biogas. The facility has three wind turbines (each 0.9 MW), a 3 MW solar power plant and a 1 MW biogas power plant. The complex integrates a regulation and control facility, a water reservoir, a testing area (polygon), a laboratory and a training centre as a showcase and capability-building hub for renewable energy in Azerbaijan.

The complex was built in 2011 to contribute to the energy supply for Gobustan city (Phase 1) and the wider Gobustan region (Phase 2). While Phase 1 has been commissioned and is in operation, additional power generation capacities will be required for Phase 2. Hence, the Gobustan facility combines a pilot and showcase facility with training and offers practical experience in the development and operation of renewable energy technologies.

⁵ Azalternativenergy LLC was established in 2013. It is subordinate to SAARES and operates according to its Charter. The present business of Azalternativenergy LLC includes the design, engineering, construction and management of renewable energy power stations, as well as the generation, distribution, purchase and sale of the energy from renewable energy sources (solar, wind, biomass, thermal water, water flow, waste and other renewable sources).



Photograph: Shutterstock





4. KEY CHALLENGES AND RECOMMENDATIONS

This section presents a set of short- to medium-term recommendations to address key challenges and support the development of the renewable energy market in Azerbaijan. These recommended actions focus on providing a solid basis for creating a more conducive investment environment for renewable energy. At the same time, the government is already making progress towards the realisation of these actions.

4.1. Legal and regulatory framework

The existing legal and regulatory framework for energy in Azerbaijan is covered by several laws on energy, electricity, heating and the use of energy resources that also include specific provisions for the use of renewable energy. There are several secondary legislations regulating specific aspects of electricity generation from renewable energy, such as investment protection, environmental protection and taxation.

However, the country does not have a dedicated, comprehensive law governing the various aspects of renewable energy development. This creates challenges for market entrants when navigating legal and regulatory requirements, resulting in delays in the development of new projects and increased perception of risk among investors. A complex and ambiguous permitting procedure further hinders the development of renewable energy.

Action 1: Adopt a renewable energy law

A dedicated law could provide overall direction to the renewable energy sector in Azerbaijan and significantly contribute to the development of a local market for renewables. Such a law would serve as an important reference point for renewable energy market players by providing a clear and reliable long-term perspective.

The law should ideally cover all key elements of a sound legal and regulatory framework for renewable energy, starting with the definition and types of sources and technologies based on the existing technical potential in Azerbaijan. It could also outline elements related to government support mechanisms and principles of grid management relating to renewable energy. Furthermore, the law could provide the grounds to specify and simplify procedures for private sector investments, especially with respect to permitting.

Effective enforcement of a renewable energy law requires an appropriate institutional framework and administrative capacity, such as an independent regulator with responsibility for the oversight of contract enforcement. Thus, the law could also allocate roles and responsibilities to relevant government entities.

Current status: In accordance with Presidential Decree No. 1209 of 29 May 2019, “On the acceleration of the reforms in the energy sector of the Republic of Azerbaijan”, the development of the draft law on “**Use of renewable energy sources in power generation**” has been initiated. At the time of publication for this report, the draft law had reached the approval phase.

Action 2: Streamlining the permitting procedure for renewable energy

Permitting requirements and procedures could be streamlined under a renewable energy law to provide a clear source of reference, as well as future direction should any amendments be applied. The overarching principles for the design of permitting procedures are simplicity, transparency and the flexibility to adapt to regulatory and market changes.

As a starting point, land plots for renewable energy project development could be allocated in zones with accessible connectivity to basic infrastructure, such as the electricity grid, water and roads. Furthermore, the establishment of a ‘one-stop-shop’ system for renewable energy projects could be considered to simplify and streamline the permitting process and facilitate better co-ordination of internal administrative processes and permitting requirements. Such a system should have the necessary decision-making powers to facilitate the different steps of the process that will allow the acquisition of permits.

Publishing procedures for obtaining permits online, with information on the steps required – including the necessary documentation, expected timelines and the responsible government institutions – would provide more transparency to developers and investors.

Current Status: Renewable energy project developers require permission for power plant construction, land use and power generation, in accordance with internationally accepted standards.

4.2. Policy support mechanisms

Low energy tariffs, especially due to fossil fuel subsidies, constitute one of the main barriers to the development of renewable energy in Azerbaijan. Pricing fossil fuels below international market prices hinders the deployment of renewable energy in power generation as well as in end-use sectors such as heating, cooling and transport. Renewable energy tariffs in Azerbaijan currently range between 2.94 and 3.35 US cents. Combined with the overall complexity of current policy frameworks, these tariff levels do not justify favourable decisions on project development from domestic or international investors.

Tariff regulations are currently not adapted to reflect the specific case of renewable energy, which has a different cost structure in terms of high initial capital expenditures (CAPEX) and relatively low operating expenditures (OPEX).

Therefore, the methodology for setting energy (and renewable energy) tariffs in Azerbaijan, both power and non-power, has been suboptimal for supporting renewable energy market development.

The current methodology, which is applied to all government services, requires economic justification for the expenses recovered; however, renewable energy requires a differentiated approach to address the nascent nature of the sector in Azerbaijan and the inherent issue of high upfront investment and lower operational costs. One instrument that could serve as an effective price discovery mechanism is auction; however, this would need to be designed in a way that attracts investors and incites competition while also ensuring that projects are delivered.

Action 3: Enhance the procurement of renewable energy

There is a need to identify support mechanisms that would facilitate the transition towards a functioning renewable energy market. Feed-in tariffs are critical to support the initial development of a national renewable energy market. However, as the market matures further, the use of auctions could offer the possibility of procuring renewable energy at lower prices through market-based price discovery. There are a number of prerequisites for this approach to be applied, including stable policy and regulatory frameworks and a high degree of competition in the market.

A holistic approach to the design of key support mechanisms for renewable energy, encompassing both power and non-power sectors, would be beneficial for the development of renewables in Azerbaijan. IRENA’s report, ***Renewable energy auctions: A guide to design***, provides a comprehensive overview of design options for countries considering auctions (IRENA 2015b).

Current Status: Azerbaijan is working towards conducting renewable energy auctions. In this regard, the Ministry of Energy is undertaking steps, including on-the-ground measurements, to define and prioritise zones with high renewable energy resource intensity. Eight zones (five wind and three solar) with total capacity of 750 MW have been already identified. Preliminary assessments on ownership and designation of lands, potential environmental impacts, and existing infrastructure have been conducted in these areas. The project “Assistance in designing and implementing renewable energy auctions in Azerbaijan”, is being implemented with the support of the European Bank for Reconstruction and Development (EBRD).

4.3. Renewable energy financing

Underlying market barriers and perceived high risks constrain the financing of renewable energy projects in Azerbaijan. Dedicated credit lines for energy efficiency and renewable energy investment are limited and market absorption is low. Potential projects are hampered by the lack of primary and secondary legislation as well as the lack of awareness concerning the benefits of renewable energy.

While measures have been recently implemented to align its banking sector regulations with international norms, renewable energy projects continue to face challenges in terms of access to capital in Azerbaijan due to lack of liquidity in the local banking system and high interest rates – which can be as high as 30% per annum on local currency. Collateral requirements from local banks are demanding and make local financing very costly compared to more developed renewable energy markets.

Another critical element in attracting private investors into the sector through increased bankability of renewable energy projects is the power purchase agreement (PPA), which is an important contract that governs the sale and purchase of power and provides long-term clarity on roles, responsibilities, costs, revenues and associated risks. However, Azerbaijan does not have a standard PPA for renewable energy, which increases the perceived risk among renewable energy developers and investors.

Action 4: Establish a dedicated financing mechanism to address off-taker risk

Azerbaijan could benefit from creating facilitation mechanisms for the financing of renewable energy projects that will enable development of the renewable energy market, especially in its initial phases. Dedicated financing facilities for renewable energy projects could alleviate some of the difficulties and enhance the country's attractiveness for international and local project developers and investors.

With a view to de-risking renewable energy projects, a dedicated financing mechanism overseen by a credit worthy institution could facilitate access to cheaper capital. One option is to create a dedicated fund to support renewable energy projects, which could be capitalised through a levy on conventional energy sources and disbursed through a robust off-taker arrangement.

Given the lack of interest from local banks in financing renewable energy projects, the government of Azerbaijan could also consider creating a risk mitigation facility to encourage investment. Such a facility could provide guarantees for viable projects and collaborate with local banks to help build their knowledge and capacity on renewable energy project financing.

Another option could be the provision of aggregated support for smaller projects to help the renewable energy market to take-off. Aggregating smaller projects allows for the streamlining of the due diligence process and access to larger pools of investment for local projects. For more insights, see IRENA's report, *Unlocking renewable energy investment: The role of risk mitigation and structured finance* (IRENA 2016b).

Current status: The draft law on “Use of renewable energy sources in power generation” includes the application of guaranteed tariffs, active consumer support and other promotional mechanisms. Currently, in addition to the existing investment promotion mechanism, the Ministry of Energy has submitted proposals to the government regarding additional concessions on tax and customs.

Action 5: Adopt a standard power purchasing agreement (PPA)

Drafting and publishing a standard PPA for renewable projects will help to reduce perceived risk within the private sector and improve transparency and predictability in Azerbaijan's renewable energy market. Robust PPAs can improve the economics of renewable energy projects, while suboptimal PPAs, on the other hand, may increase the costs of procurement.

While the inherent features of PPAs vary depending on the specific country, there are some standard elements that a robust PPA can include to provide assurances to developers and investors, including the following:

- Price in currency value per kWh of electricity produced, with a price adjustment mechanism to account for inflation and currency risk.
- Tenure, based on number of years (preferably in the range of 20 years).
- Supply commitment, which can depend on the type of technology and may vary from annual to daily, improving predictability for both parties.
- Additional elements such as coverage of policy/regulatory risks, dispute settlement and ownership provisions will further increase transparency and increase the attractiveness of Azerbaijan to developers and investors.

⁶ <https://navigator.irena.org/inside/pn/learn/Pages/PMToolPPA.aspx>

For more details on key clauses in PPAs, refer to the IRENA Project Navigator.⁶ In addition, IRENA, jointly with the Terrawatt Initiative (TWI), launched the Open Solar Contracts initiative to provide standardised, open-source legal documentation solutions to simplify and streamline contractual processes and facilitate solar power project development.

Current status: The Ministry of Energy, in collaboration with an international consulting firm, has developed a draft standard PPA that considers best practices and reflects close consultation with stakeholders. Negotiations with private sector companies are underway to start implementing pilot projects through the PPA.

4.4. Long-term energy planning

Azerbaijan has a framework in place for planning its long-term overall energy sector development; however, existing planning processes could be updated to reflect the needs of the nascent renewable energy sector. Energy planning covers several aspects, often starting with the development of a national vision and long-term targets for the energy sector within a wider regional and global context. Integrating long-term planning with Azerbaijan's overall energy sector strategy could stimulate the country's renewable energy market development and improve its attractiveness to investors.

Action 6: Develop long-term energy scenarios

To identify the optimal energy mix and inform policy decisions accordingly, a detailed long-term planning exercise could be undertaken for energy demand in the electricity, industry, residential, commercial, agriculture and transport sectors. In order to fully assess the potential for electrification, energy efficiency and renewable energy penetration, Azerbaijan's energy planning requires a deeper focus on non-power sectors, such as heating and cooling, and transport.

Such analyses will assess the costs and benefits of different renewable energy technologies (solar, wind, bioenergy, etc.), including their potential for penetration and optimal scale of deployment. To this end, an assessment of technical and economic renewable energy potential by technology is required to outline future scenarios with increased shares of renewable energy. There is also a need to comprehensively assess current energy infrastructure, focusing on aspects such as the country's power grid and the investments needed for grid upgrades.

The development of long-term energy scenarios could help address the issue of integrating variable renewables into the power grid in the medium - to long-term, thereby allaying the technical concerns of generators, grid operators and distributors. More insights are included in IRENA's report, *Planning for the renewable future: Long-term modelling and tools to expand variable renewable power in emerging economies* (IRENA 2017).

Current status: As part of national power sector planning, the country has been carrying out assessments to account for energy demand growth, the supply network, scheduling and dispatch. In line with renewable energy development, efforts are underway to identify zones with high potential and assess the infrastructure needed to ensure smooth integration into the power system.

Action 7: Adopt a long-term renewable energy target

While Azerbaijan has already approved a renewable energy target for 2020, a robust target for the 2030 horizon and possibly beyond could offer more long-term clarity for the private sector and investors as well as encourage the development of new projects. Targets enhance the transparency of the policy-making process by providing a common information base to all stakeholders, thereby fostering public support.

When backed by supportive policy and investment frameworks, targets can be instrumental in indicating the envisioned trajectory of market growth, thereby helping to anchor medium and long-term expectations. By giving a sense of trajectory and growth, they can also contribute to lowering deployment costs and establishing a supply chain utilising local industry (see IRENA's report, *Renewable energy target setting*, 2015a).

Policies supporting renewable energy development adopted by countries around the world are mostly focused on the power sector, with relatively few countries providing support for renewables in end-use sectors. To realise the potential of renewables across sectors, targets need to be set across heating, cooling, transport and power.

Current status: Beyond the 420 MW target for 2020, the government is considering a longer-term target to increase the share of renewable energy in power generation up to 30% by 2030. To achieve these ambitious targets for 2020 and 2030, the implementation of auctions has been identified as the main priority.

4.5. Grid regulation for renewable energy

Grid codes set the rules and technical requirements for power system and energy market operation. They serve dual policy goals: on one hand, they provide assurances of reliability, quality and security of supply; while on the other, they create technical conditions for the gradual growth of variable renewable energy. Azerbaijan faces challenges related to technical regulation for the grid connection of renewable power generation units. There is currently no applicable grid code in place which defines the technical requirements for the integration of renewable energy and provides a reference point for renewable power generators.

From the perspective of the grid operator in Azerbaijan, the variable nature of some renewable energy resources – such as wind and solar PV – creates a challenge for their integration into the grid, thereby slowing down the development of renewable energy. Rules for acquiring grid connections, grid codes, dispatch priorities and curtailment compensation are some of the critical issues that may affect early projects in the development of a national renewable energy programme.

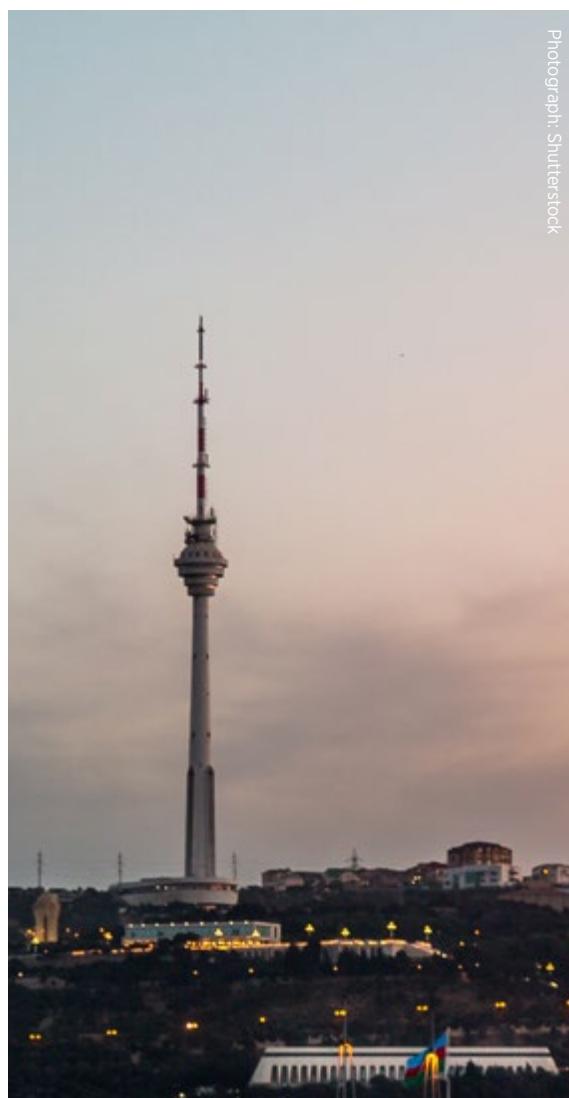
Action 8: Develop and implement a grid connection code with standards for variable renewable energy integration

The Government of Azerbaijan could provide a mandate to relevant organisations to develop a grid connection code for VRE in consultation with all relevant actors. The function of a grid connection code including variable renewable energy is to provide technical requirements for wind and PV plants when connecting to a country's electricity grid. This helps in ensuring the quality and standardisation of equipment, and the fair treatment of generators and operators concerning grid connection, while also maintaining system stability and reliability.

The establishment of a country-wide grid code could improve overall grid management, creating positive effects on the development of renewable energy by reducing the perceived technical risks for investors and developers. This may also facilitate regional integration and enhance electricity exports, which is relevant for Azerbaijan, given its overcapacity of electricity generation.

The process of developing a national variable renewable energy grid code includes number of elements, such as preparation of technical studies, data collection and assessment of country-specific aspects, as elaborated in IRENA's report, *Scaling-up variable renewable power: The role of grid codes* (IRENA 2016a).

Current status: The Ministry of Energy, with the support of EBRD and the involvement of a consulting firm, has implemented a project, "Strengthening the grid to support renewable energy projects in Azerbaijan", to identify potential of renewable energy resources and opportunities for integrating them into the grid.



Photograph: Shutterstock

4.6. Technical knowledge and raising awareness

While Azerbaijan has made initial inroads into developing local capabilities in renewable energy, the scale of planned renewable energy development (in line with the 2020 target and beyond) requires a broad and deep understanding of the full life cycle of renewable energy projects and the associated knowledge and skill requirements. In Azerbaijan, there is a limited existing skill base in the areas of renewable energy policy making, technologies, and technical and project development. Moreover, the wider public is not fully aware of the range of benefits offered by renewable energy.

Given the targets set by the government for renewable energy uptake, substantive efforts are needed to build capacity and develop skills among employees of the central government and local institutions (e.g. financial entities). Raising awareness of policy and regulatory fundamentals for renewable energy and its benefits in terms of economic and social development in Azerbaijan is an important element in scaling up renewables.

Private sector stakeholders interested in entering the renewable energy market could benefit from capacity building relating to the latest technology developments and future trends, as well as business models and case studies from abroad. Azerbaijan's existing training facilities, such as the Gobustan Experimental Polygon and Training Centre, could be leveraged for this purpose. Institutes of higher learning may also be encouraged to offer courses on topics related to renewable energy.

Efforts are needed to build capacity and develop skills among government employees

Action 9: Raise awareness and develop a capacity-building strategy

The government could plan a long-term programme of activities to increase general awareness and capacity on renewable energy, targeting state institutions, local enterprises and citizens. Such a programme could also integrate certifications in training curricula, with a focus on building local operation and maintenance skills to enhance employment opportunities.

Government institutions could benefit from specialised capacity building on renewable energy policy and regulation, and evaluation techniques for renewable energy projects. For the private sector, courses could be offered explaining opportunities for setting up renewable energy enterprises, including information on available government support schemes and partners. Additionally, certification and training on various renewable energy applications and related technologies for both power and non-power uses could be useful.

Greater awareness of the benefits of renewable energy and how these apply to the overall economic situation in Azerbaijan could be helpful among the wider public. An awareness campaign could be organised through a series of information activities, especially in regions with high potential for renewable energy development. In addition, various other formats could be designed to raise awareness, such as campaigns on social media, competitions and challenges for students in schools, higher institutes of learning and universities, as well as local events in selected towns and cities.

Current status: The Ministry of Energy and the SAARES implement activities on an annual basis to raise public awareness about the use of renewable energy and the production of carbon-free electricity. Furthermore, the Ministry of Energy is strengthening its co-operation on renewables with international private companies and partners to promote investments. The growing number of signed memoranda of understanding (MoUs) between the Ministry of Energy and foreign partners is a clear indication of the strong interest in developing renewables in Azerbaijan. Throughout 2018 and 2019, a series of consultative events was held on the theme "Public-private partnership in the development of renewable energy legislation", with the objective of obtaining feedback from stakeholders, including international companies, financial institutions and local stakeholders, on the proposed legislation process.

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Annex 1: Overview of entities in the energy sector

INSTITUTIONS AT GOVERNMENT LEVEL	
Ministry of Energy	The Ministry is responsible for the design and implementation of state policy and regulation in the energy sector, mainly concerning natural gas production, transportation, processing, distribution and supply; electricity generation, transmission, distribution and supply; and energy saving and energy efficiency. Moreover, the Ministry controls relevant state-owned enterprises.
Tariff Council	This is the implementing body for energy prices, service fees and collections across all regulated entities in the economy. The Council is chaired by the Ministry of Economic Development and has 12 members.
State Agency on Alternative and Renewable Energy Sources (SAARES)	SAARES was established following a Presidential Decree on July 16, 2009, and was subsequently tasked with driving the development of the country's renewable energy resources and related projects. The status of the Agency was altered by a Presidential Decree No. 464 of 14 January 2019.
Energy Regulatory Agency	This recently established Agency (December 2017) is the Public Legal Entity under the Ministry of Energy in charge of bringing utility services in line with the requirements of the market economy; achieving sustainable development by further improving control mechanisms; maintaining transparency and flexibility in energy supply; and ensuring accessibility of these services for entrepreneurs.
STATE BODIES AND INSTITUTIONS	
Azerenerji JSC	Electricity generation and transmission.
Azerishiq JSC	Electricity distribution and supply.
Azeristiliktehizat JSC	District heating.
State Oil Company of Azerbaijan Republic (SOCAR)	SOCAR is involved in all aspects of the petroleum industry associated with prospecting, exploration and development of oil and gas fields; preparation for refinery and transportation of oil and gas condensate; and oil-chemistry products in onshore and offshore areas of the Republic, as well as the sale of their derivatives in domestic and foreign markets. SOCAR is able to meet the demand of the Republic for oil and oil-chemistry products and exports to international markets.
Azerigas	Natural gas extraction, processing, transmission, distribution and supply.
State Energy Agency of the Nakhchivan Autonomous Republic of Azerbaijan	Electricity generation, transmission, supply and distribution in the territory of the Nakhchivan Autonomous Republic of Azerbaijan (regional energy exchanging with Turkey and Iran).
Azalternativenergy LLC	Under the structure of the State Agency on Alternative and Renewable Energy Sources, this 100%-state-owned company was established to implement renewable energy projects; generate, transmit and distribute electricity from alternative and renewable energy; and provide construction and engineering services to both the government and the private sector.
PRIVATE ENERGY COMPANIES	
Private small hydropower stations	Electricity generation and sale.
Private wind power stations	Electricity generation and sale.
Tamiz Shahar JSC	Electricity generation from municipal waste.

Annex 2: Technical assistance projects in the renewable energy sector

PROJECT FOCUS	DONOR	BENEFICIARY
Support for the development of the Long-Term Energy Strategy of Azerbaijan (inception phase).	European Commission, EU4ENERGY, Energy Charter Secretariat	Ministry of Energy
Support for developing a draft law on the electricity market compliant with the EU Third Energy Package.	USAID	Ministry of Energy
Development of the legal and regulatory framework for the expansion of the renewable energy sector.	European Commission	Ministry of Energy
Development of the legal and regulatory framework for the expansion of the renewable energy sector.	EBRD	Ministry of Energy
Support for the implementation of renewable energy auctions in Azerbaijan.	EBRD	Ministry of Energy
Regional TA project on improving energy statistics and policy developments in the countries of Eastern Europe, the Caucasus and Central Asia.	European Commission, IEA	State Statistical Committee, Ministry of Energy
"Azerbaijan: Preparing a Power Sector Financial Recovery Plan" TA project.	ADB	Ministry of Energy, Ministry of Finance
Support for the establishment of an independent energy regulator governing internal energy (electricity and gas) markets and preparation of the draft law "On Independent Energy Regulator".	EBRD	Ministry of Energy, Energy Regulatory Agency
Grid code development.	ADB	Ministry of Energy





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