Monitoring Energy Transitions in Eurasia: Analysis and Policy Implications

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Monitoring Energy Transitions in Eurasia (Azerbaijan, Kazakhstan, Kyrgyzstan, and Ukraine): Analysis and Policy Implications

Final Report

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Acronyms and Abbreviations

ADB – Asian Development Bank
AERA - Azerbaijan Energy Regulatory Agency
CHP – combined heat and power plant
COP26 – United Nations Climate Change Conference 2021
EBRD – European Bank for Reconstruction and Development
EITI – Extractive Industries Transparency Initiative
ENTSO-E – European Network of Transmission System Operators for Electricity
FDI – foreign direct investments
FiT – feed-in tariff
FSC – Financial Settlement Center [in Kazakhstan]
GHG – greenhouse gases
GKPEN – State Committee on industry, energy and natural resources of the Kyrgyz Republic
HPP – hydroelectric power plants
IEA – International Energy Agency
KEGOC – Kazakhstan Electricity Grid Operating Company
MoE – Ministry of Energy
MW – megawatt
NDC – Nationally Determined Contribution
NEURC – National Energy and Utilities Regulatory Commission of Ukraine
NNEGC – National Nuclear Energy Generating Company of Ukraine
NPP – nuclear power plant
PPA – power purchase agreements
PV – Photovoltaics (PV)
RE – renewable energy
RES – renewable energy sources
RISE – Regulatory Indicators for Sustainable Energy (World Bank)
SAEE – State Agency for Energy Efficiency and Energy Saving of Ukraine (SAEE)
SOEs – state-owned enterprises
TWh – terawatt hours
UAH – Ukrainian hryvnia (national currency)
UNFCCC - United Nations Framework Convention on Climate Change

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Executive Summary

Post-Soviet countries have embraced the energy transition discourse, but how well did they perform so far? And what policy lessons can be learnt from their experiences? This report provides an overview of the status of non-conventional renewable energy sources (such as geothermal, wind, solar, biomass and small hydroelectric plants (IEA/IRENA 2019)), renewable energy targets and legal and regulatory frameworks adopted in four post-Soviet countries: Azerbaijan, Kazakhstan, Kyrgyzstan, and Ukraine. In addition, the report identifies gaps in state support and promotion of renewable energy projects in each individual country and offers some policy suggestions.

Key findings and policy recommendations can be summarized as follows:

1. ***Structural Barriers***: Persistence of legacy infrastructure inherited from the Soviet era will likely continue. Examples include coal-fired thermal plants in Kazakhstan and Ukraine, natural gas-based electricity generating plants in Azerbaijan and Kazakhstan. Change is difficult due to a considerable sunk cost in the inherited infrastructure and fossil fuel-linked vested interests seeking to maintain the status quo.
2. ***Outlook***: The phasing out of conventional energy sources and their replacement with non-conventional renewables is going to be prolonged process. As elsewhere in the world, a radical transition to non-conventional renewables is unlikely. Renewables will be introduced incrementally.
3. ***Hydro***: Most renewable gains come from hydropower. While hydro is carbon neutral, large hydroelectric plants in Kyrgyzstan require huge capital investment for renovation. Large hydro also has negative environmental impacts.
4. ***Policy Support Schemes***: The four countries use different policy support schemes for non-hydro renewables: Feed-in tariffs (Kazakhstan and Ukraine), auctions (Kazakhstan), and public investments (notably Azerbaijan and Kazakhstan), and none of these (Kyrgyzstan). Ukraine is so far a leading country on the share of non-hydro renewables (wind and solar generated some 6.6% of total electricity in 2020), and it is also one of the earlier adopters of renewable technology and has an elaborate legislative framework. This indicates some positive link between the quality of a country's legislative framework, on one hand, and the pace and extent of its renewable expansion, on the other.
5. ***Implementation Gaps***: In all four cases (except for Ukraine), significant gaps (and lags) are observed between the approval of renewable laws and their realization in practice. Implementation of a new rule or regulation is often delayed (Azerbaijan, Kazakhstan) or is not followed through at all (as in Kyrgyzstan).
6. ***State Intervention***: As Ukraine's relatively more successful case demonstrates, creating a favorable enabling environment for private renewable companies is more effective and efficient than excessive state intervention, an approach favored by Azerbaijan. The role of the state needs to be limited to setting clear rules and offering policy support.
7. ***Quality of Governance***: In Ukraine, EU integration-driven deeper energy sector reform contributed to better governance of its power sector. In both Azerbaijan and Kazakhstan, weaker accountability and oversight mechanisms in policy implementation raise the risks of corruption. A stronger engagement of civil society groups can address some of the accountability issues.
8. ***Just Transition***: Countries planning to phase out coal (e.g. Ukraine) need to address social justice issues concerning loss of jobs for mining sector employees and other impacts. Here too civil society organizations can play a more active role.

1. Introduction

The global energy system is undergoing a major socio-technical transformation – dubbed the "energy transition" – driven by climate change concerns and innovations in renewable energy technologies (Singh et al. 2019). In 2015, world leaders signed the historic Paris Agreement on climate change, which set forth binding commitments to reduce greenhouse gas (GHG) emissions in an effort to limit global warming to well below 2 °C (United Nations 2015). The European Union, Germany, the UK and many other countries as well as several major companies set net-zero emissions targets by 2050. On April 22, 2021, the Biden Administration announced a national target of cutting GHG emissions by up to 52% by 2030. On July 14, 2021, the European Commission adopted a set of policies – commonly known as the EU Green Deal – to cut GHG emissions by 55% compared to 1990 levels. To meet these ambitious targets, additional efforts are required to limit global CO_2 emissions to net zero by around 2050 (Welsby et al. 2021).

Over the past decade, investments in clean technologies have enabled the development and expansion of renewable energy capacity at fast pace. Here are some impressive figures:

> "Globally, the number of electric vehicles on the road has jumped from 17,000 in 2010 to more than 7.2 million today. The installation of solar power went from 290 megawatts (MW) in 2001 to around 100,000 MW in 2020 (World Economic Forum (WEF) 2021, 33).

Most definitions agree that the current energy transition is a shift in the use of primary fuel and technology, but extends beyond the source of fuel. Smil (2010, vii) defines *energy transition* as "the change in the composition (structure) of primary energy supply, the gradual shift from a specific pattern of energy provision to a new state of an energy system". The current energy transition can thus be defined as a regime shift from the energy system based on fossil fuels and nuclear energy to one powered by renewable energy sources (RES) such as wind, solar, and biomass (Strunz 2014). Moreover, the ongoing energy transition pursues two key inter-related goals: the expansion of renewable energy sources and the reduction of greenhouse gas emissions (Lindberg, Markard, and Andersen 2019).

Scholars of the so called "transition studies" have identified three main analytical dimensions of a sociotechnical transition: actors, technologies and institutions (Geels 2004). Accordingly, a systemic transition can be conceptualized as a series of interdependent changes in each of these sets of dimensions (Lindberg, Markard, and Andersen 2019).

Alongside the term "energy transition", the concept of "just transition" has gain traction in academic literature and policy circles in the context of discussion of low-carbon transitions and mitigation of climate change. This concept seeks to capture important socio-economic and political dimensions associated with the shift to a low-carbon economy. The concept broadly captures the social and environmental justice dimensions of clean transitions and more specifically seeks to capture the costs and impacts of decarbonization such as job losses associated with the phasing out of carbon-intensive industries.

As Newell and Mulvaney (2013, 134) put it, "where job losses are unavoidable, adequate support would be needed for people and sectors that stand to lose out as a result of decarbonising the economy through compensation and retraining for new employment opportunities. It would also ensure that new jobs created in low-carbon sectors provide 'decent' jobs". In a similar vein, Publish What You Pay (PWYP 2021) notes that a low-carbon energy transition should be "people-focused" emphasizing that the phasing out of fossil fuels and their replacement with non-carbon or low-carbon energy sources should take into account its impacts on the communities and needs to be "an

economically fair and socially just transition … that addresses the needs of every community, worker and country that depend on the fossil fuel industry".

Moreover, the energy transition implies a move to a net-zero emissions energy system. Not all energy sectors lend themselves readily to deep decarbonization. While energy services such as heating, lighting and cooling seem relatively easy to decarbonize through electrification from renewable sources, other energy sources with high carbon intensity and emission levels that are deemed difficult for electrification include aviation, long-distance transport, and shipping, production of steel and cement (Davis et al. 2018).

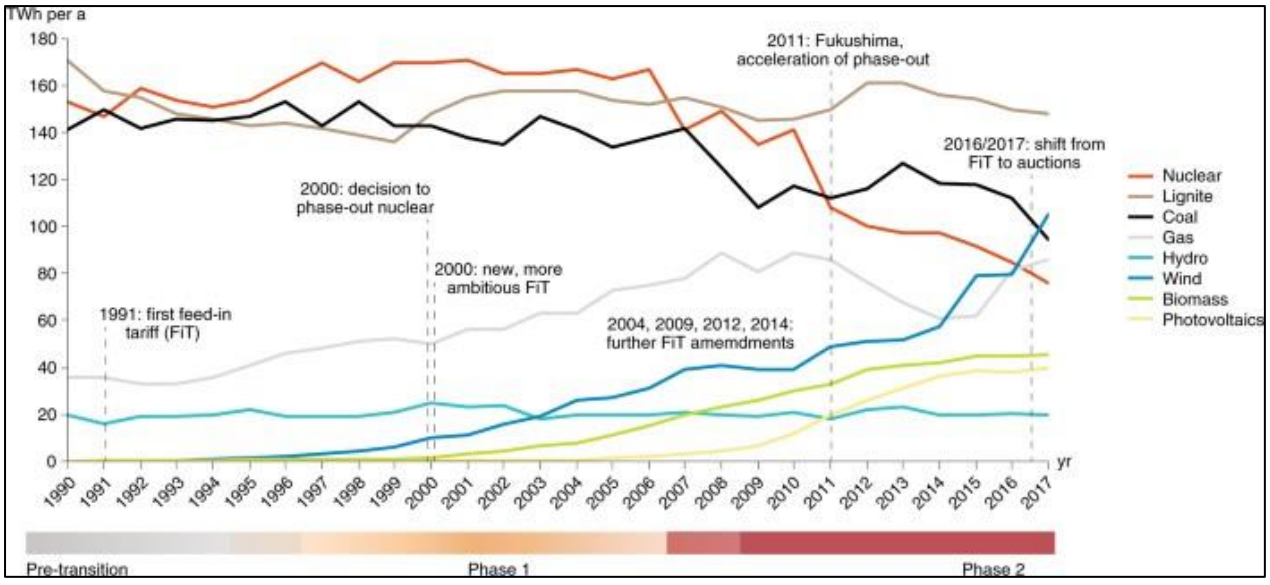
The German Experience as Best Practice

Much of the extant research on energy transitions is inspired by the German experience known as "*energiewende*" ("energy transition", lit: Wende = turn, turnaround). *Energiewende* is the German government's concerted effort to shift to low-carbon, renewables-based energy system. This process comprises the two interrelated steps: phasing out of nuclear and fossil fuels in electricity generation and their replacement with renewables including wind, solar photovoltaic (PV), biomass and hydro (Von Hirschhausen 2014).

The *energiewende* agenda sets out to achieve three goals: 1) to increase the share of renewables; 2) to set GHG [greenhouse gas] emission reduction targets; and 3) to phase out nuclear. To meet these goals, long-terms targets had to be translated into concrete policy actions. In 2016, Germany (2016) adopted "The Climate Action Plan 2050", which outlines the German government's ambitious climate mitigation policy. Germany sets to become greenhouse gas-neutral by 2050.

Greater use of electricity is seen as one key area for deep decarbonization. While countries are moving towards a low-carbon future at different pace, clean technology has spread across countries with countries like Norway leading on EVs, Denmark, Ireland, and Germany on wind power (Fleming 2019), and China on electric buses (Hanna and Victor 2021). Germany managed to increase the share of renewables in power generation from below 2% in 2000 to more than 30% in 2017, while the share of nuclear energy fell from 31% to 12% (see Figure 1.1).

Figure 1.1. Key Developments in the German Energy Transition



Source: adapted from Markard (2018)

Measuring "Energy Transition"

The World Economic Forum's (WEF) Energy Transitions Index (ETI) is perhaps the best known among existing measures of energy transition. The ETI is a composite of scores of two sub-indices: the system performance and its enabling environment (also known as "transition readiness") (Singh et al. 2019; WEF 2021). A country's energy system and its progress is measured along 39 indicators, and ranking is performed on a 100-point scale.

One of the indicators used in constructing the ETI is related to regulatory frameworks. However, it is not sufficiently comprehensive and only looks at the extent to which a country's regulatory policy framework supports energy efficiency measures. Moreover, aggregating multiple variables into two scores (later combined into one score) generates issues with measurement validity. For example, a country's relatively high (or low) standing on energy security, human capital or economic growth is not necessarily an indicator of that country's performance on the low-carbon energy transition.

Table 1.1. Renewable Energy Indicators for Azerbaijan, Kazakhstan, Kyrgyzstan, and Ukraine, 2019

(Regulatory Indicators for Sustainable Energy (RISE))

Indicators (out of max. 100)	**Azerbaijan**	**Kazakhstan**	**Kyrgyzstan**	**Ukraine**
Legal Framework for Renewable Energy	80	60	60	100
Planning for RE expansion	58	35	4	80
Incentives and regulatory support for RE	6	35	27	45
Attributes of financial and regulatory incentives	8	33	33	58
Network connection and use	6	64	47	64
Counterparty risk	17	79	23	66
Carbon Pricing and Monitoring	0	100	0	50
Overall score (out of 100)	**25**	**58**	**28**	**66**

Source: World Bank, RISE 2020, https://rise.esmap.org/

The World Economic Forum's ETI regulation-related performance is captured by World Bank's (2020) Regulatory Indicators for Sustainable Energy (RISE). RISE is a composite of four dimensions: electricity access, clean cooking, renewable energy (RE), and energy efficiency. Of these, RE is relevant to the goals of this study, especially an indicator called "Legal framework for renewable energy [RE]".

While RISE is generally a useful guide, it does not provide a through and detailed analysis of a country's energy system in its specific political-economic context. For example, it neglects an in-depth understanding or diagnosis of specific needs, constraints and obstacles as well as various stakeholders' positions and interests on a path to low-carbon future. A more careful and nuanced assessment would require a mapping of the relative power of various actors: veto players, vested interests, and RE advocates. Moreover, RISE does not look into the government's commitment and action such as through adoption of a well-coordinated policy plan, i.e. if there a Climate Action Plan, specific targets, mechanisms of implementation and oversight, accountability and compliance reporting.

Ideally, a good index would cover some of the following questions (Lindberg, Markard, and Andersen 2019): whether public policies specify renewable transition targets; the level of funding

for renewables R&D; whether the government provides support for specific clean technologies; and whether there are plans with regards to phasing out of unwanted technologies such as nuclear or coal.

Renewable policy support schemes include, among others, feed-in tariff (FiT), renewable quotas as well as public investment and auction mechanisms (Ecofys and GIZ 2012). A ***feed-in-tariff*** is based on the guaranteed payment of a fixed, minimum price for kilowatt-hour (kWh) of energy produced from RES (Couture and Gagnon 2010). ***Renewable quotas***, also known as renewable portfolio standards, are the minimum share of RE in the electricity mix of power utilities. For example, renewable quotas are used extensively in China where provinces and municipalities are mandated to produce a fixed share of energy from RES (Wan and Tong 2018). ***Public investment*** is another form of RE support whereby the state provides direct funding to RE projects. Direct public investment is generally viewed as less efficient than a competitive market structure and its applicability thus needs to be limited to the early stages of RE deployment (Ecofys and GIZ 2012). Finally, ***public competitive bidding*** (also called auctions) is a support scheme in which RE companies win purchase contracts based on competitive bids. Auction schemes guarantee winners stable, long-term revenue streams and have the advantage of reducing energy prices (Elizondo-Azuela and Barroso 2012). Table 1.2 presents the advantages and disadvantages of various policy support instruments.

Table 1.2. Policy Support Schemes for Renewable Energy

	Advantages	**Disadvantages**
Feed-in Tariff (FiT)	high effectiveness; high investment security; strong market dynamics	higher electricity prices; difficult policy design
Renewable Quotas	strong market orientation; less government intervention; easier policy design than FiT	lower effectiveness than FiT; not necessarily cheaper than FiT
Public Investment	facilitates investment in RE projects	generally less efficient than private sector engagement
Public Competitive Bidding/Auctions	strong market orientation; competitive prices; check on capacity addition	applicants may bid too low to win the tender; may lead to non-completion of project

Source: adapted from Ecofys and GIZ 2012, p. 23.

Aims of this Study

In tackling climate change, the world is gradually shifting away from fossil fuels towards the adoption of low-carbon energy sources (such as solar, wind and hydro) and green technology (green tech). While most oil and mineral-rich countries in post-Soviet Eurasia have taken steps to increase the share of renewables in their respective energy mixes, there still remain gaps between government pledges and implementation of concrete energy transition policies (see e.g. Shadrina 2020; Laldjebaev et al. 2021; Karatayev et al. 2021). Notably the existence of implementation gaps cast doubt on the capacity of these states to meet their declared renewable and carbon emission

reduction targets. This study aims to explore these gaps by elaborating an analytical framework and applying it to monitor countries' performance on a low-carbon transition and to track their progress on adoption and implementation of relevant legislative and regulatory frameworks in relation to renewables development.

The study covers four post-Soviet countries of Azerbaijan, Kazakhstan, Kyrgyzstan, and Ukraine with variable progress on the renewable expansion. All four countries share some similarities such as legacies of the post-communist planned economy, the dominance of state-owned enterprises, weak rule of law and their continued reliance on infrastructure and management standards inherited from the Soviet era. However, they display a substantial degree of variation on the number of resource-related variables such as resource availability, composition of the national energy mix, as well as the pace of a transition to renewable sources.

As Table 1.1 shows, these countries show a striking variation on their performance on regulatory indices on renewable-related regulation and governance frameworks as measured by World Bank's 2020 RISE Index. On the 100-point scale of regulatory indicators, scores range from 66 (for Ukraine) to 25 (for Azerbaijan). These differences are particularly noticeable at a more disaggregated level of the dataset. For example, on the component of planning for renewable energy expansion, Ukraine is ranked the highest with a score of 80 whereas Kyrgyzstan has the lowest score of 4 (out of 100).

The report is organized as follows: each country chapter starts with a brief summary of its energy mix, renewables potential, and recent developments with respect to renewable projects. This is followed by an outline of its international climate commitments and renewable targets. It then delves deeper into an individual country's legal and regulatory framework. Finally, it examines a set of political-economic factors enabling, slowing down or blocking energy transitions in the given country-specific context including key stakeholders and their positioning on the adoption of renewables and implementation of RE-related policies (see Annex A for the Expert Questionnaire).

2. Azerbaijan

Executive Summary

As a traditional producer of oil and natural gas, Azerbaijan has abundant – albeit gradually shrinking – hydrocarbon reserves to tap into to meet its energy supply needs. Its entire energy supply and electricity generation system is built around domestically-sourced and relatively affordable sources of natural gas and oil (but no coal). In Azerbaijan, as in other oil-rich countries with legacy fossil fuel infrastructure (such as gas-fired power plants), there is a weak demand for a radical shift to low-carbon sources.

In addition, state domination of the national energy market and its incomplete liberalization implies high barriers to the entry for potential RE private companies. For example, there is a total of 57 thermal power plants operating in Azerbaijan, and 50 of them are state-owned. The electricity sector is dominated by two vertically-integrated companies, *Azerenerji* (generation and transmission) and *Azerishiq* (distribution) (Energy Charter 2020). Excessive political centralization and the dominant role played by state monopolies are seen as key obstacles to developing renewable-sourced electricity generation capacity in Azerbaijan (Ahmadov 2021).

With respect to the legislative framework, it took a long time for the government to adopt a separate law on renewables. The draft law on RES that had been long in the making was finally adopted in May 2021 (Law on Renewable Energy Sources, 31 May 2021), and it is yet to be seen how effectively it will be implemented. If the government is to meet its 30% renewable target by 2030 a more robust government action is needed to accelerate the deployment of renewables. The regulatory structure tasked with the promotion of RES – the Agency for Renewable Energy Sources under the Ministry of Energy [MoE] – is viewed as insufficiently empowered to change the status quo or to have a meaningful say in setting the energy transition agenda.

Change in the policy discourse in recent years is likely to be a response to shifts in the global energy markets. The sharp drop in world oil prices in 2014 appears to have prompted the government to look for non-hydrocarbon energy sources to diversify its supply. In 2020, following the Second Karabakh War and recapture of much of its previously occupied territories, the authorities in Baku announced plans to convert those territories into a green zone with the help foreign investment. The ongoing global energy transition pushes the government to prioritize RES in the medium term, although official statements seem to be contradictory. For example, on the one hand, the MoE of Azerbaijan, talks about the adherence to international obligations on climate change and the need to accelerate decarbonization efforts, but, on the other hand, the MoE announced that the fossil fuel era is not over yet and that Azerbaijan has no intent to fully abandon conventional oil and natural gas (Ministry of Energy 2021).

For a traditional fossil fuel producers (Azerbaijan included), there appears to be no sense of urgency to shift to renewables. While the government took some initial steps to acquire clean energy technology, such as solar panels and wind turbines, to tap into its considerable RES potential, there has been a considerable lag in adopting an appropriate legislative framework. Similarly, the status and jurisdiction of the regulatory body for RE has underwent frequent changes indicating policy inconsistency and uncertainty. A great deal of instability in the policy environment, top-down decision making without civil society engagement and lags in introducing relevant legislation have delayed the effective deployment of renewables.

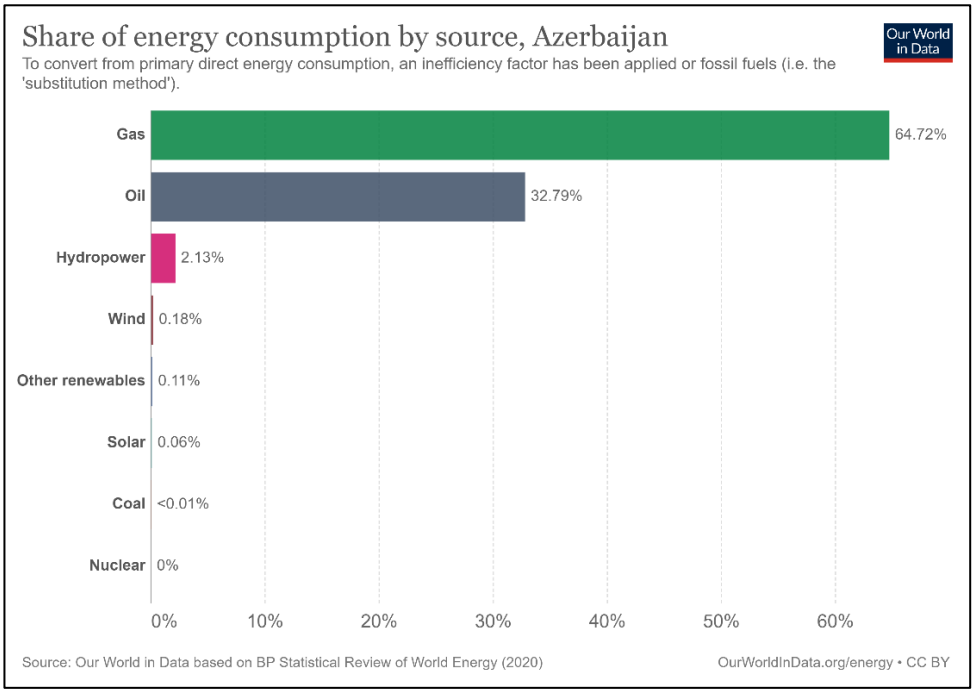
Although there is more talk of RES now than a decade ago, the energy transition has not yet become a policy priority on the government's agenda. The main obstacle to a successful energy transition is the existing energy management system dominated by state-owned companies. Unlike countries with a relatively liberalized market economy where private RE companies act as the driving force for a low-carbon transition, Azerbaijan with its state capitalist system (Guliyev 2020a) lacks

institutionalized private sector mechanisms needed to attract capital and technological innovation into domestic RE development.

Background

Azerbaijan is a traditional oil producing country where the oil and gas industry dominates the economy and provides most of the country's energy supply. Importantly, the oil and gas sector is the key pillar of the government's export earnings and fiscal revenue. As of 2019, Azerbaijan's energy mix (total energy consumption) had the following distribution: natural gas (65%), oil (33%), and hydropower (2%) (Our World in Data Azerbaijan Energy Profile 2020) (See Figure 2.1). In other words, fossil fuels account for 97.5% and low-carbon sources for just some 2.5% of all energy consumption.

Figure 2.1. Energy Consumption by Source in Azerbaijan, 2019
Fossil fuels (gas and oil) are the dominant sources of energy in Azerbaijan accounting for 97.5% of the country's energy mix.

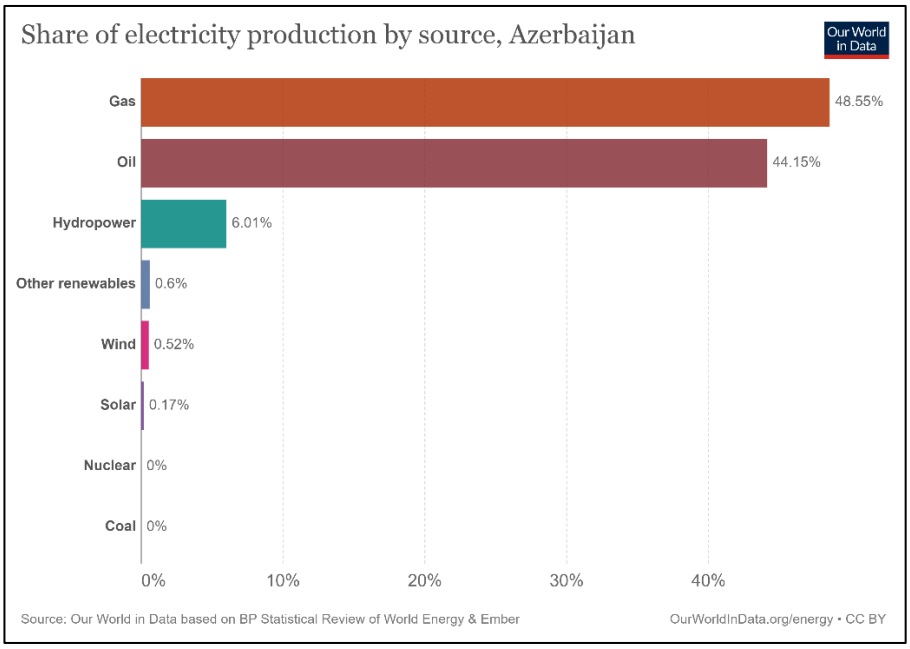


Source: Our World in Data Azerbaijan Energy Profile 2020, https://ourworldindata.org/energy/country/azerbaijan#what-sources-does-the-country-get-its-energy-from (accessed October 2021)

The share of renewables is higher in total electricity generation and is made up of the following sources: fossil fuels stand at 92.7% (including 48.5% [gas], 44% [oi]) while renewables (hydropower – 6%, wind – 0.5%, solar – 0.17%) account for 7.3% of total electricity (Our World in Data 2020) (see Figure 2.2). The country's rich potential for renewables remains largely untapped (Vidadili et al. 2017). Estimates of renewable energy potential suggest 23 GW of solar, 3 GW of wind, and 380MW of biomass of RES in Azerbaijan (Energy Charter 2020).

Figure 2.2. The Share of Electricity by Source in Azerbaijan, 2019

Around 93% of electricity is fossil fuel-sourced, while 7% of the country's electricity comes from low-carbon sources.



Source: Our World in Data Azerbaijan Energy Profile 2020, https://ourworldindata.org/grapher/share-elec-by-source?time=latest&country=~AZE (accessed October 2021)

The government has made strides to acquire RE technology reflected in the Presidential Order No. 1209 dated 29 May 2019 on the "Acceleration of Reforms in the Energy Sector" and the Order of the President of the Republic of Azerbaijan No. 1673 dated 5 December 2019 on the "Implementation of Pilot Projects in the Field of Use of Renewable Energy Sources". In January 2020, agreements on the first pilot projects in renewable energy were signed with Saudi Arabia's ACWA Power and Abu-Dhabi's state-owned renewable company Masdar (Ministry of Energy 2020b). The first agreement (with ACWA) is for the construction of a 240MW wind plant, and the second one (with Masdar) is a plan to build of a 230 MW solar power plant worth US $200 million. Electricity generated at the plant will be purchased by Azerenergy OJSC.

In Azerbaijan, as of 2017 the total installed renewable power capacity amounted to 1267 MW (hydro: 1132 MW, solar: 35 MW, wind: 62 MW, and biomass: 38 MW) (IRENA 2019, 18). Largest RE projects are Azerishiq-owned 50 MW Yeni Yashma wind farm in Khizi (north of Baku) commissioned in 2018 and a 22 MW solar power plant in Nakhchivan (Yusifov 2018).

Climate Policy and Renewable Energy Targets

Azerbaijan joined the UNFCCC in 1995 and ratified the Kyoto Protocol in 2000 (EIA 2021). In October 2016, Azerbaijan ratified the Paris Agreement and pledged to reduce its GHG emissions by 35% by 2030 compared to the 1990 base-year level (NDC Azerbaijan 2017). At the 2021 United Nations Climate Change Conference (referred to as COP26), Azerbaijan announced its goal to reduce GHG emissions by 40% by 2050 and to create a "zero-emission zone in the liberated territories in Karabakh" (Azerbaijan COP26 Statement 2021).

To achieve this goal, the government set a target to increase the share of renewables in electricity production to 30% by 2030. Works are under way to commission power plants based on RES with a capacity of 440 MW in 2020-2022, 460 MW in 2023-2025, and 600 MW in 2026-2030 (Ministry of Energy 2020a). The government's "green energy zone" plan for reclaimed territories in Karabakh include the development of green agriculture, construction of smart cities and the rehabilitation of large areas of forests (Azerbaijan COP26 Statement 2021).

While the NDC outlines mitigation measures including, among others, the "development of legislative acts and regulatory documents", there is no comprehensive national climate action plan or strategy outlining concrete steps to achieve the specified quantitative targets, neither the NDC targets seem to be mandatory (IEA 2021). Azerbaijan has not adopted a net-zero target and associated timeline to meet it.

Legal and Regulatory Framework

This section outlines some of the key legal acts governing renewable energy development in Azerbaijan. An important first step was the adoption of the State Program on the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan approved by Presidential Order No. 462, dated 21 October 2004. In 2011, Presidential Decree No. 1958 "Concerning the Development of the State Strategy for the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan for 2012–2020" was approved by the president with the aim to produce the "State Strategy on the Use of Alternative and Renewable Energy for the 2012–2020 period" (Nasibov 2021). In 2016, President Ilham Aliyev signed a decree to approve "Strategic Road Maps for the National Economy and Main Economic Sectors"(SRM), which outlined the short-, medium- and long-term goals for the development of the economy and eleven key sectors including the priorities for the development of the renewable energy sector (Farajullayeva 2019).

Until spring 2021, Azerbaijan did not have separate laws on renewable energy or energy efficiency (IRENA 2019; Bayramov 2021). Following 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 (IRENA 2019). The law was finally approved in 2021.

Azerbaijan is still developing a feed-in tariffs [FiT] framework viewed as a key policy tool at the initial stages of RE development. It lags behind on the introduction of auctions for RES procurement. Auctions are introduced as RE market matures to allow for the procurement of RES at market-based prices (IRENA 2019).

Moreover, Azerbaijan lacks a specific regulatory framework for the development of RES except for purchase tariffs for RE-generated electricity (Energy Charter 2020). Much of activity in developing RE-related legislative and regulatory framework is carried out in cooperation with donor organizations: with EBRD on implementation of RE auctions and with the Asian Development Bank (ADB) on the construction of the first floating solar photovoltaic (PV) plant (Energy Charter 2020).

The Presidential Decree No. 182 of 2009 established the State Agency on Alternative and Renewable Energy Sources (SAARES) as part of the Ministry for Industry and Energy. The Agency commenced operating in 2010 (IEA 2021). In 2012, SAARES was abolished and the State Company on Alternative and Renewable Energy Sources was established on its basis. The status of the Agency was altered several times. In September 2020, the Decree No. 1159 of President of Azerbaijan established the Azerbaijan Renewable Energy Agency under the Ministry of Energy and the Charter of the Agency was approved. The Agency is in charge of "the arrangement and regulation of

activities in the field of renewable energy sources and their efficient use in Azerbaijan, and is involved in the implementation of state policy" (Ministry of Energy website).

Analysis and Policy Implications

While the legislative mechanism provides a policy and legislative framework for RE development, it is uncertain whether the inauguration of the relevant framework will be enough to meet the ambitious climate mitigation and renewable energy transition targets the government set out to achieve. The existing system of governing RE is excessively hierarchical and centralized with the state playing a leading role (Ahmadov 2021). Ideally, the state should set the rules of the game and monitor compliance with those rules without interfering in the game itself or trying to influence the outcome. Best-practices in RE development shows that a successful decentralized RES model is predicated on the existence of small private producers operating in various segments of the RE market.

The Azerbaijani energy sector is dominated by a few vertically integrated state-owned monopolies, notably Azerenerji and Azerishiq. State control of energy generation, distribution and delivery is seen inimical to the establishment of favourable business environment for the deployment of RES. Most investments in RES in Azerbaijan have to date been dominated by the state and international donors (Aydin 2020). Recent renewable contracts with Masdar and ACWA Power reflect this dominant approach to renewable support schemes in Azerbaijan in which state/public investment plays a key role.

Appointment of technocrats to key positions in recent years signal some potentially positive steps especially with regards to reforming state-owned enterprises (SOEs) including in the energy sector. Large-scale investment projects implemented in the liberated territories, include large renewable energy projects, which might provide an additional stimulus for the authorities to create a level-playing field for renewable companies in Azerbaijan.

The surge in energy prices following the ease of COVID-19 pandemic challenges earlier assumptions about the transition to renewable energy sources. Taking advantage of this, traditional energy exporters, such as Azerbaijan, sharply increased the rate of production and supply of natural gas and oil to the European markets. If fossil fuel prices remain at current levels, there will be no pressure on traditional oil-exporting countries like Azerbaijan to reduce oil and gas production, reducing incentives to accelerate low-carbon transitions.

Despite recent changes, SOEs are still omnipotent with vested interest in the existing fossil fuel-based system to persist, and weak market liberalization makes Azerbaijan's power sector less attractive to foreign investment. Unless they manage to adapt, the SOEs with high stakes in the oil sector stand to lose from a future shift to low-carbon sources.

3. Kazakhstan

Executive Summary

Kazakhstan is a large fossil fuel-producing country where oil and gas together account for 35% of GDP and 75% of total export (EY 2021). Despite being a major oil and gas producer, Kazakhstan has made great strides in developing renewable sources. It has certainly been a leading country in adopting an appropriate legislative and policy framework with regards to the development of renewables among traditionally oil-producing countries in the former Soviet space. It was among the first to adopt the auction scheme for the sale of renewables and 28 such auctions were held in the years 2018-2019.

The Kazakhstani authorities have set ambitious targets to increase the share of solar and wind energy in total electricity to 3% by 2020, 10% by 2030, and 50% by 2050. The government has managed to meet the 3% target, and work is under way to meet the other targets too.

Despite its elaborate policy and legislative framework, however, the deployment of renewables has been slow (Mouraviev 2021), and some experts doubt that RES policies are implemented effectively enough to meet the 2030 and 2050 targets. Fossil fuels (mostly coal and natural gas) still account for some 89% of all electricity generated in Kazakhstan.

There are a number of shortcomings in the existing RES legislative and policy framework in Kazakhstan. One area of improvement is a lack of clear rules governing the process of acquiring and getting access to land for renewable energy projects (Karatayev 2021).

Second, the policy instability reflected in frequent changes in the RES framework and oversight institutions introduces an element of unpredictability in the policymaking environment. Such policy instability and a lag between the adoption and implementation of renewable policies are linked with increased level of risk (or its perception) for foreign companies willing to invest in Kazakhstan's renewables sector (Laldjebaev et al. 2021).

Finally, Kazakhstan's reputation for low accountability, weak rule of law and high perception of corruption makes its energy market less attractive for potential foreign investors and increases the risks of investment. This ultimately delays the expansion of renewables and can slow down the speed of RE development, which might ultimately jeopardize the government's plans to meet said RE and climate change targets (Karatayev and Clarke 2016). Unless the government improves transparency and accountability including by closer engagement with civil society, current polices alone are likely to be insufficient to lead to a more extensive adoption and utilization of renewables.

Background

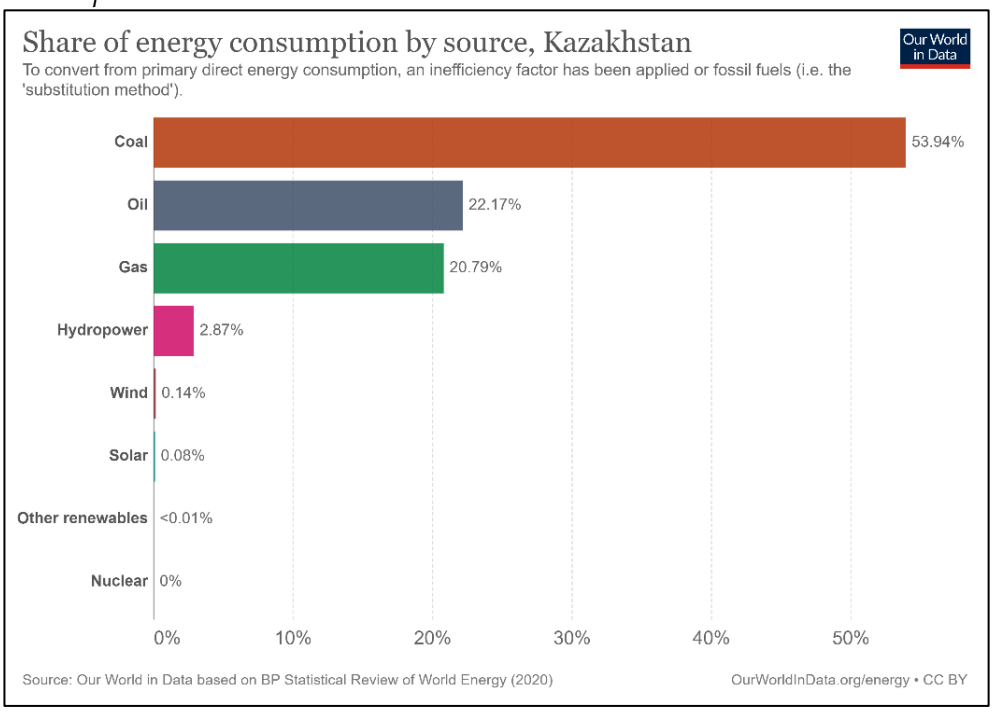
Kazakhstan is a major producer and exporter of fossil fuels (oil, natural gas, and coal). It is the world's 9th largest producer of coal, the 17th producer of crude oil, and 24th for natural gas (IEA 2020). The country's total oil reserves are estimated at 30 billion barrels, and it holds 2.3 trillion m^3 in proven gas reserves (BP 2021).

Kazakhstan's energy mix is poorly diversified and relies heavily on fossil fuels. As of 2019, the shares of different sources were distributed as follows: fossil fuels – 97% (of which coal – 54%, oil – 22%, natural gas – 21 %), hydropower (2.87%), and renewable energy (solar and wind) – less than 1% each. RES contribute around 0.5% to Kazakhstan's energy mix (Our World in Data Kazakhstan

Energy Profile 2020; Karatayev and Clarke 2016). In short, only about 3.1% (mostly hydropower) of the country's energy comes from low-carbon sources (hydropower, solar and wind) (see Figure 3.1).

Figure 3.1. Energy Consumption by Source in Kazakhstan, 2019

Fossil fuels make up 97% of Kazakhstan's energy mix with coal accounting for 54% of total energy consumption.



Source: Our World in Data Kazakhstan Energy Profile 2020 based on BP Statistical Review of World Energy (2020), https://ourworldindata.org/energy/country/kazakhstan#what-sources-does-the-country-get-its-energy-from

Renewables play a more important role in electricity generation: 11% of the country's electricity comes from renewables (mostly hydropower (9%), plus solar and wind (around 1% each) (Our World in Data Kazakhstan Energy Profile 2020) (see Figure 3.2). About 80% of all electricity originates in the industrial north and is generated by thermal plants near coal mines and then transmitted and distributed across the country (Karatayev and Clarke 2016). In fact, 70% of all electricity is produced in coal-fired plants (EBRD 2016), and power and heating together account for about 80% of total carbon emissions in Kazakhstan (EBRD 2016).

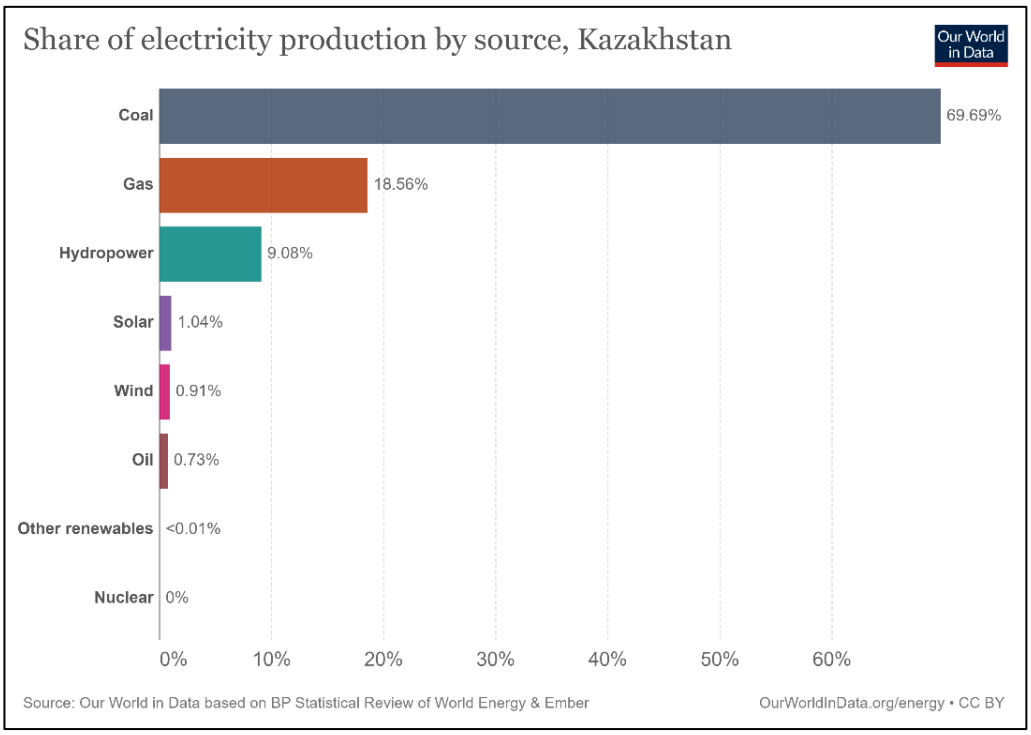
Kazakhstan's RES potential is estimated as follows: hydro (62 billion kWh/year), solar (2.5 billion kWh/year) and geothermal at 4.3 GW (USAID 2020a).

Climate Policy and Renewable Energy Targets

Under the Kyoto Protocol, Kazakhstan has committed voluntarily to reduce carbon dioxide emissions. Kazakhstan's commitment under the Paris Agreement – which it ratified in 2016 – targets a 15-25% reduction in greenhouse gas (GHG) emissions by 2030 compared to the 1990 level (Kazakhstan NDC, 2016).

In 2013, Kazakhstan adopted the "Green Economy Concept" which sets renewable and low-carbon energy (electricity) generation targets for solar and wind at 3% by 2020, 10% by 2030, and 50% by 2050 (Kazakhstan 2013; ADB 2020). The authorities announced in May 2021 that the 3% target had been met in 2020, and President Toqayev instructed the government to increase the share of renewables to 15% by 2030 (Satubaldina 2021). While this official renewable energy target is supported by the government's action plan, it remains legally non-binding (World Bank RISE, 2020).

Figure 3.2. Share of Electricity by Source in Kazakhstan, 2019
Fossil fuels (mostly coal and gas) account for 89% of all electricity generated in Kazakhstan.



Source: Our World in Data Kazakhstan Energy Profile 2020, based on BP Statistical Review of World Energy and Ember https://ourworldindata.org/grapher/share-electricity-fossil-fuels?tab=chart&country=~KAZ

As of 2020, Kazakhstan launched 19 new RE projects worth $1.1 billion (Makszimov 2020). In November 2020, the government approved the Zhanatas Wind Project worth US$95.3 million to support the construction of a new wind farm in southern Kazakhstan (EBRD 2020). As of 2020, there was a total of 101 renewable energy facilities in Kazakhstan, including 37 solar power plants, 37 small hydropower plants, 22 wind power plants, and 5 biogas power plants (USAID 2020a) (See Figure 3.3 for mapping of some of these project.)

Legal and Regulatory Framework

In 2013, the government adopted the "Nation Concept on Transition to a Green Economy up to 2050" setting the 50% renewables target by 2050 (PWC 2021). According to the NDC, the share of

renewable energy sources, including large hydroelectric power plants, in domestic electricity demand should increase from 11% in 2020 to 32.7% in 2030. In 2013, the government adopted "Action Plan for the implementation of the Concept for the transition of the Republic of Kazakhstan to a green economy for 2013-2020" (Resolution of the Government of Kazakhstan, 2013). A new strategy is currently being developed with regards to strategies of low-carbon development in Kazakhstan until 2050, which was scheduled for completion in June 2021 (Satubaldina 2021).

The "Kazakhstan 2050" Development Strategy is a long-term basis for all state planning documents, including strategic plans of various ministries and government bodies. One of the strategic objectives of the state is the transition to a low-carbon economy and a reduction in GHG emissions to mitigate the impact of climate change. It also sets the RE target to cover "at least half of the country's total energy consumption" by 2050 (Kazakhstan 2050 Strategy). A net-zero target has not been officially set. In May 2021, the government announced its plan to achieve carbon neutrality (a net-zero target) by 2060 (Satubaldina 2021; PWC 2021).

In 2009, Kazakhstan adopted "Law on Support for the Use of Renewable Energy Sources" (Kazakhstan 2009; Sospanova, 2019), which mandated a scheme for purchasing and sale of RE-generated electricity. In 2013, the government adopted a mechanism of feed-in tariffs (FIT), and in 2017, it switched to an auction mechanism (Dyusenov 2019). Kazakhstan was the first country in the Central Asian region to introduce auctions for RE. The auction scheme was launched in 2018 as a transparent and inclusive mechanism to select RE projects and ensure market-based prices for electricity from RES (Sopsanova 2019). From 2018 to 2019, a total of 28 auctions were organized with a total capacity of 1,255 MW offered and a total capacity of 1,070 MW contracted (USAID 2020b).

The law also established a Financial Settlement Center for the Support of Renewable Energy Sources [FSC] as the main institution responsible for RE procurement by providing the platform for centralized purchase and sale of RES-generated electricity (USAID 2020a). FSC, thus, acts as a centralized buyer of renewable energy (PWC 2021). Sale of RE electricity is carried out through power purchase agreements (PPAs) at an auction rate in the national currency tenge and by providing guaranteed access to the power grids (Sopsanova 2019). Kazakhstan was also one of the first among post-Soviet countries to set up a renewables reserve pool as a means of increasing investments into renewable energy facilities (Karatayev et al. 2021).

Figure 3.3. Distribution of Renewable Energy Objects in Kazakhstan

Source: Financial Settlement Center of Renewable Energy of Kazakhstan, https://rfc.kegoc.kz/en/vie/yamaps

Analysis and Policy Implications

Kazakhstan is the most advanced among Central Asian countries in terms of the ambitiousness of its renewables program and its elaborate legislative and policy framework. The Kazakhstani authorities have implemented some of the most innovative policies in the renewables sector. It was the first country in the region to introduce and implement auction support policy for renewable energy sources aimed to set clear rules for selection of RE projects and establish competitive RE prices (IEA 2020; Laldjebaev et al. 2021). Although implementation of some of these policies has occasionally been slow, Kazakhstan has managed to increase its total installed renewable capacity of operating RES to 1,846 MW (885 MW hydro, 533 MW solar, 427 MW wind, and 1 MW bio) in 2020 (PWC 2021), which was enough to reach the 3% renewable target by the end of 2020.

While the transmission grid is owned and operated by state-owned company Kazakhstan Electricity Grid Operating Company (KEGOC) with associated inefficiencies in the transmission and distribution networks (Karatayev and Clarke 2016), the electricity market is fairly competitive at the retail level, with some 45 companies operating (IEA 2020).

Despite progress, however, there are some gaps in the policy framework, especially when it comes to the regulation and implementation of RES policies. One area of improvement is a lack of clear rules with regards to permission to acquire land for renewable energy projects (Karatayev 2021).

On the other hand, frequent amendments in the RE legislation and periodic shifts in regulatory institutions give a sense of instable policy environment. Policy instability and a lag between the adoption of policies and their implementation also increase investment risks (Laldjebaev et al. 2021). Moreover, Kazakhstan's low standing on international rankings on accountability, rule of law and control of corruption makes its domestic energy market risky for foreign investment needed to accelerate the growth of the renewables sector (Karatayev and Clarke 2016).

4. Kyrgyzstan

Executive Summary

With its large hydropower plants supplying 90% of the country's total electricity, Kyrgyzstan faces a different set of challenges. Here the key challenge is to ensure sustainable energy supply from hydropower, arguably included in the renewable category. However, Kyrgyzstan's excessive dependence on large hydro plants poses the following risks and challenges to sustainable development: first, large HPPs are problematic from the environmental point of view (with detrimental impacts on wildlife and plants) (Moran et al. 2018); second, seasonal fluctuations in water levels can disrupt proper functioning of HPPs creating serious risks to the country's energy security; third, most of Kyrgyz HPPs are worn out and need renovation; fourth, there is not enough domestic funds to finance renovation of large HPPs and such investments are also questionable from both ecological and energy security perspectives noted above; fourth; while there is good potential for solar and wind, RES projects and technology are expensive to acquire; fifth, the government seems to prioritize small-scale HPPs than non-hydro RES. Finally, political and social instability makes it difficult for the power sector reform to move forward.

Said challenges may shed some light on the sluggishness in developing legislative and policy framework for non-hydro RES in Kyrgyzstan. It seems reasonable to suggest that for the Kyrgyz authorities the energy transition agenda is focused on the efforts to shift to small-scale HPPs which are less harmful for the environment than large hydro dams, and to replace thermal power plants with solar PVs and wind turbines.

Background

Kyrgyzstan is less reliant of fossil fuels for energy consumption than its Central Asian counterparts. Renewables (mostly hydroelectricity) account for 27% (as of 2018) of Kyrgyzstan's energy mix. In fact, Kyrgyzstan ranks one of the highest on the share of renewables in electricity worldwide (IEA April 2020). However, there are no large wind or solar power plants in Kyrgyzstan, and therefore they are absent from the country's energy mix. Much of the existing infrastructure is worn out (Shadrina 2020), and there is a lack of investment capital for its renovation or replacement with less environmentally harmful small-scale hydro plants.

Around 90% of total electricity in the Kyrgyz Republic is generated by hydropower plants (mostly, large hydroelectric power plants – HPPs) and the rest is generated at thermal power plants burning coal and gas. Coal is another source of energy, and, as of 2020, Kyrgyzstan produced 2.5 million tonnes of coal (Janybekkyzy 2021). Insufficient investment and aging infrastructure plague the power generation sector in Kyrgyzstan (World Bank 2017).

While the prior development of renewables (large hydro, but no solar or wind) provided with some advantages, it also precluded the development of non-hydro RES. Most electricity is generated by large hydropower facilities and thermals, therefore there has been little incentive to introduce wind or solar plants, the process that would additionally require large capital investment. There are 7 big and 15 small hydropower stations (Gassner 2017; Sabyrbekov and Ukuyeva 2019) and 2 coal- and gas-flared thermal plants (one in Bishkek and one in Osh) (See Table 1). However, general deterioration of HPPs – most of which were constructed in the 1960s and 1970s – is estimated at 80% while that of all electricity generating facilities is 70%. Power companies cumulative debt is USD 1.5 billion (Akchabar 2021).

Non-hydro renewables potential in Kyrgyzstan is substantial but remains untapped: 267,000 MW of solar, 1500 MW wind, and 200 MW bioenergy (Laldjebaev et al. 2021).

Table 4.1. Main Power-Generating Plants in Kyrgyzstan

	Date commissioned	**Installed Capacity (MW)**
Toktogul HPP	1975	1200
Kurpsay HPP	1981	800
Tash-Kumyr HPP	1985	450
Shamaldy-Sai HPP	1994	240
Uch-Kurgan HPP	1961	180
At-Bashi HPP	1970	40
Kambar-Ata HPP-2	2010	120
Small HPPs (12 in total)	1940-1960	42
Bishkek CHP	1961	812
Osh CHP	1966	50
Total		3934

Source: State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic, 2020

The share of non-hydro RES, namely solar and wind power, is insignificant (Laldjebaev et al. 2021) and accounts for less than 1% of total energy consumption.

A specific feature of the Kyrgyz energy system is that 90% of electricity generating capacity is accounted for by large-scale HPPs located in the south of the republic, and 70% of electricity consumption is in the north part of the country. Reliance on HPP energy has its drawbacks. Apart from its negative environmental impacts on wildlife (Moran et al. 2018), there are issues with stability of supply due to fluctuating water levels and seasonal shortages. For example, in 2021, Kyrgyzstan faced its largest energy crisis in recent years, due to the falling water levels at the Toktogul HPP, which supplies 40% of all electricity (Pannier 2021).

Climate Policy and Renewable Energy Targets

On 24 September 2021, Kyrgyzstan approved its updated NDC and submitted it to UNFCCC. (Kyrgyzstan NDC 2021). The NDC sets a climate mitigation target as follows: to reduce unconditionally GHG emissions by 16.63% by 2025 and by 15.97% by 2030 from "business as usual" levels. However, should international support be provided, these goals would be increased to a reduction of 36.61% by 2025 and 43.62% by 2030 (Chamberlain 2021). The National Development

Strategy for the years 2018-2040 adopted in 2018 states, in a rather vague wording, that the "implementation of planned [renewable] projects will allow increasing the capacity of power system of Kyrgyzstan by no less than 10% within 5 years, or by 385 MW". There are no numerical targets for renewables, no concrete plans on adopting non-hydro renewables. At the 76th session of the UN General Assembly in October 2021, Kyrgyz President Sadyr Japparov said his country aims to achieve carbon neutrality by 2050 by promoting hydro (Janybekkyzy 2021).

Legal and Regulatory Framework

The Law of the Kyrgyz Republic on Renewable Energy (RE Law) adopted in 2008 (amended in 2019) established an incentive framework for the development of renewable energy, including small-scale HPPs. It also created a legislative framework for renewable energy feed-in tariffs. However, most provisions of the RE Law have remained largely declaratory (Gassner 2017). Feed-in tariffs are designed to ensure compensation and coverage of investment costs for up to eight years. This law has not been fully implemented, and some of its by-laws had been under review (Laldjebaev et al. 2021). Several amendments adopted in 2019 introduced a compensation scheme for additional costs for the purchase of RES generated energy, fixed the tariff at which RE electricity will be purchased and set quotas for RE capacities (Vedeneva 2020). Quotas for RE are defined as "set by a State Committee on industry, energy and natural resources of the Kyrgyz Republic (GKPEN) amount of installed electric capacity of power plants using RE by regions and RE types for a certain time period, whose generation of electricity will be reimbursed at a maximum rate for the end users, times the FIT coefficient [1.3]" (Vedeneva 2020).

In 2019, the government adopted the Program on the Development of a "Green Economy" in the Kyrgyz Republic for 2019-2023 (Resolution of the Government of Kyrgyzstan, 2019). However, neither the National Development Strategy to 2040 nor the Green Economy program contain specific goals to be achieved or funds allocated (Shadrina 2021).

Another important piece of legislation include the National Energy Program and the Strategy for Fuel and Energy Sector Development (covering 2010-2025) which identifies the expansion of RES, especially small-scale hydropower as a priority for energy sector development. The Strategy envisages the construction of some 100 small-scale HPPs with total capacity of 180 MW (IEA 2020).

Finally, the Law of the Kyrgyz Republic "On Amendments to Certain Legislative Acts in the Field of Renewable Energy Sources" aims to improve economic mechanisms, to stimulate the use of RES, including small-scale HPPs, to attract investment (Law of Kyrgyz Republic dated June 27, 2019). The bill provides for the establishment of premiums to the tariff for electricity generated from renewable energy sources and small hydroelectric power plants for the payback period of projects using renewable energy sources.

Analysis and Policy Implications

Having legacy (Soviet-era) large hydropower plants creates challenges specific to the Kyrgyz energy sector. While hydropower has advantages over traditional fossil fuels in terms of lower levels of GHG emissions, large-scale HPPs are harmful to wildlife and plants in the river's eco-system. In addition, most of the infrastructure is ailing and needs repair or full renovation.

Against this backdrop, Kyrgyzstan set the priority to develop small-scale hydro. But here challenges abound.

First off, there are institutional barriers to the deployment of non-hydro RES, solar and wind power (Orozaliev 2013). Frequent changes of government prevents the establishment of stable policy environment or effective governance system for RE development. Among other issues, the Kyrgyz Republic still lacks a dedicated government agency for renewables deployment.

Second, there are financial barriers. The existing legislative provides weak mechanisms to incentives RES investment projects.

Third, there is poor information support for renewable energy sources. Therefore, the awareness of the benefits of using RES remains low.

The country depends on imports of coal, natural gas and oil products which account for a good part of total energy consumption. Due to low water levels in the Toktogul water reservoir there are shortage during the autumn-winter period when the consumption of electricity rises.

Most of the HPP technical facilities are outdated, and there is a need for reconstruction and modernization of existing and construction of new power transmission grids. Reconstruction requires large capital investments. However, due to corruption risks and weak accountability, the investment climate seems to be too risky for foreign companies willing to bring in much-needed cash.

Small-scale HPP energy, solar and wind energy sources can be adopted to mitigate some of these shortages and issues. The available amount of non-hydro resources can theoretically cover more than 50% of the Kyrgyz energy demand. But, at present, the practical use of this vast RES potential is insignificant and the share of non-hydro RES amounts to just less than 1% of the country's energy mix.

5. Ukraine

Executive Summary

At the COP26 summit in Glasgow this year, Ukraine pledged to achieve the net-zero target by 2050. According to new Energy Strategy until 2035 adopted in 2017, Ukraine also set to achieve a 25% renewables share in total supply by 2035 (Government of Ukraine 2017).

While Ukraine made some progress toward its climate commitments and renewable energy targets, its energy mix is still dominated by fossil fuels (including heavily-polluting coal) and nuclear power generated at ageing Soviet-era plants and worn-out reactors (Mirovalev 2021) raising Chernobyl-like safety concerns.

Over past the past decade, the share of coal in the energy mix has decline while that of renewables has increased. Yet, renewables still form a relatively small part of the country's energy mix. As of 2020, renewables accounted for around 10% of all electricity generated in Ukraine, half of it sourced from hydropower.

As a signatory to the Energy Community Treaty since 2011, Ukraine has committed itself to implementing EU's energy-related *acquis communautaire* aimed to liberalize its natural gas and electricity markets in line with EU norms. Due to these commitments, the government adopted laws in compliance with EU standards including the liberalization of gas and electricity markets, the unbundling of state-owned vertically integrated energy companies (such as Naftogaz) and the decommissioning and privatizing of Soviet-era coal mines (OECD 2019). As a result, Ukraine has a well-developed and extensive legislative and regulatory framework for its energy sector including RES.

In addition, Ukraine was one of the first countries to introduce "green" feed-in tariffs (FiT) for RE producers and to offer long-term contracts for guaranteed green energy purchases. Its downstream market is relatively liberalized and open to foreign investors.

Nevertheless, the country has been facing challenges in implementing some of these policies. First, Ukraine saw the liquidity problem in the new model of FiT employing the "Guaranteed Buyer" [the wholesale operator] (Bilyavsky 2020). Due to financial arears and absence of a proper debt management mechanism, the wholesale operator accumulated debt in the amount of UAH 25.1 billion (US $929 million) to RES producing companies for the purchase of electricity at "green" FiT tariffs.

Ukraine is also facing acute issues of reducing energy consumption, increasing energy efficiency and equitable transformation of coal-producing regions. It is estimated that capital investment required for the implementation of NDC by 2030 will reach EUR 102 billion (Ministry of Environmental Protection and Natural Resources of Ukraine, 2021).

Decommissioning of coal mines, though a positive step to reduce CO_2 emissions, raises a set of challenges relating to just transitions. The authorities need to consider setting up a mechanism for protection of labor and social welfare of workers and communities affected by phasing out of coal mining.

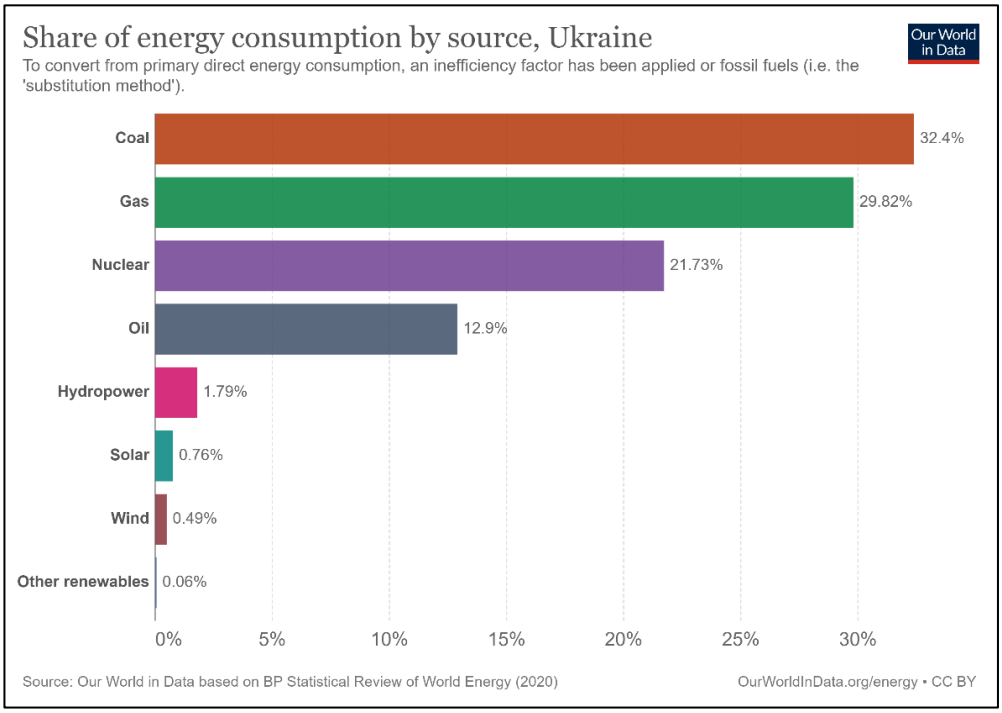
Background

Ukraine's energy mix relies on a combination of various sources. Fossil fuels stand at about 75% including 43% oil and gas, and 32.4% coal (as of 2019). Nuclear stands out as a second source suppling 22% of energy followed by hydropower (1.8%). Solar and wind combined make up 1.3%

of energy consumption in Ukraine (Our World in Data Ukraine Energy Profile, 2021) (See Figure 5.1).

With 83 terawatt hours [TWh] (as of 2019) from nuclear, Ukraine is one of the world's largest producers of nuclear energy (IEA 2020). As of 2020, nuclear power clearly dominated electricity generation in Ukraine accounting for about half of all electricity produced followed by coal (28%) and gas (8%) (Our World in Data Ukraine 2021) (see Figure 5.2). The share of renewables (including hydropower) is around 10% (as of 2020). Wind and solar plants together produced some 6.6% of electricity in 2020 (see Table 5.1). Most of electricity is produced by coal- and gas-fired thermal plants as well as nuclear plants. According to its annual report, NEURC (2020) identified that in 2020, most of electricity was produced by the state company National Nuclear Energy Generating Company of Ukraine (NNEGC) Energoatom, which is a part of the MoE of Ukraine. NNEGC Energoatom operates all NPPs in the country and produces over 51.7% of all electricity. On fossil fuel supplies, Ukraine is reliant on imports for some 83% of its oil consumption, 33% of its natural gas and 50% of its coal (IEA 2020).

Figure 5.1. Share of Energy Consumption by Source in Ukraine, 2019
Fossil fuels account for 75% of energy consumption, 22% nuclear, and non-hydro renewables are just 1.3%.



Source: Our World in Data Ukraine Energy Profile, 2021, https://ourworldindata.org/energy/country/ukraine

Ukraine has good renewable energy potential estimated to amount to up to 4 GW of solar energy and 320 GW of wind (IRENA 2015). In 2018, Ukraine saw 347 RE projects supplying electricity at FiT rates to the wholesale electricity market (IEA 2020). Ukraine's RE market is fairly competitive (NEURC 2020). Beginning on April 1, 2020, the government started to implement "green" tariffs for electricity produced by RE companies. Ukraine has been able to attract an estimated € 2.5 billion of investment in RES development (Belyavsky 2020).

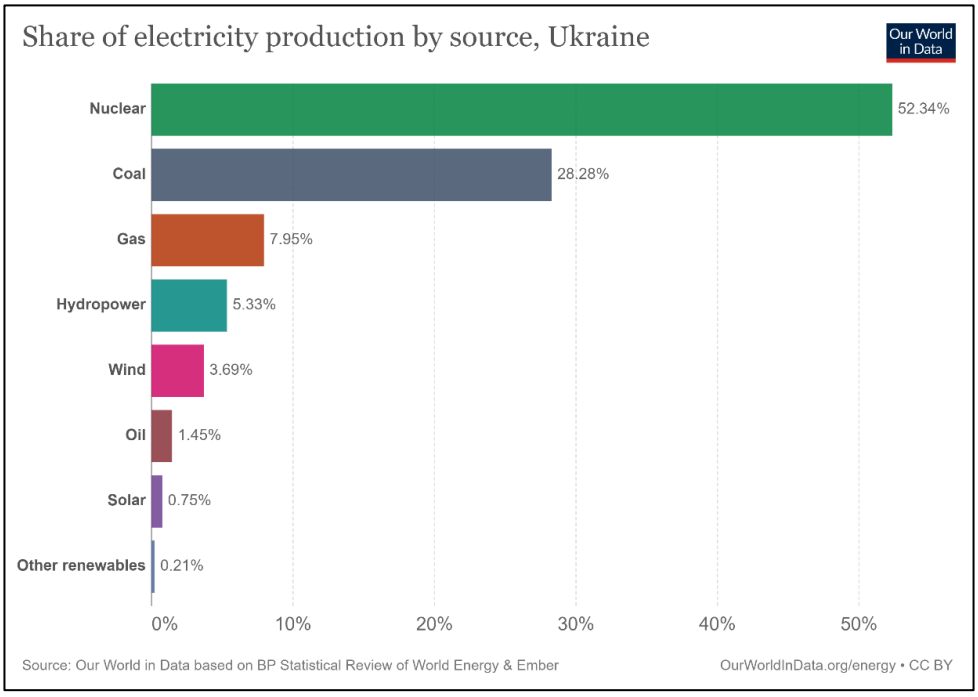
Climate Policy and Renewable Energy Targets

On 31 July 2021, Ukraine submitted its updated NDC to the UNFCCC establishing the target of a 65% reduction below 1990 levels by 2030 (NDC Ukraine 2021). The updated NDC includes the new goal of climate neutrality by 2060.

In December 2019, European Commission President Ursula von der Leyen has declared a strategic goal of making the EU climate neutral by 2050 under the European Green Deal. This transition is both a challenge and an opportunity for Ukraine, a country with an extremely ambitious EU Association Agreement and cooperation as part of the Energy Community. In January 2020, the government released "Ukraine 2050 Green Energy Transition Concept". A distinctive feature of the Concept is that it is based on a multifactorial modeling of scenarios for the development of Ukraine's energy sector with a perspective for the period up to 2050.

Figure 5.2. Electricity Production by Source in Ukraine, 2020

Nuclear dominates electricity generation in Ukraine accounting for about half of total electricity followed by oil and gas.



Source: Our World in Data Ukraine Energy Profile, 2021, https://ourworldindata.org/energy/country/ukraine

Ukraine's legislative framework is composed of strategic visions and laws including, among others, the Concept of Public Policy in Climate Change for the period up to 2030 adopted in 2016 (Cabinet of Ministers of Ukraine, 2016), the 2017 Action Plan for the Implementation of the Concept of Public Policy in Climate Change (Cabinet of Ministers of Ukraine, 2017), and Ukraine 2050 Low Emission Development Strategy adopted in 2018. In March 2021, the Cabinet of Ministers of Ukraine approved the National Economic Strategy until 2030 outlining the measures to achieve climate neutrality no later than by 2060 (Cabinet of Ministers of Ukraine, 2021). The updated NDC also includes the new goal of climate neutrality by 2060.

Table 5.1. Energy Production in 2017 and 2020: Sales in the Wholesale Electricity Market

	2017	2020
Thermal power plants (TPP GK)	28.5%	26.6% (39 562,6 MW)
Nuclear power plants (NPPs)	56.6%	51.7% (76 202,5 MW)
Hydroelectric power plants (HPPs)/ Pumped storage plants (PSPs)	6.9%	5.0% (7 583,5 MW)
Combined heat and power (CHP) plants	6.5%	9.5% (14 643,3 MW)
Wind power plants (WPP)	1.5%	2.3% (3 094 MW)
Solar power plants (SPP)		4.3% (6 059 MW)
Biofuel / biogas stations and others		0.7% (1 160 MW)

Sources: NEURC. Annual Report 2017:
https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2017.pdf
NEURC. Annual Report 2020:
https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2020.pdf

In July 2020, Ukraine officially supported the European Green Deal, which is designed to make the European continent climate-neutral by 2050. Despite the fact that the GHG reduction target in Ukraine's "Updated NDC" is set for 2030, necessary policies and measures until 2050 have also been taken into account in order to include the long-term decarbonization target.

In August 2017, the government adopted the new Energy Strategy of Ukraine to 2035 which sets the goal of increasing the share of renewable sources to 25% by 2035. In 2017, the SAEE introduced a map for tracking investment projects in renewables and energy efficiency in Ukraine.

Legal and Regulatory Framework

Kyiv's drive to expedite the shift to a greater RE deployment stems partly from Ukraine's aspirations of integration with the EU. The integration of Ukraine's power grid with the pan-European energy system ENTSO-E (European Network of Transmission System Operators for Electricity) is one of the key strategic goals of Ukraine and the priority tasks envisaged by the EU-Ukraine Association Agreement (2014). This is viewed as an important component of improving Ukraine's energy security, as synchronous work with European energy unions will increase the efficiency and sustainability of Ukraine's energy system.

As a member of the Energy Community Treaty since 2011, Ukraine adopted commitments to introduce EU energy laws, known as "*acquis communautaire*." This results in the adoption of EU norms and standards with regards to unbundling and liberalization of the natural gas and electricity markets (notably reforming Naftogaz). It also committed to expand the share of renewables in the energy mix (OECD 2020)

The essential task of the Energy Strategy of Ukraine "Safety, Energy Efficiency, Competitiveness until 2035" is to reduce energy consumption by half until 2030 and to boost the Ukrainian production of both traditional and renewable energy sources. Said document specifies the following structure of final energy consumption by 2035: nuclear power will provide 50% of the country's electricity, renewable sources – 25%, hydropower – 13% and the rest 12% will be covered by thermal electric power stations.

The key legal acts governing renewable energy development include, among others, the following:

- The Energy Strategy of Ukraine "Safety, Energy Efficiency, Competitiveness" until 2035
- The Law of Ukraine "On the Alternative Energy Sources"

- The Law of Ukraine "On Electricity"

The main tools that stimulate the development of alternative energy sources is the "green" tariff for RES-generated electricity. In Ukraine, the "green" tariff was introduced by law in 2009 for the period up to 2030 (Law of Ukraine "On Alternative Energy Sources"). The RES sector development is stimulated also by the Law of Ukraine "On Electricity Market" which provides for the possibility of concluding long-term contracts for the purchase of electricity generated at a "green" tariff until 2030. In September 2020, the Cabinet of Ministers amended procedures for electronic auctions to permit the wholesale operator – the "Guaranteed Buyer" – to sell RES-generated electricity at special auctions under bilateral agreements (Asters 2020). In September 2021, Ukraine's Ministry of Energy has published a draft law on its website to set up an auction scheme for large-scale renewables (Bellini 2021).

To further stimulate the production of energy from renewable sources, the Ukrainian parliament adopted in 2017 the Law of Ukraine "On Amendments to the Law of Ukraine on Heat Supply to Stimulate the Production of Thermal Energy from Alternative Energy Sources" (Law of Ukraine, 2017). It is envisaged to establish an incentive tariff for thermal energy from RE sources. The tariff for thermal energy from RES is set at the levels of 90% of the current tariff for thermal energy from gas.

There are two central executive bodies that are responsible on regulation and overseeing the renewable energy sector in Ukraine: the National Energy and Utilities Regulatory Commission (NEURC) and the State Agency for Energy Efficiency and Energy Saving of Ukraine (SAEE). The SAEE is a central executive body whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine through the Minister of Energy. SAEE implements state policy in the field of efficient use of fuel and energy resources, energy saving, and RES.

State regulation, management and implementation of the state policy in the field of alternative energy sources in the field of alternative energy sources is carried out by the Ministry of Energy and Coal Industry of Ukraine and other authorized bodies of executive power. As an energy regulator of Ukraine, the NEURC was established in 1994 as a permanent central executive body responsible for regulation of natural monopolies in the power sector, in the oil and gas complex and in the realm of heat generation.

Analysis and Policy Implications

Ukraine's updated NDC (2021) sets the target of a 65% GHGs reduction by 2030 compared to 1990 levels, and set a new goal to attain climate neutrality by 2060. Although the government has clearly advanced on the renewables agenda, it is still uncertain whether the climate commitments and renewable target of 25% reduction by 2035 will be met.

The reform of energy markets in Ukraine is taking into account the obligations of Ukraine as a Contracting Party to the Energy Community and in accordance with the requirements of the Association Agreement between Ukraine and the EU. According to the Energy Community Secretariat, Ukraine is one of the leaders of the Energy Community in the pace of implementation of energy reforms in 2020 and ranks second in the overall ranking of member states in terms of implementation of European legislation with a total score of 61% (Energy Community Secretariat 2020).

The increase in the share of electricity generation from renewable sources is linked to the "green" tariff introduced in Ukraine in 2008. However, RE producing companies have faced the problem of financial compensation for energy sold at a "green" tariff in accordance with agreements with the

SE “Guaranteed Buyer” (OECD 2020). Due to the difficult economic situation, state-owned enterprises were unable to cover the costs of purchased green energy in a timely manner. At the end of July 2020, President Volodymyr Zelensky signed a law on reducing the “green” tariff (by 15% - for solar power plants and 7.5% - for wind) (Law of Ukraine 2020). This law was to be the first step towards solving the problematic issues of the energy market, in particular in terms of settling accounts with producers of “green” electricity.

Thus, the existing legal framework has not fully resolved the problem of accumulating debts to RE electricity producers. The Government of Ukraine has not developed a comprehensive strategy for the functioning of the RES sector until 2030, given the active development of hydrogen energy in the world and the challenges associated with the loss of liquidity in the energy market and change in the national economy due to the COVID-19 pandemic.

The key aspect of achieving zero-net target is rejection of the use of coal. Closure of mines and cessation of coal production can have significant negative consequences for the development of mining regions affecting mining workers and communities. In September 2021, the government adopted a draft resolution of the Cabinet of Ministers of Ukraine “On approval of the Concept of the State target program of fair transformation of coal regions of Ukraine for the period up to 2030” developed by the Ministry of Regional Development (Law of Ukraine 2021). This resolution seeks to offer a comprehensive solution to the problems that arise from the reduction of coal production.

6. Conclusion: Key Challenges and Policy Recommendations

This study shows the persistent power of legacy energy infrastructure inherited from Soviet times and path-dependent patterns of energy consumption. But it also shows how country-specific circumstances influence policy choices with regard to expansion of renewables and energy transition policies.

In transitioning to clean energy sources, legacy infrastructures pose different sets of challenges for oil and gas producing countries (Azerbaijan and Kazakhstan) and non-oil countries (Kyrgyzstan and Ukraine). In Azerbaijan and Kazakhstan, the medium-term challenge is to foster a partial transition to low-carbon sources in an effort to reduce GHG emissions and mitigate fiscal impacts of energy transitions undertaken by major European countries in their quest to become energy self-sufficient (Guliyev 2020b). (Table 6.1 outlines key results derived from the comparative analysis).

In oil-dependent countries, the bloated state is poised to play a leading role in transitions to renewables sources. Here the state dominates the upstream and downstream of the energy sector, and state-owned companies often enjoy a monopolistic position. The state can and does channel a portion of oil revenues to renewable investments such as the installation of solar panels and wind turbines. However, excessive and continuous state intervention – which might be justified at initial stages – ends up undermining the very cause it is trying to promote. State preponderance in energy supply and electricity generation is likely to hamper the expansion of renewables as government over-regulation produces market distortions discouraging capital investment.

We can see how these processes unfold to shape RES policies in Kazakhstan and Azerbaijan. In both countries, policy instability, inadequate governance mechanisms and company risk perceptions seem to have hindered the inflows of FDI into their respective RES sectors. In Azerbaijan, in particular, the government's statist approach has delayed the adoption of relevant legislation for years. While Kazakhstan has been more pro-active in introducing a relevant legislative framework, there too certain gaps in governance arrangements such as lack of clarity in the investment process and bureaucratic discretion are often identified as obstacles to a more rapid RE expansion (Mouraviev 2020).

Instead of state intervention, in both cases the government should limit its role to setting rules for competition, unbundling vertically-integrated monopolies, lowering barriers to entry for smaller companies, improving accountability to encourage investment from foreign companies, offering incentives for local RE companies to develop innovative capacities through facilitating of the transfer of know-how and training programs for local cadres.

In non-oil countries, these challenges seem to be of different nature. Here the state realizes the limits of its role and capabilities and allows market competition to be a major driving force. Overcoming the legacies of state ownership and fostering private entrepreneurship are seen as key ingredients.

In Kyrgyzstan, where hydropower generates 90% of total electricity, the shift to non-hydro renewables is a more difficult due to a shortage of capital and the landlocked geographic position which makes it distant from key centers of manufacturing, trade and banking. Hydropower is considered clean in terms of carbon emissions, hence, there is also lower outside pressure to shift to wind and solar. Here the challenge is rather to maintain the existing installed hydropower infrastructure most of which is worn and in need of repair. Ideally, small HPPs should be prioritized to replace existing large HPPs, however, a lack of capital investment (and political will) and the path-dependent forces of past choices and legacy hydropower infrastructure locked the

country in the persistent dependence on large HPPs which have negative impacts on its rivers' ecosystems (e.g. fisheries).

Table 6.1. Comparative Assessment of Performance on Promotion of Renewable Energy

	Azerbaijan	**Kazakhstan**	**Kyrgyzstan**	**Ukraine**
RE target	Yes	Yes	No	Yes
Definition of target	2030: 30%	2020: 3% solar & wind 2030: 10% 2050: 50%	No generation-based target.	2035: 25%
Extent to which target is fulfilled	Target only recently defined.	2020 target largely met	N/A	Target only recently defined.
Current share of RES in electricity	2019: 7.3% (gen) Hydro: 6% Wind: 0.5% Solar: 0.17%	2019: 11% (gen) Mostly hydro: 9% Solar & wind: 2%	2020: 90% (gen) Mostly by large hydro (HPPs)	2020: 10%(gen) Hydro: 5.3% Wind: 3.7% Solar: 0.75%
Regulatory support scheme	Yes	Yes	Yes	Yes
Type of support schemes in place	Public investment; Feed-in tariff	Public investment; Feed-in tariff; Competitive bidding/auctions	Feed-in tariff (law)	"Green" Feed-in tariff
Extent to which support schemes are implemented	Mostly public/state investments, i.e. pilot projects: Solar: 230 MW (US$200 million; with Abu Dhabi's Masdar), Wind: 240 MW (with Saudi's ACWA Power); FiT included in RE Law adopted in 2021 (not yet enforced).	FiT scheme implemented from 2013-2017; In 2018-2019, a total of 28 auctions held; Zhanatas Wind Project worth US $95.3 million (among others).	FiT not implemented New strategy to construct 100 small-scale HPPs with total capacity of 180 MW.	FiT from 2009 to 2030; Auctions (draft law adopted in 2021)

Note: Spreadsheet adapted from Ecofys and GIZ 2012; evaluation is based on material presented in the text.

Moreover, falling water levels in rivers (possibly due to over-use and effects of climate change) should serve as alarm bell to the Kyrgyz policymakers of the urgency to diversify the country's energy mix and the need to foster the expansion of wind, solar and biomass to mitigate possible shortages and to ensure sustainable energy supply.

In Ukraine, nuclear and coal are two legacy components of the power generation system, largely inherited from the Soviet era. Nuclear energy is considered clean, but as the Ukrainian own experience with Chernobyl Disaster and thee more recent Fukushima disaster in 2011 showed, there are serious safety concerns.

Coal is particularly problematic as one of the biggest sources of carbon emissions, and its phasing out should be a key priority for the Ukrainian authorities. There is a room for boosting RES and gradual replacement of coal and gas with cleaner renewable sources. Ukraine has the advantage of proximity to western European markets. It pursues Western integration through the Association Agreement with the European Union signed in 2014. The forces pushing Ukraine towards deeper EU integration – including by adoption of EU laws and standards concerning energy regulation and energy sector liberalization – might help Ukraine to disrupt the persistence influence of Soviet legacy infrastructures and to break up the vicious path-dependent cycle of nuclear/fossil-fuel-based energy supply.

Due to its Western integrationist aspirations, Ukraine has introduced progressive and extensive legislative and regulatory framework for the management of its energy sector including the development of RES. Ukraine seems to be on the right track on renewables expansion. But to achieve its ambitious climate targets and low-carbon future goals, the Ukrainian government needs to commit itself to full implementation of energy-sector reforms and dismantle old Soviet management traditions and distortions especially at the local level.

Its renewable development plan stipulates the reduction in coal's share in the energy mix. To meet this goal, Ukraine needs to consider phasing out coal completely, but it also require a more careful and thorough assessment of social impacts of coal phase-out on mining-sector employees (notably, managing the consequences of job losses and the transition of labor to low-carbon sectors). The decommissioning of coal-fired plants is a thorny process associated with loss of employment for miners and disruption of community life in traditional mining regions. In this respect, the stakeholders should consider the possibility of applying the "just transition" framework as a multidimensional analytical tool for examining various issues arising from the phasing of coal and other fossil fuel as part of future decarbonization efforts.

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Annex A – Expert Questionnaire

ENERGY TRANSITIONS 2021 – TEMPLATE

Project: Monitoring Energy Transitions in Eurasia - METE (Azerbaijan, Kazakhstan, Kyrgyzstan, Ukraine)

GUIDELINES AND REPORT STRUCTURE

The purpose of this project is to develop a context-specific analytical tool or framework to monitor a country's performance in the renewables sector as well as to track that country's progress on adoption and implementation of relevant legislative and regulatory frameworks in relation to the shift to low-carbon energy sources, the process commonly known as energy transitions.

Your input is a valuable contribution to our understanding of the speed and substance of energy transitions in the post-communist Eurasian region. As a country expert, you are asked to fill out the following survey for your country of expertise. The survey consists of the Executive Summary and three parts:

- Executive Summary – a short, one paragraph, summary of key developments in the realm of legislative-regulatory policies with regard to renewables development
- Country energy background (Part 1)
- Questionnaire of 10 questions (Part 2), and
- Political-economy /stakeholder analysis and Policy Implications (Part 3).

In sum, you final country assessment should include the following:

- **Executive Summary** [max. 600 words]– summarizing the main developments in the energy sector pertaining to the use of renewables.
- **Part 1 - Background** [max. 1500 words]- provide information on your country's energy profile including its energy mix, renewables potential, relevant regulatory bodies and major steps taken by the government in the last 5 years (01.01.2017-01.10.2021) to expedite the shift to a greater deployment of renewable sources.
- **Part 2 – Questionnaire** is a list of specific questions concerning a country's legal framework covering the following: renewable targets, the adoption of an action plan, sector-specific policies promoting renewables (e.g. electricity generation, heating, transport), legislative framework, and regulatory institutions.
- **Part 3 – Analysis and Policy Implications** [max. 1500 words] – In this section, experts examine a set of political-economic factors enabling, slowing or blocking (i.e. posing barriers to) energy transitions in the given country including the key stakeholders' preferences and their position on renewables adoption and implementation. Relevant stakeholders include: government policy makers, renewable companies, state-owned companies, and environmental groups. This part also highlights key policy implications and recommendations for reform advocates and civil society groups at the domestic and international levels.

SUBMISSION: Answers to all three parts will be integrated to produce country profiles for the Final Report. Please fill out and submit your Survey Response in MS Word format to Dr. Farid Guliyev, the principal investigator for the METE Project. **Deadline: November 10th, 2021.**

COUNTRY: PLEASE WRITE THE NAME OF COUNTRY HERE: _____

EXECUTIVE SUMMARY

PART 1 - BACKGROUND

Provide information on country's profile including its energy mix, renewables potential, relevant regulatory bodies etc.

Part 2 - QUESTIONNAIRE

(with a focus on outlining a country's legal-regulatory framework)

Please provide answers to the following questions with detailed responses. Your answers should be backed up by properly cited evidence (e.g. official documents, reports, media stories etc).

1. What is the government's renewable energy target under its nationally determined contribution (NDC)?
2. Is there a renewable action plan related to the NDC?
3. Is there a comprehensive national Climate Action Plan?
4. Is there a net-zero target and timeline to meet it?
5. What are the key legal acts governing renewable energy development?
6. Is there a specific target for renewables in electricity / power generation? For different sectors: residential (heating and cooling), ground transportation?
7. Is there a legal framework to promote investment on renewable energy?
8. How is the renewables sector regulated? Is there a specific government agency set up to oversee the adoption and implementation of renewables plan or strategy?
9. Do renewables companies have to acquire licenses to operate? If so, what is the procedure?
10. Is there a designated institution for tracking progress in renewable energy development?

PART 3: ANALYSIS AND POLICY IMPLICATIONS

Examine the country's political-economic context with a focus on factors enabling, slowing or blocking the process of energy transition including key stakeholders' and their positioning on renewables adoption and implementation.