Advancing Energy Security in Central Asia

OSCE Organization for Security and Co-operation in Europe

The OSCE Secretariat is proud to present this report, "Advancing Energy Security in Central Asia," a comprehensive analysis of the existing and emerging energy security issues for the five OSCE participating States in the region.

The report is based on a study carried out in the framework of OSCE mandates on energy security, namely Decision No. 12/06 (Brussels) on energy security dialogue in the OSCE; Decision No. 6/09 (Athens) on strengthening dialogue and co-operation in energy security in the OSCE area; Decision No. 5/13 (Kyiv) on the improving the environmental footprint of energy-related activities in the OSCE region, and Decision No. 6/13 (Kyiv) on the protection of energy networks from natural and man-made disasters.

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01 Introduction

In working towards the goal of achieving energy security, the countries of Central Asia are facing similar challenges – mountain and desert terrain that can impede access to the region's energy resources, for example, and inadequate capacity and outdated infrastructure that impose limits on production and efficiency.

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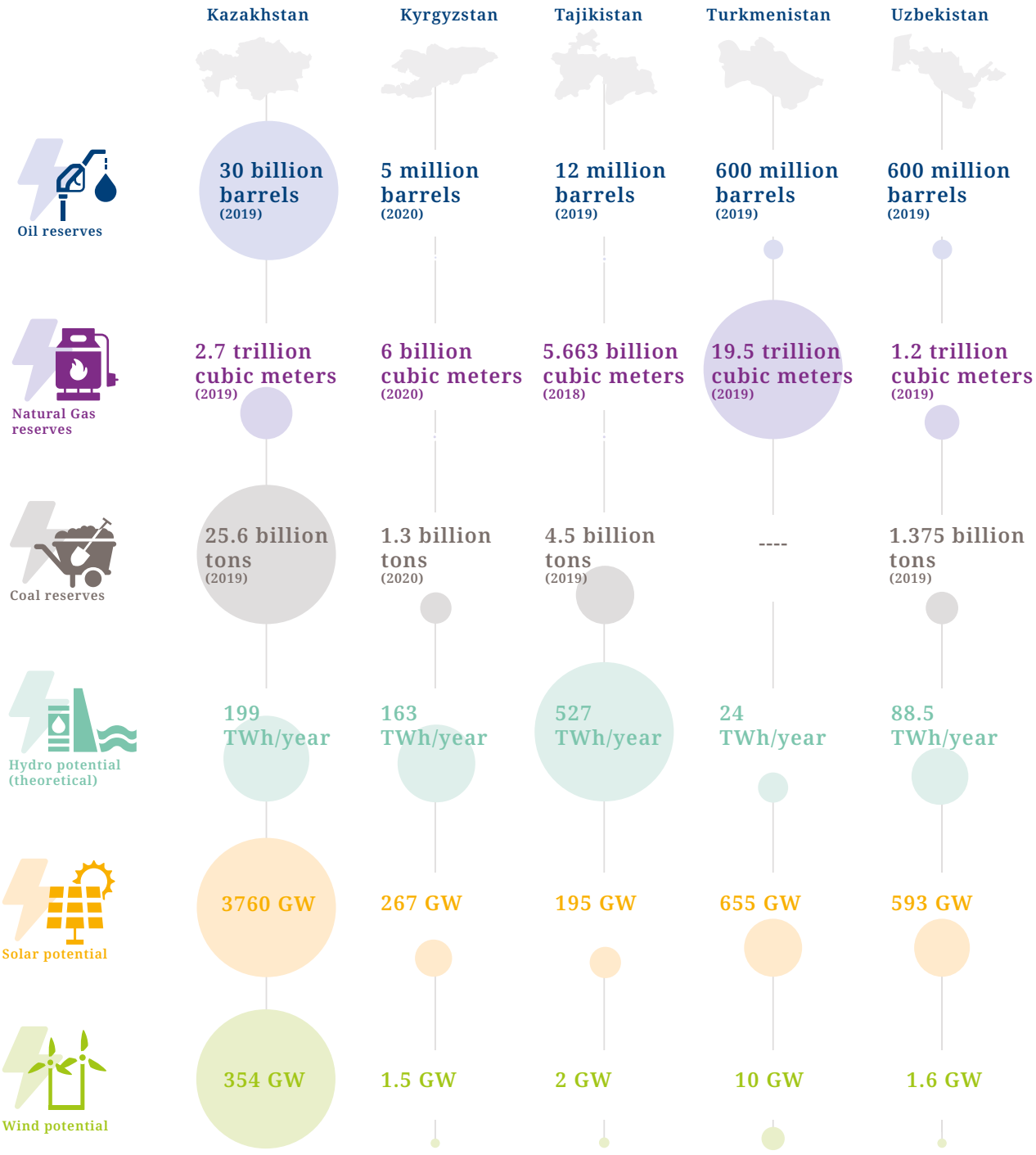
Kyrgyzstan

Growing energy demand in winter and variations in supply are causing seasonal gaps in service across the region, and many communities and households in remote areas remain unconnected to the power grid. In addition, the countries in the region have all pledged to do their part in reducing the emissions that cause climate change. This study, Advancing Energy Security in Central Asia, suggests that the development of a strategy for achieving energy security in the region must consider each of these concerns. This report focuses on the electricity sector, which is particularly vulnerable to challenges such as weak infrastructure and climate change, and which carries significant social impacts for the whole region. The countries' shared challenges, their history of co-operation on energy and the complementary nature of their national energy needs and strengths provide a foundation for mutually beneficial regional co-operation.

Resource distribution in the region

Central Asia is one of the most resource-rich regions in the world with abundant reserves of hydrocarbons – oil, gas and coal – and significant potential to develop solar, wind and hydropower. Kazakhstan has significant oil and coal reserves with excellent potential for solar and wind, and Uzbekistan and Turkmenistan possess abundant natural gas reserves with strong prospects for solar, while Tajikistan and Kyrgyzstan are blessed with some of the world's best geography for hydropower.

Figure 1.
Hydrocarbon reserves and potential renewable energy sources in Central Asia[1]



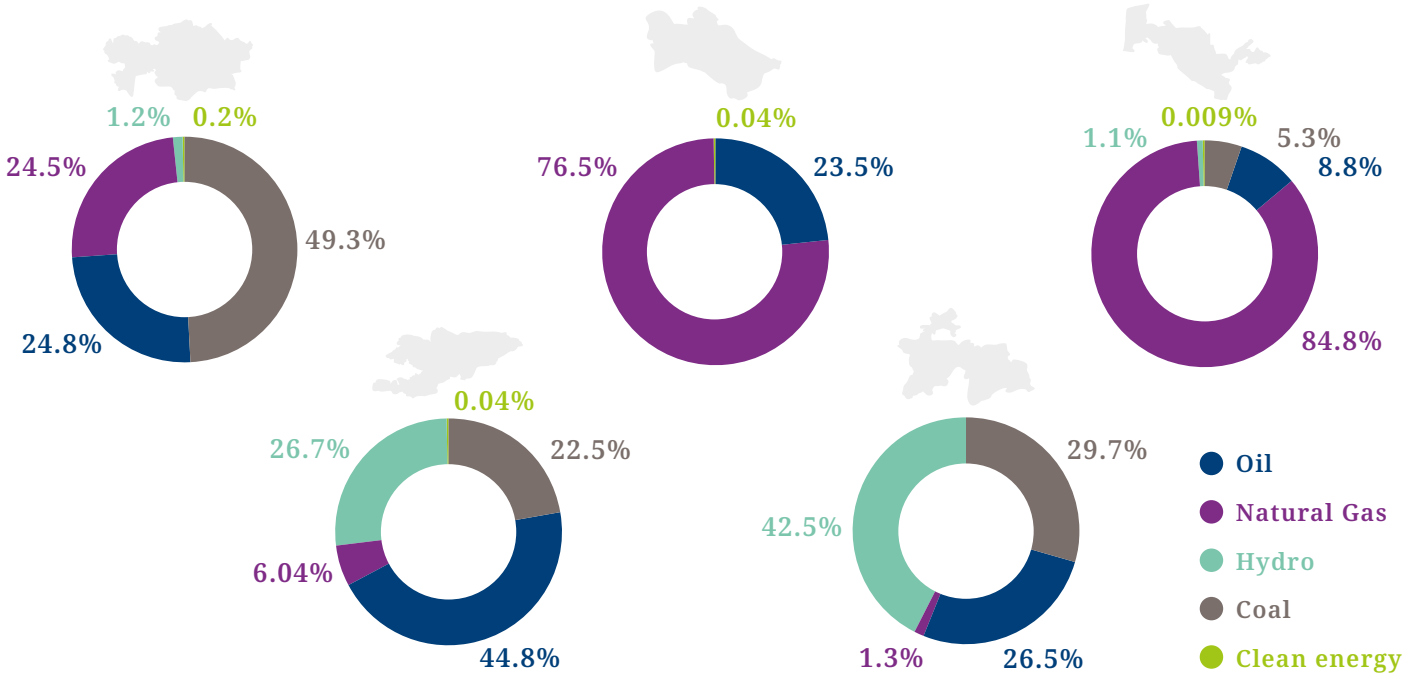
The legacy of the Central Asian Power System

The geographic conditions in Central Asia created incentives for interstate co-operation and the pooling of resources, and the Soviet period witnessed the creation of a complex network that integrated the region's five republics. Instead of building self-sufficient energy production systems for each republic, engineers prioritized cost-efficiency in the construction of power stations and built an electricity grid that disregarded internal borders.

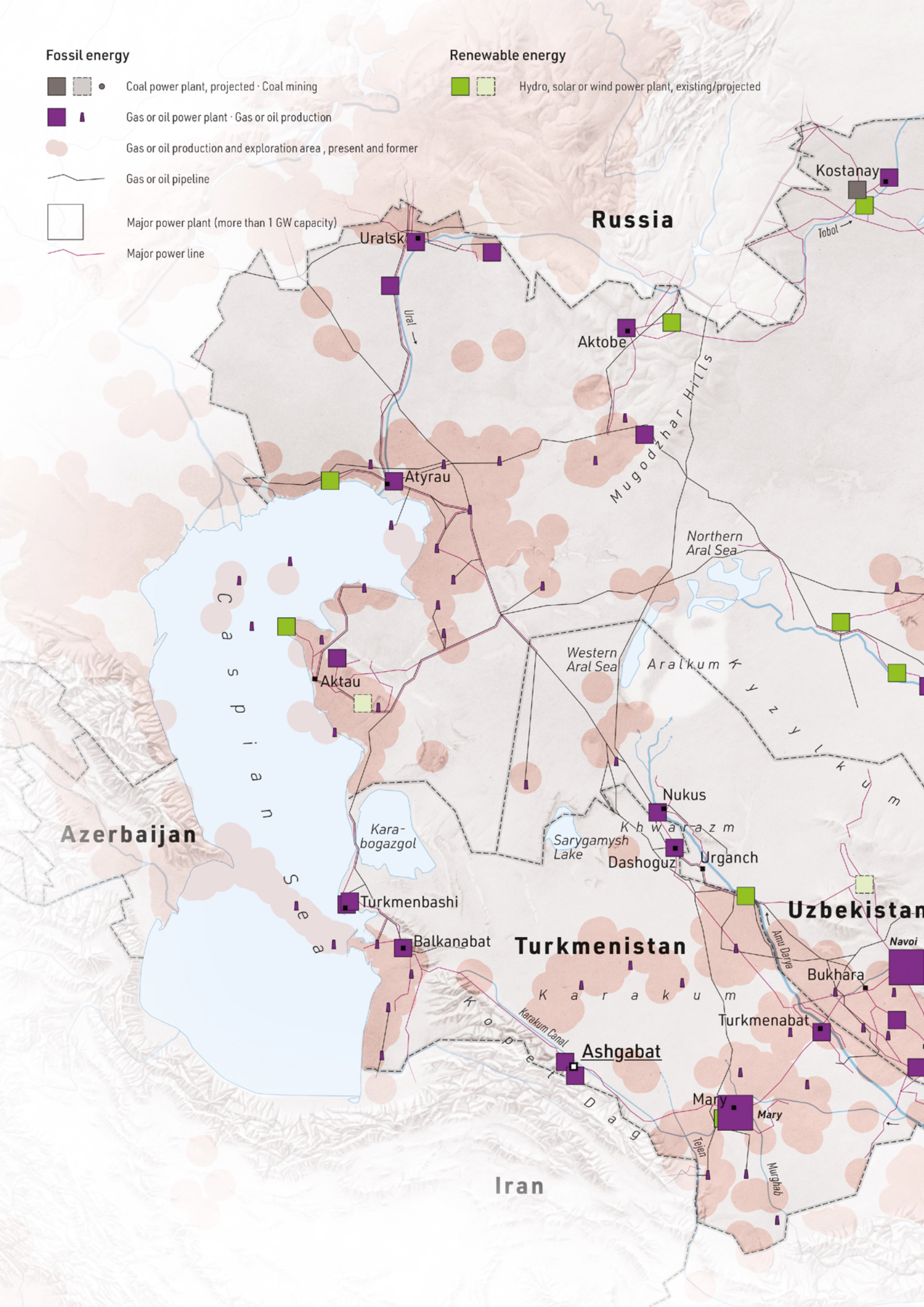
The system closely linked the consumption of electricity, fuel and water. Tajikistan and Kyrgyzstan would release water to downstream countries during the growing period and simultaneously supply hydroelectricity when reservoirs were full. Kazakhstan, Turkmenistan and Uzbekistan would in turn supply oil, natural gas and thermally generated electricity to their upstream neighbours during the low water season. This system – the Central Asian Power System (CAPS) – ensured the sufficiency and reliability of energy supplies throughout the region from a central dispatch center in Tashkent, Uzbekistan.

The post-independence national energy mixes in the region reflect the distribution of resources among the countries, with all five relying on hydrocarbons for the majority of their primary energy supply – which includes heating, power and transport – but with pronounced differences.

Figure 2.
Energy mixes by country, 2018[2]



Uzbekistan and Turkmenistan are heavily dependent on natural gas, and Kazakhstan on coal. Tajikistan and Kyrgyzstan rely on coal and oil to supplement hydropower in periods of peak energy demand. Other renewable energy sources such as solar, wind, geothermal and biofuels play a minimal role throughout the region. This overdependence on a single source of energy applies not only to primary energy, but also to the electricity sector in particular – where renewable hydro generation dominates in Kyrgyzstan and Tajikistan.


Fossil energy
Coal power plant, projected · Coal mining
Gas or oil power plant · Gas or oil production
Gas or oil production and exploration area , present and former
Gas or oil pipeline
Major power plant (more than 1 GW capacity)
Major power line
Renewable energy
Hydro, solar or wind power plant, existing/projected
Russia
Kostanay
Tobol
Uralsk
Ural
Aktobe
Mugodzhar Hills
Atyrau
Northern Aral Sea
Western Aral Sea
Aralkum
Caspian Sea
Aktau
Azerbaijan
Kara-bogazgol
Sarygamysh Lake
Nukus
Khwarazm
Dashoguz
Urganch
Uzbekistan
Turkmenbashi
Balkanabat
Turkmenistan
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Mary
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Murghab
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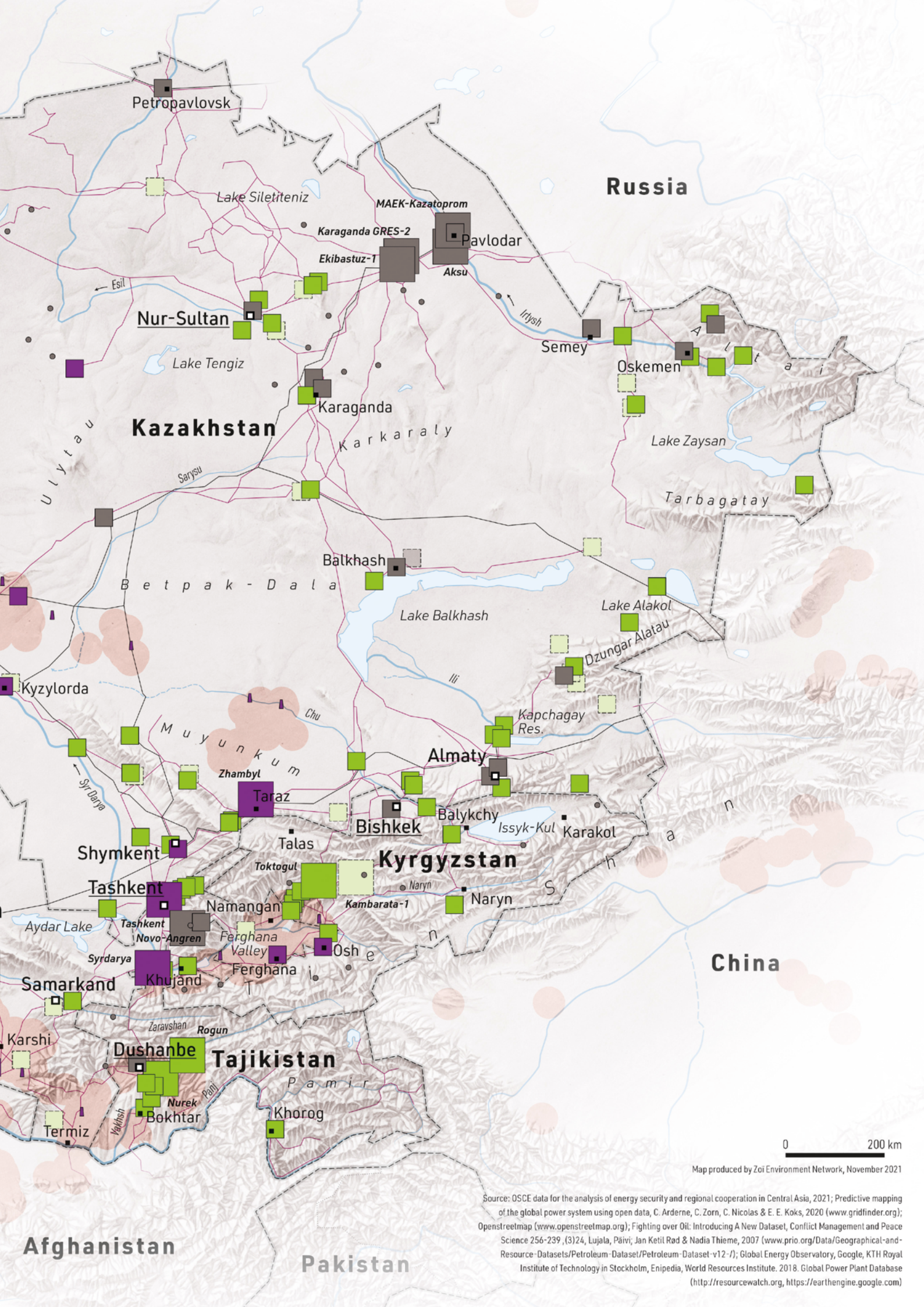


Map produced by Zoï Environment Network, November 2021

Source: OSCE data for the analysis of energy security and regional cooperation in Central Asia, 2021; Predictive mapping of the global power system using open data, C. Arderne, C. Zorn, C. Nicolas & E. E. Koks, 2020 (www.gridfinder.org); Openstreetmap (www.openstreetmap.org); Fighting over Oil: Introducing A New Dataset, Conflict Management and Peace Science 256-239 ,(3)24, Lujala, Päivi; Jan Ketil Rød & Nadia Thieme, 2007 (www.prio.org/Data/Geographical-and-Resource-Datasets/Petroleum-Dataset/Petroleum-Dataset-v12-/); Global Energy Observatory, Google, KTH Royal Institute of Technology in Stockholm, Enipedia, World Resources Institute. 2018. Global Power Plant Database (http://resourcewatch.org, https://earthengine.google.com)

Figure 3.
Installed power generation capacity by country and source in MW, 2019–2021

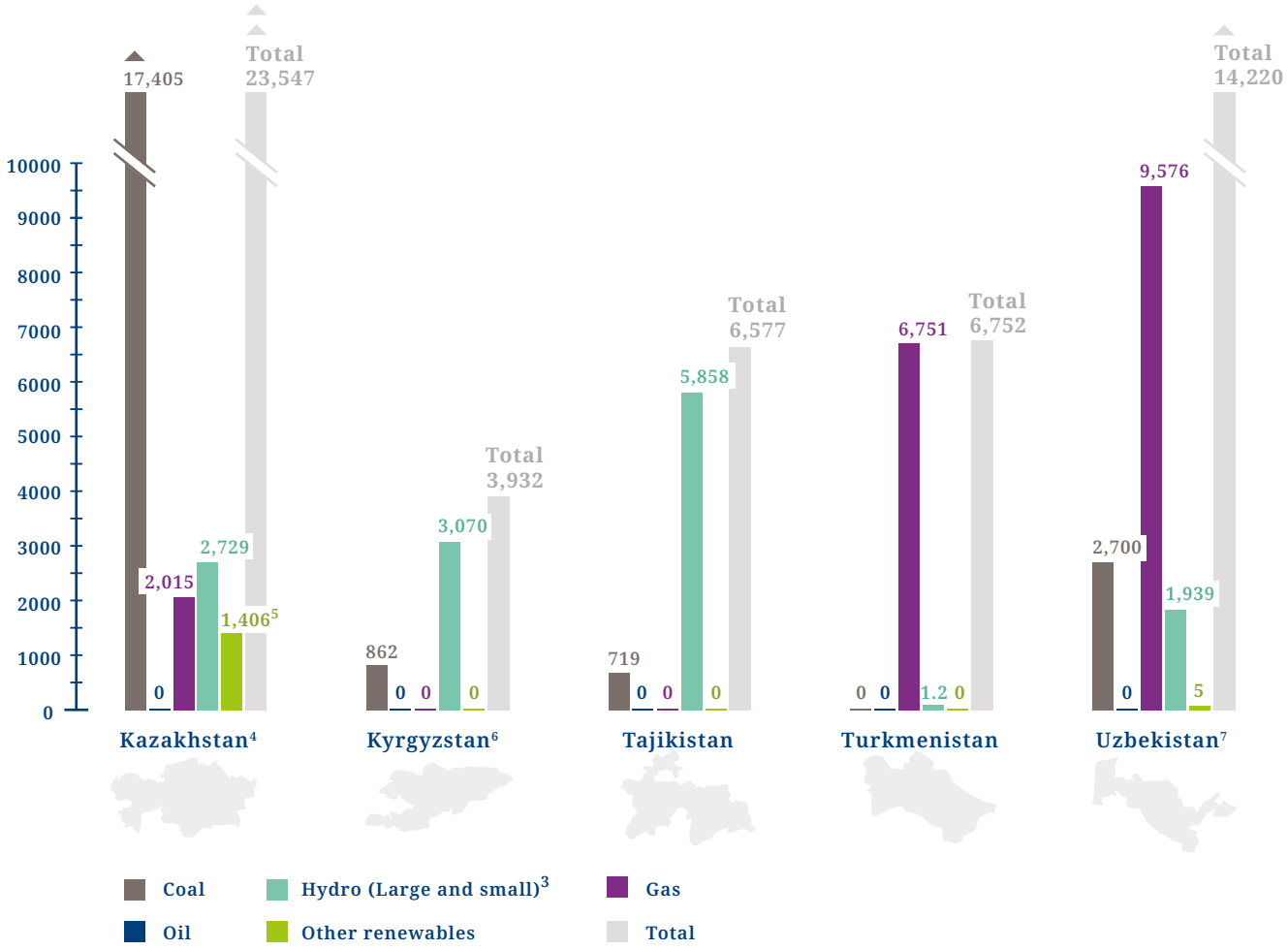
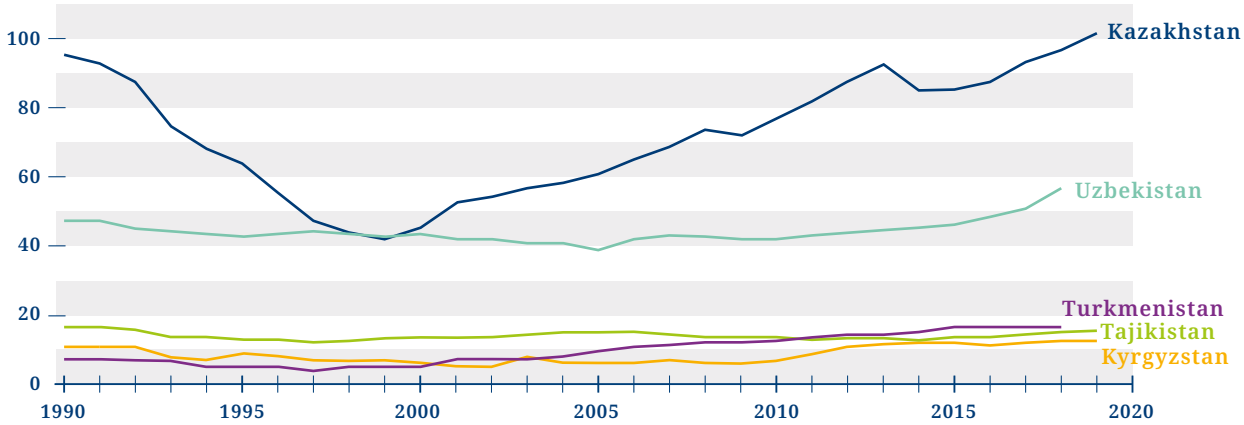


Figure 4.
Electricity consumption by country, 1990–2019 (TWh)[8]



The production and consumption of electricity decreased sharply in the 1990s, but has generally increased since the early 2000s as the population grew and new generation capacity was added to the system.

The growth in electricity consumption has been uneven across the five countries, and all the governments in the region face challenges in safeguarding their energy security while building reliable energy production and transmission systems.

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Kazakhstan

02. Progress since independence

In the late 1990s and early 2000s, the countries of Central Asia started pursuing policies aimed at establishing independent and self-sufficient power systems that would be less vulnerable to unilateral power supply disruptions from outside.

The countries stopped trading electricity and fuel with each other, but the national systems were not fully self-sufficient, and the results included the irrational use of water and energy resources, frequent power supply disruptions and weakened energy security in the region.[9] The Central Asian Power System was weakened after Turkmenistan left in 2003 and formally ended with Uzbekistan's withdrawal in 2009.[10] It was partially recreated in the late 2010s and early 2020s without Turkmenistan's involvement.

The Central Asian countries have since made significant progress in assuring that the classic building blocks of energy security are in place: they have expanded refining capacity and met demand for oil and oil products, increased gasification to meet growing heating and power needs, and extended the national power transmission networks after the initial dissolution of CAPS.

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Aktau, Kazakhstan

Production and processing

Of the countries in the region, Kazakhstan has been particularly successful in expanding hydrocarbon production and processing in response to growing demand. The country's crude and condensate production stood at an estimated 2 million barrels per day in 2020, an historic level,[11] but despite having the largest oil production in the region, Kazakhstan's oil refining capacity remained largely underdeveloped throughout the 1990s and 2000s. As a result, the country had to import almost 30 per cent of its refined oil products from its neighbours during that period. Aware of their vulnerability to external supplies of oil products, Kazakh authorities successfully initiated an oil refinery modernization programme in 2009.[12]

With the modernization process of the refineries in Atyrau, Pavlodar and Shymkent in 2018, Kazakhstan has started producing enough refined oil products to meet its domestic needs,[13] and the country now enjoys the largest oil refining capacity in Central Asia. Kazakhstan is now a net exporter of products to Europe and Central Asia.[14] Thanks to the oil refinery modernization programmes in the country, local customers now enjoy stable and secure domestic supplies of refined oil products. Similar improvements in production and processing capacity can be observed in neighbouring Uzbekistan and Turkmenistan, showing how the region has successfully expanded access of processed fuels to industry and consumers alike.

Gasification

Some countries in the region have successfully promoted initiatives to increase the share of domestically produced natural gas in their overall consumption balance in order to boost socio-economic development and energy security, while also reducing the environmental impact of energy production. Natural gas has a smaller environmental impact than other fossil fuels and is perceived as a good alternative to coal for household consumption, especially for cooking and heating in rural areas.

Turkmenistan has made sustained investments in developing domestic gas production and gas-based power and heat generation since independence, and the country's departure from CAPS made the expansion of domestic generation capacity a top priority. Initiatives aimed at boosting power generation capacity[15] resulted in the country having 13 state-owned power plants with a total capacity of 6,752 MW.[16] In addition, the country has opened the largest combined cycle power plant in Central Asia with generation capacity of 1,574 MW.[17] The combined capacity of Turkmenistan's 12 gas-fired thermal power plants is 6,751.2 MW while the country's sole hydropower plant has a capacity of 1.2 MW.[18]

Kazakhstan possesses the second-largest reserves of natural gas in Central Asia,[19] but limited pipeline capacity and lack of connectivity to resource-poor regions led the authorities to rely on coal and to import gas from neighbouring countries to meet their primary energy needs. To increase the share of gas in the country's energy mix, authorities have adopted three gasification programmes,[20] each representing a new stage of the gasification initiative.[21]

The national operator for gas transmission and distribution has worked with local and central authorities to extend the national gas transit network over the past decade. As of 2019, the nationwide gasification level had reached approximately 9 million out of a population of 18 million.[22] The gasification level is expected to reach almost 12 million residents by 2025.[23] In an attempt to decrease the dependence of the southern regions on imported gas from neighbouring Uzbekistan, the Beineu–Bozoy–Shymkent gas pipeline was put into operation in 2015.[24] The central and northern regions of the country have also been connected to the gas network through the Saryarka pipeline, allowing them to reduce their reliance on coal for their power and heating needs.

The success of gasification campaigns, which have thus far mostly benefitted urban dwellers, is mostly measured by the number of settlements connected to the major gas pipeline network, but the cost of individual pipes to households is covered by individuals. Such costs are often unbearably high for low-income rural residents, and some households in rural settlements with gas availability still suffer from lack of access and energy insecurity.[25]

Infrastructure

The region's growing demand for power has incentivized governments to expand their power transmission networks. In Kyrgyzstan, about 88 per cent of the nation's total installed hydropower capacity is located in the southern part of the country, and more than 70 per cent of total consumption comes from Bishkek and other major urban areas located in the north.[26] Political and administrative borders were not an issue during the Soviet era, and the power transmission network developed in such a way that electricity generated in the south was delivered to the north through Kazakhstan and Uzbekistan at Kyrgyzstan's expense.

After several power supply disruptions and the demise of CAPS in 2009, Kyrgyz authorities decided to establish an independent countrywide transmission network, and in 2014 inaugurated the 500 kV Datka-Kemin transmission line connecting the south and the north. The line enabled the country to establish a national transmission grid, improve the reliability of power supplies and reduce Kyrgyzstan's reliance on imports of electricity.

Turkmenistan's expanded power generation capacities have led to the expansion of its power transmission network. In 2018, the government signed a US $500 million loan agreement with the Asian Development Bank (ADB) to strengthen the transmission network with the aim of expanding the domestic power system and potentially turning Turkmenistan into an electricity exporter.[27]

Domestic power supplies and the country's export capacity are expected to grow further with the extension of the transmission ring along the Ahal-Balkan and Balkan-Dashoguz power lines. In addition, the first leg of the Turkmenistan–Afghanistan–Pakistan power transmission line was completed in January 2021,[28] and will eventually supply electricity to Afghanistan's fourth largest city of Mazar-i-Sharif.[29]

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Kyrgyzstan

03 Ongoing modernization

The transmission and distribution lines and hydropower and thermal power plants built in the Soviet era are in need of modernization and replacement.

The region's power demand is growing and is becoming more seasonal with pronounced consumption peaks during colder months. With the growing risk of blackouts or transmission failures becoming one of the region's key energy security challenges, the countries are prioritizing the expansion and modernization of their electricity systems.

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Uzbekistan

Power plants and the grid

The need for grid modernization is an issue across the region, but Uzbekistan may most clearly exemplify how outdated infrastructure can erode energy security in Central Asia. During the Soviet era, Uzbekistan's power infrastructure connected all other countries in the region. Consequently, the first large-scale power generation facilities and transmission networks in the region were built in Uzbekistan, and the country now has the most extensive transmission and distribution infrastructure in the region, but also the most outdated one. Up to 75 per cent of Uzbekistan's power infrastructure was put in place more than three decades ago – 66 per cent of the transmission grid, 62 per cent of the distribution grid and 74 per cent of the substations.[30] In 2019, losses in the transmission and distribution system averaged 17.4 per cent, three times the average in the Organisation for Economic Co-operation and Development countries.[31]

The obsolesce level of up to 50 per cent for the power generation plants around the country increases the risk of power supply cuts,[32] and ageing electricity infrastructure makes the grid vulnerable to extreme weather conditions, which sometimes cause country-wide electricity blackouts during the first rainy days of the winter months.[33] The factors that increase the risk of blackouts include the ageing distribution network, especially cable lines with a voltage of 6-10 kV; the proximity of residential buildings and trees to power lines; and the high number of households connected to a single transformer. During cold winter days, when many households plug in their electric appliances at the same time, transformers often fail to withstand the overload pressure and cause local outages.[34]

These issues can all be addressed through modernizing the distribution grid and expanding coverage, particularly in densely populated areas. In response, the Uzbek government is prioritizing the modernization of power production and transmission both in its own plans[35] and in joint initiatives with multilateral institutions such as the ADB.[36] Ongoing electricity market reforms that are expected to help reduce power outages to zero in ten years[37] include the modernization of existing power plants, the construction of new generation facilities and the diversification of energy sources.

Kyrgyzstan has faced similar challenges, and currently up to 80 per cent of the power shutdowns in the country occur due to network failures. In particular, power generation facilities constructed between the 1960s and 1980s suffer from extensive power loss and require significant funding for maintenance.[38] Most of Kyrgyz power generation facilities are 35–50 years old and are operating beyond their useful economic and technical lives. Over 50 per cent of the transmission substations are close to 30 years old, and about 20 per cent of the power lines have been in use for at least 40 years. About 90 per cent of the power transmission and infrastructure networks in the capital city require repair.[39]

Kyrgyz authorities have redirected available resources to improving the efficiency of the power generation and transmission networks,[40] and power sector management reforms and the rehabilitation of power generation facilities have had some success in minimizing commercial losses. As a result, electricity losses were reduced from the 40 per cent level in 2009 to slightly over 15 per cent of the total power supply in 2019,[41] but technical power loss remains high.

The electricity consumption of households is growing, with the residential sector currently accounting for 52 per cent of overall power consumption[42] as more households use electricity for cooking and heating. This increasing demand for household energy puts additional load on power stations and the transmission network, and makes grid modernization an ever-more pressing concern for the country.

The Tajik national power company has 450 transmission and distribution substations that require large-scale modernization, and the country's outdated transmission lines do not allow hydropower plants to operate at their full installed capacity. The World Bank estimates electricity losses at 24–28 per cent while the average for power systems of similar age and configuration stands at about 11–12 per cent.[43]

Financial and technological constraints render the modernization of Tajikistan's entire power transmission infrastructure problematic, but the country could feasibly minimize a majority of the technical losses by digitalizing the management of large substations, a step that could decrease electricity losses by 30 per cent.[44] The government has taken the first steps to address this issue by working together with multilateral institutions and initiating projects to update transmission cables and stations.

Hydropower

The hydropower-dependent countries of Kyrgyzstan and Tajikistan face an additional challenge in the rehabilitation of their hydropower stations in order to meet peaks in electricity demand for household heating needs from November to March when energy consumption is as much as three times higher than in summer months.[45] Ageing hydropower infrastructure cannot cope with sharp peaks in demand, particularly when water levels in reservoirs are lower, as in winter. The impact of climate change on glacier retreat will make water supplies even less predictable, and create significant risks for blackouts throughout the region.

Kyrgyzstan is currently using only 13 per cent of its total hydro potential,[46] and has identified large hydropower development as a priority in order to achieve energy security. The Naryn River is the major source of water for the country's hydropower, with 90 per cent of hydropower generating capacities either currently installed or planned for construction on this river.[47] A plan to build seven more cascades with a total of 33 hydropower stations[48] would more than double Kyrgyzstan's power generation capacity, and by 2027 the combination of new and rehabilitated hydropower facilities is expected to increase power generation capacity by more than 700 MW.[49]

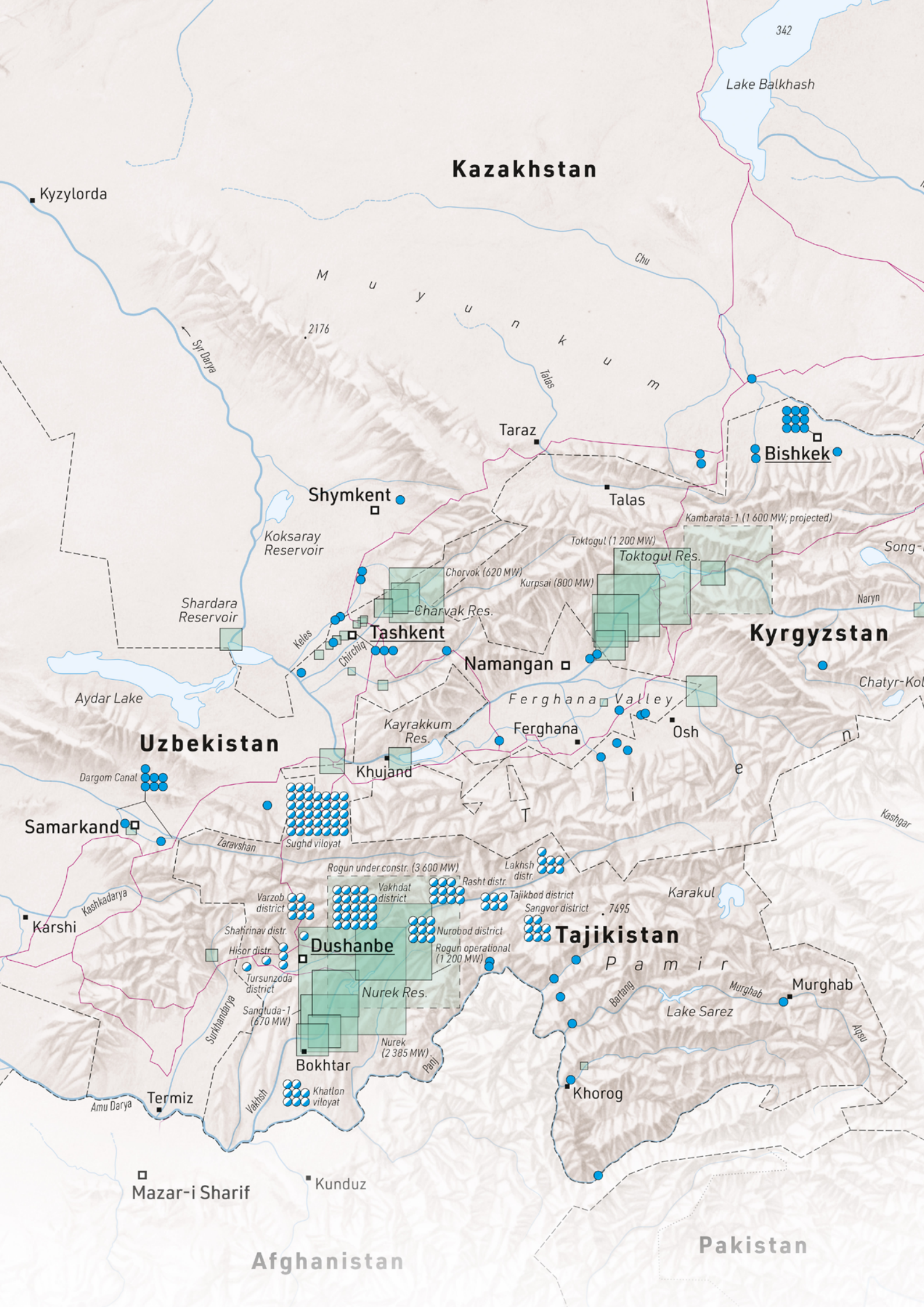
Construction of Kambarata–2, a hydropower plant project, started in 1986, stopped after the collapse of the Soviet Union, resumed in 2003 and started operating with a capacity of 120 MW in 2010. It remains the only hydropower project completed since independence. Its twin project, Kambarata-1, is expected to make a much bigger contribution to Kyrgyzstan's energy security with up to 1,900 MW installed capacity and the ability to generate up to 5 billion kWh of electricity per year.

Finding the US $3 billion in funding for the Kambarata-1 and the US $727 million for the Upper Naryn Cascade plants remains a major obstacle.[50] The high financial and environmental risks are discouraging the foreign investors Kyrgyzstan is counting on.[51] Without expanding hydropower generation capacity, however, Kyrgyzstan may not be able to keep up with the growing domestic power demand and will lose out on potential revenues from exporting excess hydroelectric power to neighbouring countries.

Tajikistan faces similar challenges. As of 2019, the country's installed power capacity had reached 6,577 MW, with 5,858 MW from hydro plants and 719 MW from thermal power plants.[52] The country uses only 5 per cent of its considerable hydropower potential and generates around 15 billion kWh per year.[53] Seasonal variations and changing water levels are preventing Tajikistan from meeting its power needs year-round. The collapse of CAPS compromised imports of thermal electricity from neighbouring Uzbekistan and has left the country exposed to power supply cuts in winter.

The rehabilitation of hydropower plants can help meet the overall demand by restoring lost capacity.[54] The country's biggest power plant, Nurek HPP, provides more than half of Tajik power generation, but is currently operating at slightly over 50 per cent of its original installed capacity. Other hydro dams, such as the Kairakkum HPP, which was constructed in 1956, are operating beyond their initial lifespan and have seen their operational capacity decrease significantly. Most plants and dams are yet to undergo modernization. Having acknowledged that investment in increasing the efficiency of hydroelectric production facilities can benefit both safety and energy security, Tajik authorities have started engaging multilateral institutions such as the World Bank and ADB in the rehabilitation of those facilities.

Rehabilitation alone, however, will not restore enough capacity to meet seasonal variations in demand, so Tajikistan also needs to build new power generation facilities.


Lake Balkhash
342
Kazakhstan
Kyzylorda
Chu
M u y u n k u m
2176
Syr Darya
Talas
Taraz
Bishkek
Shymkent
Talas
Kambarata-1 (1 600 MW; projected)
Toktogul (1 200 MW)
Toktogul Res.
Koksaray Reservoir
Chorvok (620 MW)
Kurpsai (800 MW)
Charvak Res.
Shardara Reservoir
Kyrgyzstan
Naryn
Keles
Chirchiq
Tashkent
Namangan
Aydar Lake
Ferghana Valley
Kayrakkum Res.
Ferghana
Osh
Uzbekistan
Khujand
Dargom Canal
Samarkand
Sughd viloyat
Zaravshan
Kashkadarya
Karshi
Rogun under constr. (3 600 MW)
Lakhsh distr.
Vakhdat district
Rasht distr.
Varzob district
Tajikbod district
Sangvor district
7495
Karakul
Shahrinav distr.
Nurobod district
Hisor distr.
Dushanbe
Rogun operational (1 200 MW)
Tajikistan
Pamir
Tursunzoda district
Nurek Res.
Murghab
Bartang
Murghab
Lake Sarez
Sangtuda-1 (670 MW)
Surkhandarya
Nurek (2 385 MW)
Bokhtar
Panj
Aqsu
Khorog
Khatlon viloyat
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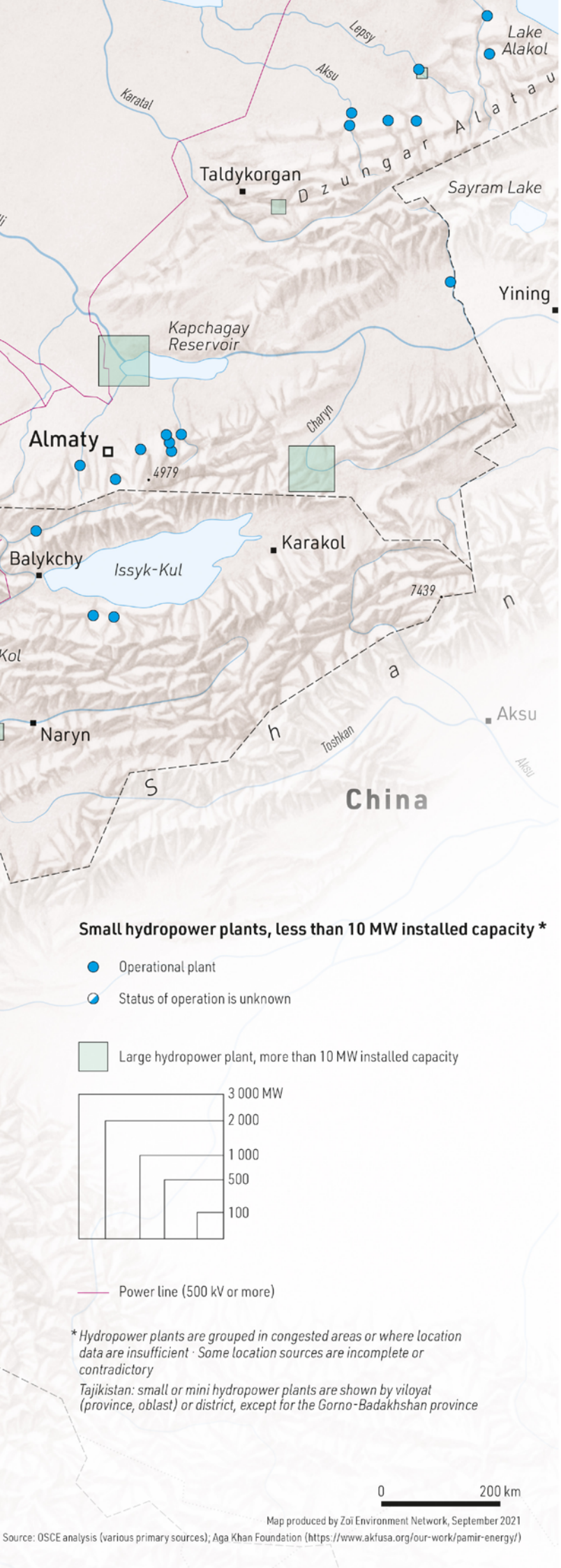

Of the alternatives under consideration, the government prioritized the construction of the Rogun Dam because it had the highest production potential. Construction of the dam began in 1976, but the project has been suspended multiple times, mostly due to lack of financing, safety considerations and water supply issues. Following economic, technical and environmental assessments conducted by the World Bank, the project was restarted in 2016, and is currently under construction at a cost of US $3.9 billion. The completed dam is expected to almost double the country's current power production by adding 17 billion kWh per year,[55] but it will take up to 16 years until the plant starts operating at full capacity, so Tajikistan needs alternative solutions to meet its energy security needs in the meantime.[56] In light of recently improved relations between upstream and downstream Central Asian states, however, Tajikistan is now discussing the possible construction of a few large hydropower plants on transboundary rivers with neighbouring Uzbekistan – a positive step in regional energy co-operation.

© Didor Sadulloev
Tajikistan.

Seasonal gaps

The time and resources needed to modernize existing hydropower infrastructure and construct new projects have led Central Asia countries to look to coal as a short-term solution to energy insecurity. Its low cost and wide availability make it an attractive choice, but the experiences of Kyrgyzstan, Tajikistan and Kazakhstan demonstrate the high environmental and social costs that come with coal.

Kyrgyzstan depends on Combined Heat and Power Plants (CHPPs) to meet the additional load during the winter months when reservoir water levels are low and demand for power is high. The Bishkek CHPP is the largest in the country and plays an important role in providing reliable electricity to the capital in winter. The plant relies primarily on imported coal, however, which not only leads to deteriorated air quality in the city, but also makes Kyrgyzstan more dependent on other countries and producers. In addition, the cost of using 650 MW of thermal power during the period of high demand adds up to about US $83 million for the purchase of coal and gas.[57]

The country is exploring the development of local coal deposits, but domestic production remains limited.[58] While the state-owned enterprise, Kyrgyz Coal, has managed to increase the production of coal by more than six times in the last decade, inefficient management prevents the company from implementing modern extraction technologies and efficient logistics.[59] In addition, the low quality of Kyrgyz coal, particularly from the Kara-Keche coal mine, has been linked by experts to the environmental deterioration in and around the capital.[60]

In Tajikistan, annual coal use reached 2 million tonnes in 2019, a hundredfold increase from levels in 2000. Consumption is expected to reach 3 million tonnes per year by 2021,[61] as authorities aim to increase the use of coal in thermal power plants and industry in order to solve the country's energy insecurity. Certainly, coal-fired stations have helped address energy shortages that were particularly acute a decade ago: before the Dushanbe-2 plant started operating in 2016, winter energy shortages were estimated at 9 per cent of annual consumption.[62] Blackouts in the capital have become less common since, but the increased use of coal has worsened the air quality in Dushanbe, with air pollutants growing by 2.6 times in the 2017–2018 period compared to just a year before.[63]

Kazakhstan, where coal accounts for 50 per cent of primary energy consumption and 70 per cent of electricity generation in the country,[64] is experiencing a similar energy security dilemma. The continued use of coal has a severe environmental impact, with major cities such as Almaty, Nur-Sultan and Shymkent all seeing air pollution exceeding air quality standards.[65] The country can potentially limit its dependence on coal for power generation by developing large hydropower. Almost 70 per cent of all currently installed hydropower generation capacity is located in the eastern part of the country – the richest in hydropower potential – with the main plants being Bukhtyrma (750 MW), Shulbinsk (702 MW) and Ust-Kamenogorsk (315 MW). The hydropower sector, however, is also quite vulnerable to climate change impacts such as floods since most of the hydraulic structures in the region have long passed their useful lives and require maintenance to continue operating safely.[66]

The challenge for the Kazakh, Kyrgyz and Tajik governments in the coming years is to find the optimal trade-off between the reliability and affordability of coal versus the environmental and economic impacts of overreliance on this source. More importantly, continued coal use cannot be justified under the various climate targets and sustainability plans adopted in the region over the past decade. Renewable energy and decentralized energy provide interesting alternatives for the region as a whole – not only to improve the lived environment and lower the chance of supply interruptions, but also to connect rural communities and settlements that continue to suffer from energy poverty.

04 Energy security for the future

In the past decade, decarbonization and renewable energy have become top priorities for energy policymakers around the globe, and Central Asia is no exception. The effects of climate change – extreme weather events, melting glaciers and increased temperatures – are already affecting the region's energy security.

At the same time, the falling cost of renewables and their promise to reinvigorate national economies have incentivized governments to adopt plans for investments in clean energy. Central Asia's significant potential for solar and wind energy and for small hydropower plants suggests that investing in renewable energy sources can have significant benefits for the region and can help address many of its energy security challenges.

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Kazakhstan

The potential of renewable energy

All five Central Asian countries have signed the Paris Climate Agreement and have adopted various legal instruments and policy mechanisms to stimulate the development of renewable energy as a path to achieving their nationally determined contributions to global emissions reductions. With the exception of large hydropower facilities, however, the region has thus far struggled to attract financing or to significantly increase the share of renewables in the national energy mixes. Financing the clean energy transition is becoming even more important as the five governments are currently revising their INDCs under the United Nations Framework Convention on Climate Change (UNFCCC) and are expected to provide new targets during Cop26 in Glasgow.

Table 1.
Nationally determined contributions under the Paris Climate Agreement

	Date of submission of INDC	% of global emissions in 2015	Main targets
Kazakhstan	28.09.2015	0.84%	- Unconditional target: 15% below 1990 levels by 2030;[67] - Conditional target: 25% below 1990 levels by 2030; - Unconditional long-term target: 25% below 1990 levels by 2050.
Kyrgyzstan	29.09.2015	0.03%	- 12-13% below Business as Usual Scenario (BAU) in 2030;[68] - 30% below BAU in 2030 with international support; - 13-16% below BAU in 2050.
Tajikistan	30.09.2015	0.02%	- 10-20% (flexible target) below the 1990 levels;[69] - 25-35% below 1990 levels by 2030 – if emission reduction programmes implemented successfully.
Turkmenistan	30.09.2015	0.20%	No concrete commitments and targets.
Uzbekistan	19.04.2017	0.54%	- 10% below 2010 levels GHG emission by 2030.[70]

Table 2.
Main Renewable Energy Laws in Central Asia

	Renewable Energy Law (2009) Environmental Code (2021)
	Law on Renewable Energy (2008)
	The Law "On the Use of Renewable Energy Sources" (2010)
	Turkmenistan Law on Renewable Energy Sources (2021)
	Law on Renewable Energy Sources (2019)

The region's renewable energy laws have had limited impact thus far, while the experience of Kazakhstan and Uzbekistan – the two states most advanced in renewable energy – reveals how big the obstacles are to transforming the Central Asia energy systems.

Successes and challenges

As the region's leader in renewable energy, Kazakhstan has established clear targets for the use of renewables – solar, wind, biomass, and small hydropower – in its energy mix: 3 per cent of total generation by 2020, 10 per cent by 2030 and 50 per cent by 2050.[71] With the adoption of the Renewable Energy Law, the government sought to create favourable conditions for investment in renewables. The incentives included a mechanism that guaranteed the purchase of electricity; feed-in tariffs; tax advantages; and other preferences. The adoption of fixed tariffs in 2013–2014 and the creation of a single power purchaser, the Settlement and Financial Center, were significant milestones that attracted foreign investment in the Kazakh renewable energy sector for the first time.[72]

In an effort to lower the costs of new installations, the authorities switched from feed-in-tariffs that guaranteed a fixed price for power to an auction process where investors bid to install a certain capacity. In 2018, the first online auction for the development of solar, wind and biomass energy production facilities and for small hydropower plants achieved significantly lower prices for the installations – about 15 per cent lower for wind, and 66 per cent lower for solar.[73] Among the preferential conditions offered to investors are the fixing of tariffs to the US dollar, 25-year guarantees of power purchases by the state, international arbitration in London, different forms of financial support, and take-or-pay provisions.[74] With these state support mechanisms, Kazakhstan has achieved its 3 per cent target in electricity generation from renewable energy sources by 2020.

By the end of 2020, Kazakhstan introduced nineteen new renewable energy projects[75] bringing green power generation capacity to a total of 1,634.7 MW, and opened the largest solar power plant in Central Asia in 2019, the Saran installation, which has a capacity of 100 MW.[76]

Figure 5.
Renewable energy projects in Kazakhstan, 2014–2020[77]

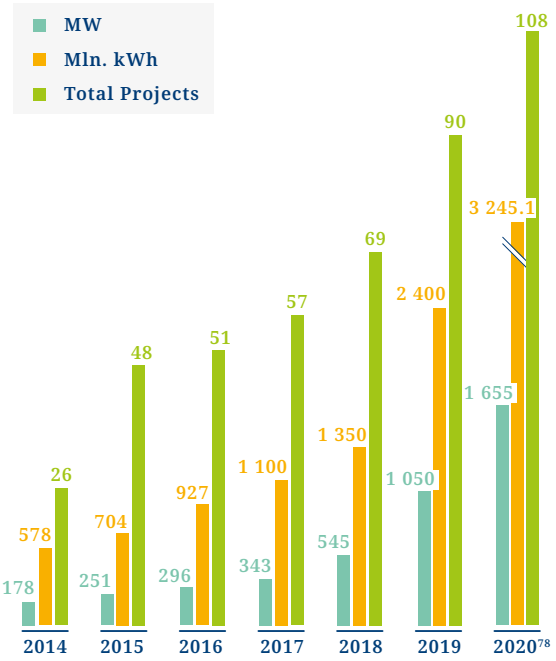
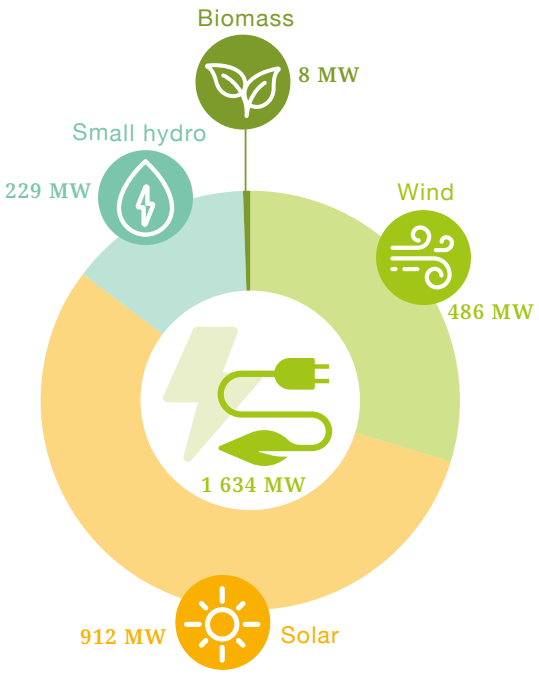
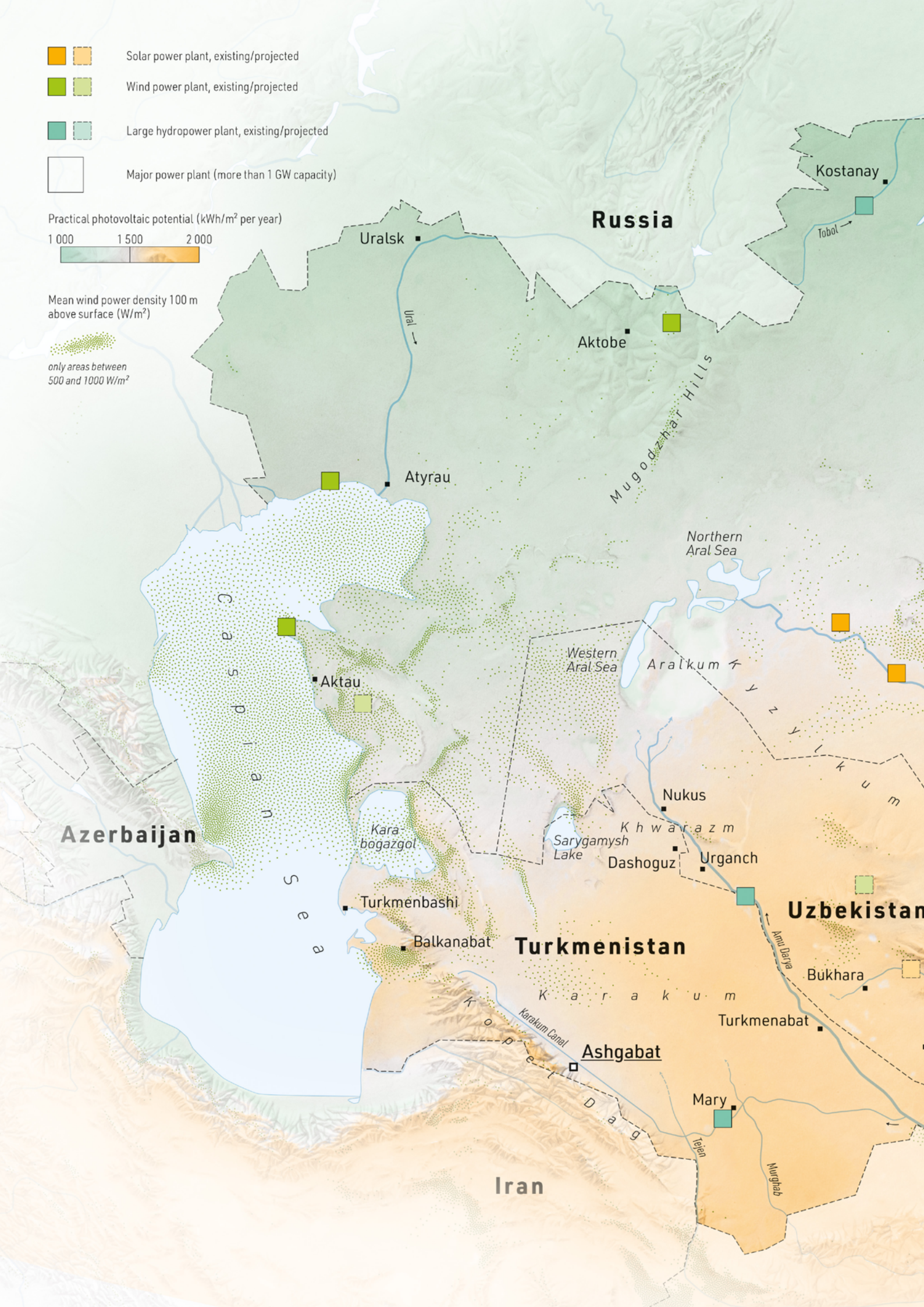


Figure 6.
Current renewable energy capacity by source, 2020[79]




Solar power plant, existing/projected
Wind power plant, existing/projected
Large hydropower plant, existing/projected
Major power plant (more than 1 GW capacity)
Practical photovoltaic potential (kWh/m² per year)
1 000
1 500
2 000
Mean wind power density 100 m above surface (W/m²)
only areas between 500 and 1000 W/m²
Russia
Kostanay
Tobol
Uralsk
Ural
Aktobe
Mugodzhar Hills
Atyrau
Northern Aral Sea
Caspian Sea
Western Aral Sea
Aralkum
Aktau
Nukus
Khwarazm
Sarygamysh Lake
Kara-bogazgol
Dashoguz
Urganch
Azerbaijan
Turkmenbashi
Uzbekistan
Balkanabat
Turkmenistan
Amu Darya
Bukhara
Karakum
Turkmenabat
Karakum Canal
Kopet Dag
Ashgabat
Mary
Tejen
Murghab
Iran


Petropavlovsk
Russia
Lake Siletiteniz
Pavlodar
Esil
Nur-Sultan
Irtysh
Semey
Lake Tengiz
Oskemen
Karaganda
Kazakhstan
Karkaraly
Lake Zaysan
Ulytau
Sarysu
Tarbagatay
Balkhash
Betpak-Dala
Lake Balkhash
Lake Alakol
Dzungar Alatau
Ili
Kyzylorda
Chu
Kapchagay Res.
Muyunkum
Almaty
Syr Darya
Taraz
Balykchy
Bishkek
Issyk-Kul
Karakol
Talas
Shymkent
Kyrgyzstan
Toktogul
Tashkent
Naryn
Kambarata-1
Naryn
Namangan
Aydar Lake
Ferghana Valley
Osh
China
Ferghana
Khujand
Samarkand
Zaravshan
Rogun
Karshi
Dushanbe
Tajikistan
Pamir
Nurek
Panj
Bokhtar
Khorog
Termiz
Vakhsh
0
200 km
Map produced by Zoï Environment Network, November 2021
Afghanistan
Pakistan
Source: OSCE data for the analysis of energy security and regional cooperation in Central Asia, 2021; Global Wind Atlas 3.0 (www.globalwindatlas.info); Global Solar Atlas 2.0 (www.globalsolaratlas.info); Global Energy Observatory, Google, KTH Royal Institute of Technology in Stockholm, Enipedia, World Resources Institute. 2018. Global Power Plant Database (http://resourcewatch.org, https://earthengine.google.com)

Meeting Kazakhstan's next renewable energy targets will require much larger investments from both the government and the private sector, in the range of US $54.6 billion to US $96.2 billion over the 2015–2045 period, taking into account the projected growth in demand.[80] This might prove especially difficult for a country that is highly dependent on revenues from hydrocarbons to finance its domestic budget and that has currency that is vulnerable to changes in oil prices. Yet the successes of projects such as Burnoe Solar or the Zhanatas wind park – which have some of the largest production capacity in the region – show that the government has learned quickly from its initial steps and that investing in bigger renewable projects can be made attractive.

Another obstacle facing Kazakhstan is the integration of intermittent renewable energy in a conventional and highly inflexible power system. Priority access to the central power grid, which allows producers to sell their energy to the grid whenever a renewable source becomes available, is not currently an issue because solar and wind are small parts of the energy mix. A growing share of intermittent renewables, however, could compromise the reliability of the country's power system,[81] in large part because of the inflexibility of coal-based power generation.

Kazakhstan's power system was designed with limited electricity generation flexibility, and it relies on coal-fired plants for more than 70 per cent of the country's total power generation. Gas-fired thermal plants and hydropower plants can be started up quickly whenever renewable generation is insufficient to meet demand;[82] coal-fired plants cannot. Kazakhstan's hydropower sector is relatively underdeveloped and particularly vulnerable to climate change, so maintaining a reliable and stable system based on coal and renewables presents a challenge, and may require the transformation of the system as a whole.

Case Study: The Burnoe Solar Power Plants

The Burnoe Solar-1 and Solar-2 power plants are the first attempts to introduce large-scale renewable energy projects in Kazakhstan.[83] In total, the two plants have a 100 MW capacity and provide electricity to 70,000 homes.[84] Together, they are expected to reduce Kazakhstan's CO_2 emissions by more than 150,000 tonnes per year.[85] While this is not much for the country – which emitted almost 314 million tonnes of carbon dioxide in 2019[86] – the plants can set an important precedent for the expansion of the clean energy sector.

Electricity generated at these two plants is connected to the central power grid via a 220 kV transmission line. Regulatory reforms, and specifically the feed-in tariffs on clean energy, were instrumental in accelerating the plants' construction. Without the government's guarantees to purchase electricity produced from renewable energy plants at a fixed rate, this project would have not been realized.

The return-on-investment period for the project was initially estimated at 12 years, but the equipment was purchased in foreign currency before the devaluation of the Tenge, so the period had to be extended to 15 years. Kazakhstan partnered with the European Bank for Reconstruction and Development (EBRD) and the multilateral Clean Technology Fund for the construction of the plants for more than US $120 million each.[87] The EBRD's concern about how the devaluation of the local currency affects the return on investments led to the decision to provide no further major loans to renewable energy projects in local currency. The Burnoe Solar power plants sprawl across 150 hectares, and the plant administration invited residents of the neighbouring villages to graze their livestock alongside the installations, but the residents believed that the animals might get exposed to solar radiation from the panels. This experience illustrates the need for awareness-raising and community outreach in areas with renewable energy facilities.

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Kazakhstan

Uzbekistan hopes to meet its Paris Agreement commitment – to cut 10 per cent emissions per unit of GDP by 2030 compared to 2010 levels[88] – through renewable energy sources. The country's power demand continues to grow and is expected to double by 2030, reaching 120.8 billion kWh by 2030.[89] Authorities plan to diversify the structure of the country's power mix to ensure sustainable electricity supplies by increasing the renewable energy contribution to the energy mix to 21 per cent of total energy consumption by 2030. The challenges to achieving this goal include financial obstacles, the intermittent nature of renewables, the lack of backup power plants and a history of unrealized solar power projects.

In the 2010s, Uzbekistan developed plans with ADB support for five 100 MW solar power plants. After several postponements, Uzbekistan cancelled or postponed the projects. Another solar project with support from Canadian investors also failed to get off the ground, and the wave of shelved projects revealed the challenge in creating the right incentives and regulatory environment to develop solar and other renewables in the region. The countries in Central Asia rely heavily on foreign companies for financing, technology and expertise in renewables, but their subsidies of electricity prices make it more difficult for investors to recoup their investments.

Uzbekistan has sought to make renewable projects more attractive by providing additional governmental support and by developing an effective financing mechanism, and are considering applying a newly enacted law on public-private partnership to facilitate collaboration between the government and the private energy sector. Under the 2016 Renewable Energy Programme, 810 projects planned for the 2017–2025 period[90] await financing by foreign investors, but the public-private partnership mechanism is yet to be applied in this context, and whether it will be sufficient to attract the required level of investment remains unclear.

In recent successes, a United Arab Emirates company won a tender to design, finance, build, and operate a 100 MW capacity solar power plant, located in the Navoi region.[91] Funding for the construction of the plant was secured with loans from international partners such as the International Finance Corporation, ADB, the World Bank Group and the European Bank for Reconstruction and Development.[92] Arrangements for the construction of wind power plants have also been made with a Saudi company. Gulf companies are experienced in implementing large-scale renewable energy projects at competitive prices abroad.[93] In addition, the price of solar photovoltaics continues to fall around the world, making this technology more attractive than coal and even gas-fired plants for new power generation capacity. As some previously postponed projects move forward with new investors and as the government improves legislation with advice from multilateral banks, the prospects for future renewable projects now seem much brighter.

There is a common understanding among Central Asian leaders of the need for an electricity tariff system that allows investors to recoup investment costs.[94] In Kyrgyzstan, the President has recently argued that reforming electricity tariffs would allow Kyrgyzstan to overcome its energy crisis by 2025 while establishing a financially sustainable energy system.[95] Tajik authorities, in consultation with international financial institutions, are also working on reforming subsidized tariffs so that they would allow full cost recovery for power generation, transmission and distribution companies by 2025.[96] Closing the cost-recovery gap will not only attract investors in renewable energy sources but will also allow power companies to invest in infrastructure maintenance and in improving the quality of services. Yet reforming power tariffs could disproportionately impact vulnerable households, particularly in rural areas, making electricity unaffordable and increasing energy insecurity for large segments of the population.

Decentralized power for remote areas

The rural areas of Central Asia – where more than half of the population lives – are poorly served by the national grids, but the region has significant potential to develop small-scale, off-grid solutions. This type of decentralized approach would not only help the countries achieve their renewable energy and climate targets, but also alleviate energy poverty and insecurity in rural communities – one of the most pressing issues for the region's socio-economic development. The scale of the problem varies from country to country, but in all cases large numbers of people are affected by the lack of a secure energy supply.

- More than 5,000 residential areas in Kazakhstan are not connected to the central power grid,[97] and residents in these remote settlements often burn coal to meet their household energy needs

- Most international studies report an electrification rate in Kyrgyzstan of 100 per cent, but the National Statistics Committee of Kyrgyzstan indicates that only 76 per cent of the population has access to reliable electricity supplies year-round[98]

- According to a 2013 World Bank study, 70 per cent of the Tajikistan population suffered from some form of power shortage during winter,[99] and while the construction of a Dushanbe thermal power plant has partially solved the problem of energy insecurity for the capital city, rural residents and people living in remote mountainous areas of Tajikistan remain vulnerable

- While Turkmenistan has a nearly 100 per cent electrification rate according to the World Bank,[100] there is little data on the coverage rate in remote rural areas in the desert

- In contrast to World Bank reporting that 100 per cent of Uzbekistan's population has access to electricity, some estimates suggest that 1,500 rural settlements that are home to 1.5 million people are not properly connected to the central power grids due to their remote location and inefficiencies in distribution and transmission[101]

Governments around the region have acknowledged this immense challenge and have introduced plans and programmes to supply electricity to remote regions. Rooftop solar panels and biomass, in particular, have the potential to be effective solutions to poor grid connections.

In Uzbekistan, the Ministry of Energy has identified 33 potential districts in the country for autonomous energy supply, and is considering the installation of solar panels for 150,000 households between 2021 and 2032.[102] These initiatives could bring immense benefits, and the delivery of electricity to the neediest 33 remote districts could trigger a push for decentralized energy development countrywide.[103]

Decentralized energy could also be a potential solution for Kazakhstan, where difficult to reach remote settlements suffer from energy poverty and are often heavily dependent on coal. Households residing in the regions of Kazakhstan with long winters lack access to cleaner energy sources, suffer from energy poverty, and as a consequence, face a higher risk of energy insecurity. Survey results show that 28 per cent of households spend more than 10 per cent of their income on energy and 77 per cent of the rural households lack access to clean fuels.[104] Autonomous renewable energy facilities can potentially help replace coal in those remote regions and mitigate the environmental impact of being overdependent on coal.

In response, Kazakhstan has developed a formal mechanism to support small-scale renewable energy sources, and will provide small enterprises or households in settlements not connected to the central grid a 50 per cent subsidy against the cost of a 5-kW renewable energy system.[105]

Currently, direct subsidies are provided only for installations with equipment manufactured in Kazakhstan, but the Kazakh renewable energy manufacturing industry is still in its infancy. The options for purchasing solar panels are limited, and the relatively high cost make the installation unprofitable. Nevertheless, the development of Kazakhstan's photovoltaic industry could amplify the impact of the initiative and bring significant benefits to rural residents.

In Kyrgyzstan and Tajikistan, small hydropower stations are the most promising decentralized energy source for vulnerable segments of the population living in remote mountainous areas. Such small HPPs can also contribute to reducing coal consumption by households. The majority of the 900,000 households without access to centralized heating systems rely on individual coal-based systems as their primary heating source.[106] Developing small hydropower and other renewables could allow Kyrgyz authorities to enhance energy security and address environmental concerns at both the local and national levels.[107]

Small hydropower has always been an integral part of the Kyrgyz power system, but the country disposed of more than 100 small hydro plants that collectively produced more than 30 per cent of total electricity generation. Most were shut down or removed from operation after independence as priority was given to the expansion of the power infrastructure and development of the country's large-scale hydropower. Now, the national energy programme intends to rehabilitate many old plants and to construct new ones, bringing on line about 100 small hydro plants with a total capacity of 180 MW.[108] A number of technical, economic and institutional challenges, however, have limited the realization of these plans, and currently only 18 small plants with a total capacity of 54 MW are operating.[109]

Tajikistan is also actively promoting the construction of the small hydropower plants with the support of multilateral institutions, and intends to build an additional 189. The country currently has more than 300 small hydropower plants, but fewer than 20 per cent remain operational.[110] The most common reason for the failure is that the streams have dried out – either completely or in winter – as a result of climate change.[111] In addition, the cost for building small hydropower plants in Tajikistan remains relatively high at US $3,000 per kW installed capacity, almost twice the cost of medium and large hydropower plants.[112] In light of the low purchasing power of rural residents, these costs may be too high for the national power company to be able to recover the investment through the existing tariff system.

Case study: Pamir Energy

An excellent example of a decentralized power system is Tajikistan's Gorno-Badakhshan Autonomous Region (GBAO) power system, which is supplied with electricity by the Pamir Energy Company. This power system consists of 11 small and medium hydropower plants with a total capacity of 40 MW. It supplies electricity to about 220,000 GBAO residents under a 25-year agreement signed between the government and the company.[113]

In this mountainous region, temperatures remain below zero for 6–7 months of the year and frequently fall below minus 40°C. In the past, the inhabitants had to rely on coal, kerosene, animal dung and firewood for cooking, heating and lighting. The cost of kerosene and coal is extremely high for an area where 51 per cent of residents live below the poverty line,[114] and the use of wood of heating has damaged local forests.[115] Pamir Energy now provides electricity to most residents in the GBAO, although there are still some areas not connected to the network. Still, this autonomous power system has considerably improved the energy security of GBAO residents by providing environmentally clean and sustainable supplies of electricity, and has helped arrest the deforestation in the region.

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Tajikistan

05 The prospects for regional co-operation

While many obstacles need to be overcome to reach the long-term goal of a decarbonized and sustainable energy system, in the short term Central Asian countries can enhance their energy security through a more rational use of resources at the regional level.

The reinstatement of regional energy trade can be a low-cost and mutually beneficial solution to many of the region's energy challenges. Regional pipeline and powerline infrastructure is already in place, the energy systems of the five countries remain highly complementary and recent political changes in the region have created opportunities for regional energy co-operation.

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Turkmenistan

Incentives for co-operation

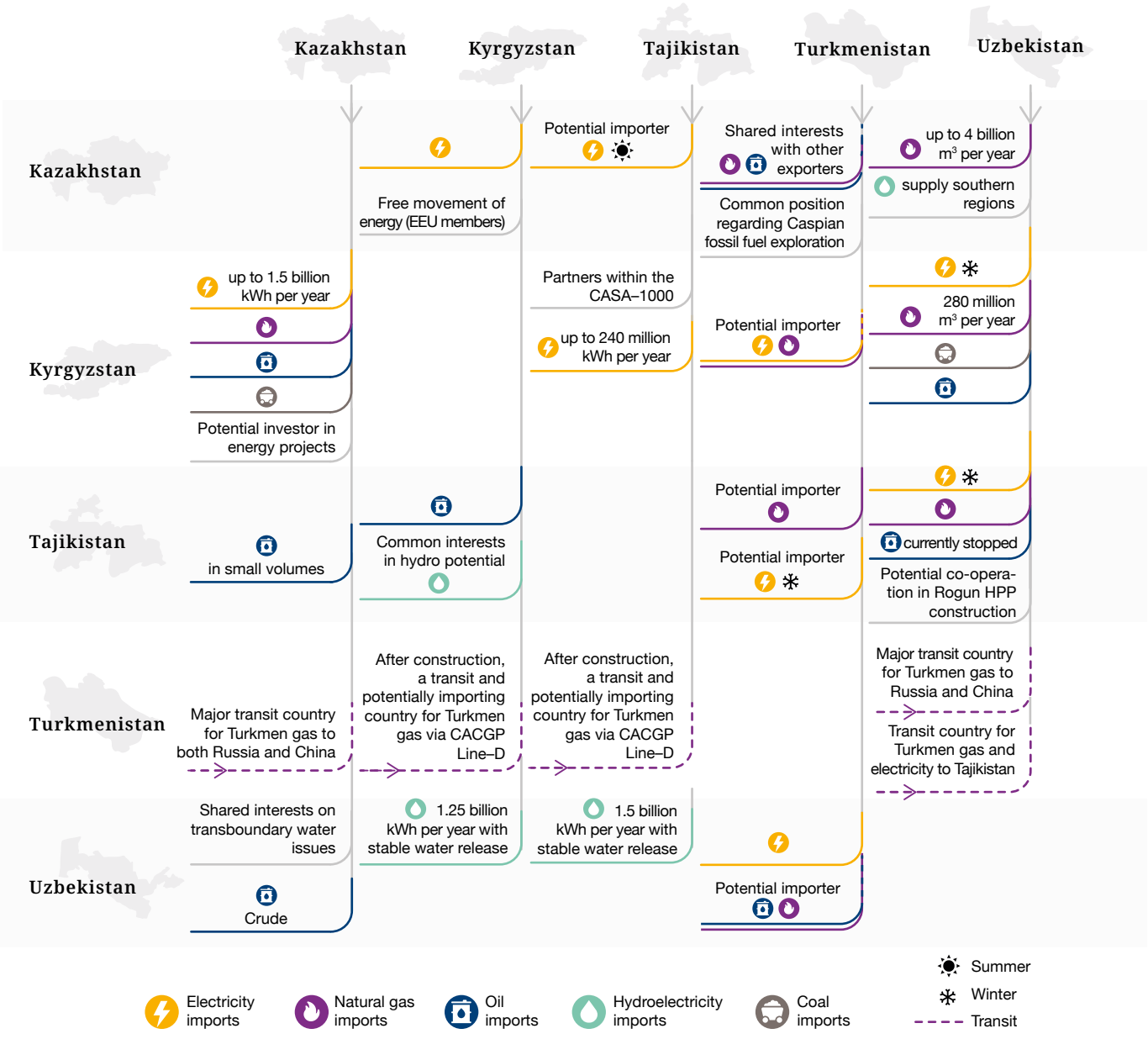
A strong basis for regional co-operation lies in the countries' shared energy security challenges, the legacies of their history of co-operation on energy, the complementary nature of their national energy needs and strengths, and the existing level of co-operation on energy matters. The shared pipeline and electric power grid networks that the countries inherited from the Soviet era are a good starting point, and the need to modernize that infrastructure combined with the shortage of sufficient capital for new transmission and distribution projects makes co-operation particularly attractive. Modernizing the existing infrastructure would be less capital intensive and time-consuming than starting from scratch, but would still provide sufficient energy access and security in each of the five countries to justify the effort.

Transnational trade in energy within the region would take advantage of the strengths of each country to fill the gaps in service in the other countries, and would result in a more rational use of regional resources. Tajikistan and Kyrgyzstan enjoy 5.5 per cent of the world's economically efficient hydropower potential; Kazakhstan possesses a considerable amount of oil and is among the top ten coal-rich countries in the world; Uzbekistan and Turkmenistan are large gas producers with considerable thermal power generation capacity.[116] Countries with excess electricity could realize additional export income, while areas with seasonal peaks in demand could benefit from additional power supply. All of these factors give new impetus to the regional power trade developed in recent years.

Uzbekistan, Kazakhstan and Kyrgyzstan are already operating within a reconstituted Central Asian Power System, and are currently focused on fully integrating Tajikistan into the system in 2021.[117]

Cooperation in the gas sector has also increased rapidly, spurred by the construction of the Central Asia-China gas pipeline network which has delivered more than 336 billion m^3 (bcm) of natural gas from Turkmenistan, Uzbekistan and Kazakhstan to China.[118] While the network has thus far connected only three of the five countries, it is currently being expanded with a fourth line that would pass through Tajikistan and Kyrgyzstan and increase the network's total capacity from 55 bcm to 85 bcm. The trend of growing natural gas exports to China could thus help integrate the sector across the region and expand supplies to countries lacking in domestic gas production.

Figure 7.
Co-operative energy sector dynamics in Central Asia



National perspectives

Uzbekistan's withdrawal from the original CAPS in the early 2000s completely isolated Tajikistan, which was connected to the system via Uzbek transmission lines, and left Tajikistan to try to meet its energy needs from its own resources.[119] The sudden cut-off from the unified system caused countrywide power outages and an energy crisis. Over time, Tajikistan compensated by increasing the share of domestic coal consumption for heating and electricity generation.

In the long term, however, Tajikistan is counting on the construction of the Rogun Dam, which would allow it to double power generation capacity nationwide. Once a source of regional conflict, Rogun has recently turned into a potential area for energy co-operation with Uzbekistan showing a willingness to provide support for the dam's construction. A 2018 agreement provides for the import of 1.5 billion kWh of Tajik electricity to Uzbekistan.[120] After restoring the power infrastructure in 2017–2018, Uzbekistan has also been supplying electricity to the northern regions of Tajikistan.[121] These steps show how renewed co-operation on both energy trade and the construction of power plants can increase the collective energy security of the whole region.

Following the breakdown of CAPS, Kyrgyzstan had maintained limited electricity trade with Kazakhstan and Uzbekistan,[122] but the reduced energy trade precluded Kyrgyzstan from using its hydropower export potential fully, and it could not meet its power needs by importing electricity generated at thermal power plants. Kyrgyzstan is now interested in importing electricity from neighbouring countries to make up for potential shortages resulting from the Toktogul reservoir's low water level and to meet winter power demand. In turn, the country could export hydroelectricity during high water periods. The technical capacity of the grid connections with Tajikistan and Kazakhstan is limited and, thus, Kyrgyz authorities are keen to revive electricity trade with Uzbekistan.[123]

In 2017, Kyrgyzstan and Uzbekistan signed an agreement for the export of Kyrgyz electricity to Uzbekistan in the amount of 1.25 billion kWh per year,[124] and Uzbekistan has also agreed to let electricity from Turkmenistan reach Kyrgyzstan and Kazakhstan via Uzbekistan's power transmission lines.[125] In 2017, Kyrgyzstan and Uzbekistan signed a memorandum of understanding for co-operation in the Kambarata-1 hydropower project, and Uzbekistan even expressed a willingness to take part in the construction of the plant.[126] Coupled with Kyrgyzstan's recent reintegration into CAPS, this co-operation shows that regional electricity trade can make a difference in addressing the country's energy security challenges, and that the prospects for co-operation are getting brighter.

New leadership in Uzbekistan is establishing a policy agenda aimed at addressing energy security concerns, and the revival of intraregional energy trade is emerging as an important consideration. As the hub for the power network in the region, Uzbekistan plays a crucial role in restoring the co-operative dynamics. It resumed electricity imports from Kyrgyzstan and Tajikistan in 2018, from Kazakhstan in 2019 and from Turkmenistan in 2020.[127] Uzbekistan is also trying to balance electricity supplies within CAPS. In July 2020, for instance, low water levels in reservoirs forced Tajikistan to suspend its power exports to Uzbekistan, so Uzbekistan compensated by increasing its electricity imports from Turkmenistan, and prevented power supply outages in the country.[128]

06 Recommendations

Achieving energy security in Central Asia requires the development of national and regional strategies that consider how to bridge the existing gaps in electricity service in remote areas and how to provide service when the increasing demand for energy in winter and variations in supply cause seasonal gaps.

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Kazakhstan

The strategies also have to consider how to reduce emissions so that the countries of Central Asia can meet their contributions under the Paris Agreement. Inadequate capacity and outdated infrastructure impose costs and limitations across the region, but abundant oil, gas and coal reserves, and the significant potential to develop solar, wind and hydropower hold promise for both the short run and the long term.

The results of this OSCE study suggest that the development of renewable energy sources offers the prospect of lower emissions, and in combination with a decentralized approach offers a solution to rural energy insecurity, and further suggest that a regional approach to co-operation on energy offers the prospect of closing seasonal gaps in service. The Organization for Security and Co-operation in Europe, in an effort to support the progress in energy security that Central Asia has achieved through policy initiatives and energy sector reforms, makes the following recommendations.

National considerations

The countries relying on hydropower in their energy mixes should assess the impacts of climate change on hydropower plants. Climate change is already changing the hydrological regimes of water streams that are vital to small hydropower development in Central Asia, and the long-term viability of small hydropower plants depends on the reliability of their water sources. Improved technical and environmental assessments would provide the foundation for decisions on how and where to proceed.

All the countries in Central Asia should develop maps that identify vulnerable areas in detail sufficient to support decisions on how to bridge service gaps. At present, the knowledge about how many households remain unconnected to the power grid or are otherwise poorly served, and where these households are specifically located, is insufficient, and a proper map could guide the strategy for improving the level of energy security across the countries and the region.

In the effort to extend power to remote areas, the countries should consider decentralized renewable energy systems. Almost all major renewable energy facilities are currently connected to the central power grids. Decentralized renewable energy systems can, however, help improve living standards in remote settlements not connected to the grid, and can reduce coal dependence and its environmental impacts for the most vulnerable segments of the population.

The countries should work with multilateral institutions to expand the policy and financial instruments necessary to implement their national renewable energy laws. The risk of future imbalances in the system warrants particular attention, as the introduction of renewables needs to be accompanied by the optimization of the entire power and gas supply system and the addition of more flexible capacity.

In developing strategies and plans for energy security, the countries should involve all stakeholders. The transition to sustainable energy will benefit from the participation of stakeholders from the government, the private sector, non-governmental organizations and households.

Regional co-operation

The countries of Central Asia should co-operate in the development of both a common energy security strategy and a regional energy governance mechanism such as CAPS. The countries already have their own energy sector development strategies, and have reinstated some bilateral and multilateral co-operation in energy trade. Reconciling country strategies with a common regional strategy and co-operating within the context of a formal regional agreement would allow Central Asia to take advantage of its collective resources to meet the individual needs of the countries while securing the longer-term sustainability of energy supplies. Such mutually beneficial intra-regional co-operation appears to be the fastest and straightest route to energy security in the region.

The countries should ensure that regional data gathering and information sharing is a part of ongoing operations of the proposed governance mechanism. Multilateral institutions such as the OSCE, ADB, and World Bank can provide technical and analytical assistance in the development of an effective regional data gathering and information sharing mechanism that can enable the region to make co-ordinated responses to regional energy security threats.

Endnotes

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