



March 2024

Uzbekistan's Policy Brief



Executive Summary

Uzbekistan's economy is the second most emitting in the region with a CO₂ Intensity of GDP roughly 77% higher than the global average. The Uzbek energy sector contributes to roughly 83%, 116.1 MT of CO₂, of its total GHG emissions, where the residential and industrial sectors account for over 70% of total GHG emissions. Thus, decarbonizing the Tajik energy sector is crucial to achieving the county's ambitious carbon emissions reductions under the Paris Agreement. Natural gas dominates the Uzbek Energy mix with a share of 85.9%, whilst renewable energy, solely hydropower, accounts for only 0.9% of the share. Electricity generation is also dominated by natural gas with 88% of the share, whilst hydropower holds a share of 7%.

Electricity demand is projected to roughly double to 120 TWh by 2030 meaning that Uzbekistan must scale up low carbon electrification. The Uzbek government Consequently plans on leveraging its expansive renewable energy potential by installing 12 GW of variable renewable energy ,7.0 GW solar and 5.0 GW wind, and 1.5 GW of hydropower by 2030. Nevertheless, The Electricity Supply Security Concept for 2020-2030 also envisages the construction of six thermal power plants with total capacity of 3.8 GW.

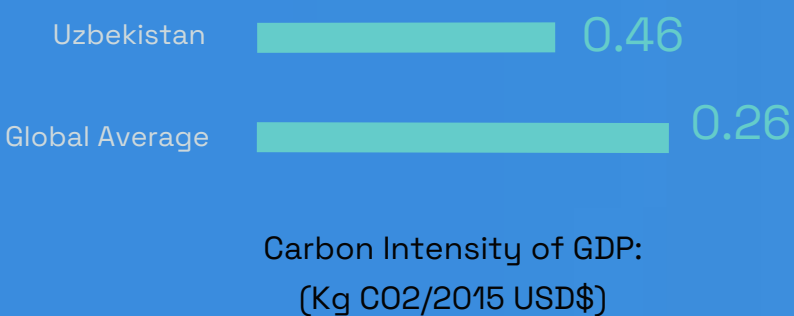
Currently, the Uzbek power system lacks flexible power generation capacity, consequently facing redundancies in balancing power supply and demand. Consequently, enabling multilateral energy trade via regional energy integration and power system interconnectivity would help Uzbekistan overcome redundancies in the short term and facilitate the integration of variable renewable energies in the long term, consequently strengthening energy security and resilience.

Whilst electricity consumption per capita is low, around 45% less than the global average, Uzbekistan is one of the most energy intensive nations in the world with energy consumption per unit of GDP more than 50% above the world average. Thus, investing in energy efficiency would significantly reduce the Uzbek economy's energy and carbon intensity and consequently strengthen Uzbekistan's energy security.

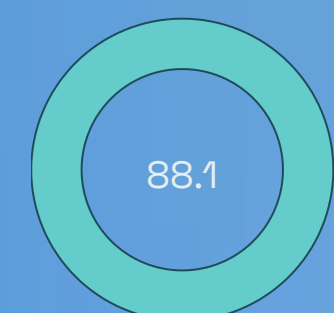
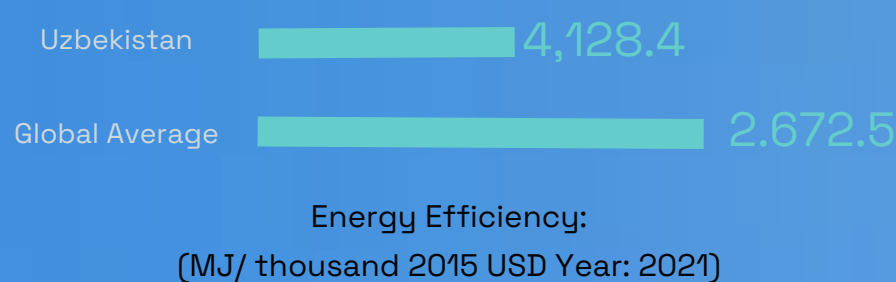
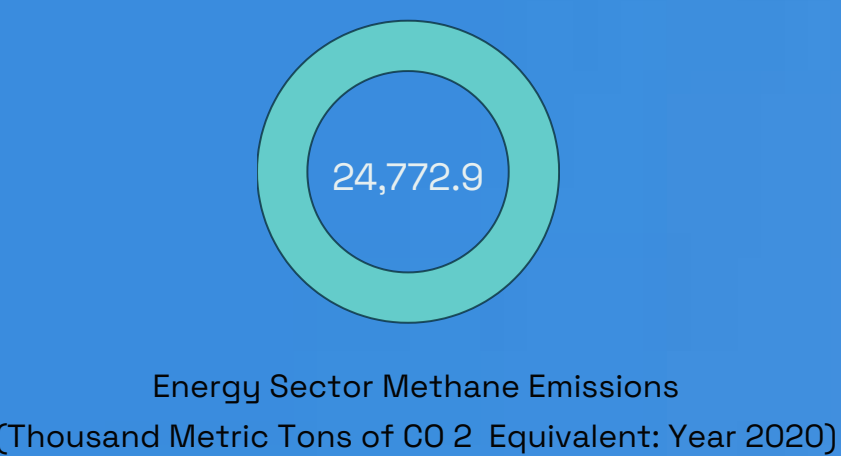
Uzbekistan has the second-largest reserves of CRMs in Central Asia, boasting significant deposits of various minerals such as copper, molybdenum, and gold. The country's mining strategy aligns with its ambitions to increase the processing of CRMs for both domestic and international industries, and consequently presents opportunities for economic development in line with the energy transition.

Tracking **SDG 7**

Ensure access to affordable, reliable, sustainable, and modern energy for all



Access to clean cooking (% of population with access Year: 2021)



Key Takeaways:

1. Uzbekistan is the second biggest emitter in the region, with a CO2 intensity of GDP 77% greater than the world average.
2. Electricity & heat generation contribute to almost 40% of GHG emissions.

Environmental and Energy Overview



NDC to Paris Agreement Targets

Uzbekistan's updated Nationally Determined Contribution includes a 35% reduction in GHG emissions (per unit of GDP) by 2030, relative to 2010 base emissions level.



Pollution

Methane emissions in energy sector (thousand metric tons of CO2 equivalent): 24,772.9 (2020)

Mortality rate attributed to household and ambient air pollution, age-standardized (per 100,000 population): 151.7 (2019)

PM2.5 air pollution, population exposed to levels exceeding WHO guideline value (% of total): 100.0 (2017)



Energy Emissions Contribution

In 2021, the Uzbek energy sector accounted for roughly 83% of the country's greenhouse gas emissions.



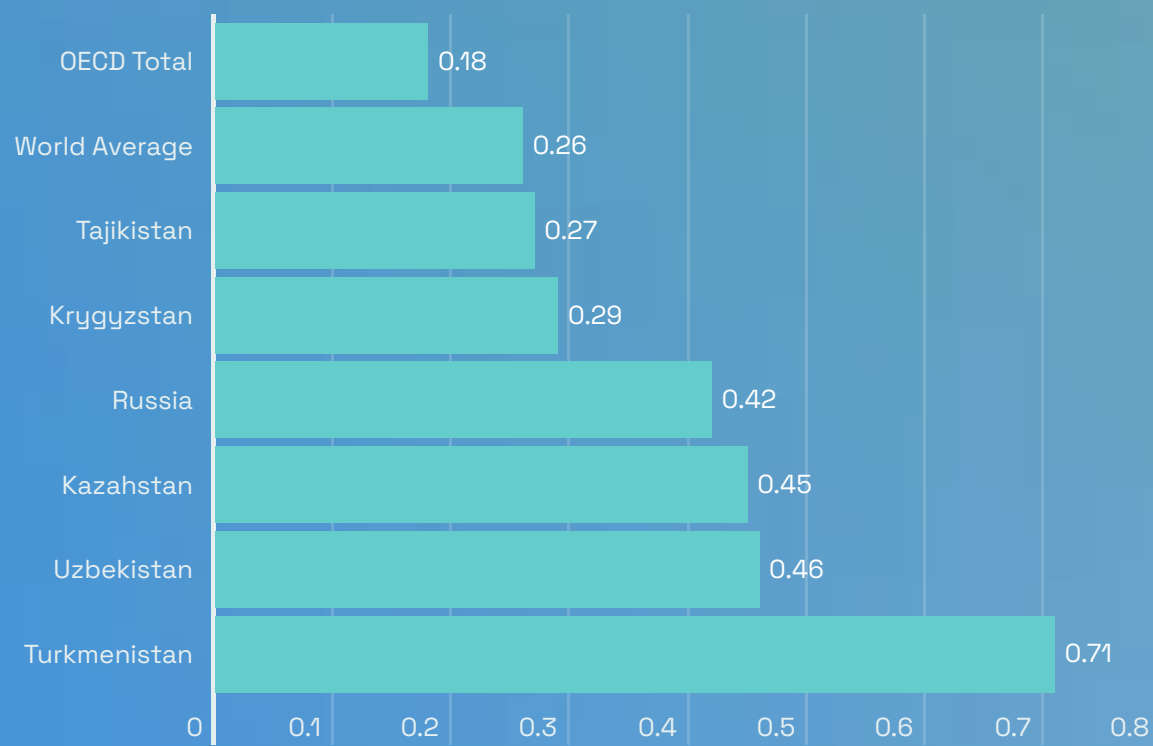
Net Energy Exports

Uzbekistan has historically been an energy surplus nation, ranking fifth in Eurasia in 2021. Nevertheless, increasing domestic energy demand has significantly reduced net energy exports. Indeed, net energy exports amounted to just 1% of total energy production in 2021. Energy exports accounted for roughly 6.2%, 0.91 Billion USD\$, of Uzbekistan's export revenue, generating 1.3% of GDP in 2021. Energy imports, on the other hand, accounted for 5.1% of total imports, 1.27 Billion USD\$. Consequently, despite being a net energy exporter, in terms of quantities of energy traded, Uzbekistan's energy trade has negative implications on its balance sheet as the energy sources imported, such as petroleum, are accompanied by higher prices than those which are exporter, notably gas.

Breakdown of Energy GHG Emissions by Sector

Sector	Co2 Emissions (MT Co2)	Co2 Emission by Sector, (% of Total)
Electricity and Heat	45.4	39.1
Residential	25.7	22.1
Industry	13	11.2
Transport	16.3	14.0
Other Energy	5.4	4.7
Commercial and Public Services	8.2	7.1
Agriculture	0.8	0.7
Not Psecified	1.3	1.1
Total Co2 Emissions	116.1	100

Uzbekistan's Carbon Intensity of GDP, 2021
CO2 emissions per unit of GDP (PPP) - (Kg CO2/2017 USD\$)

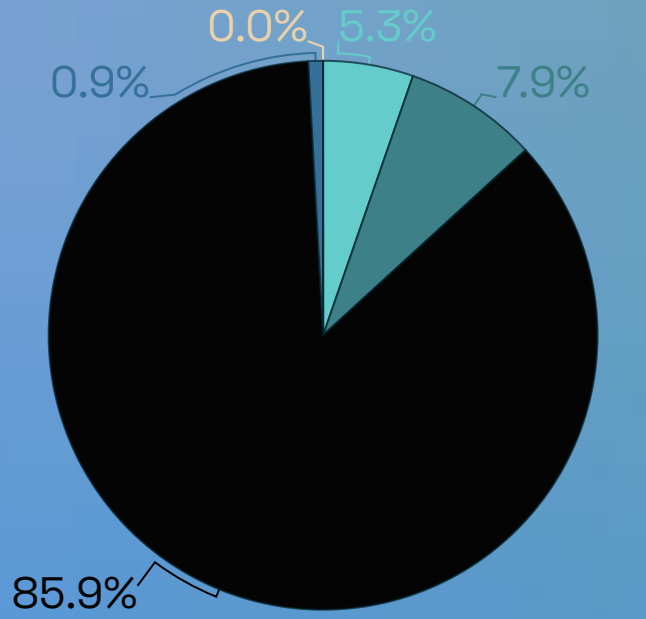


Key Takeaways:

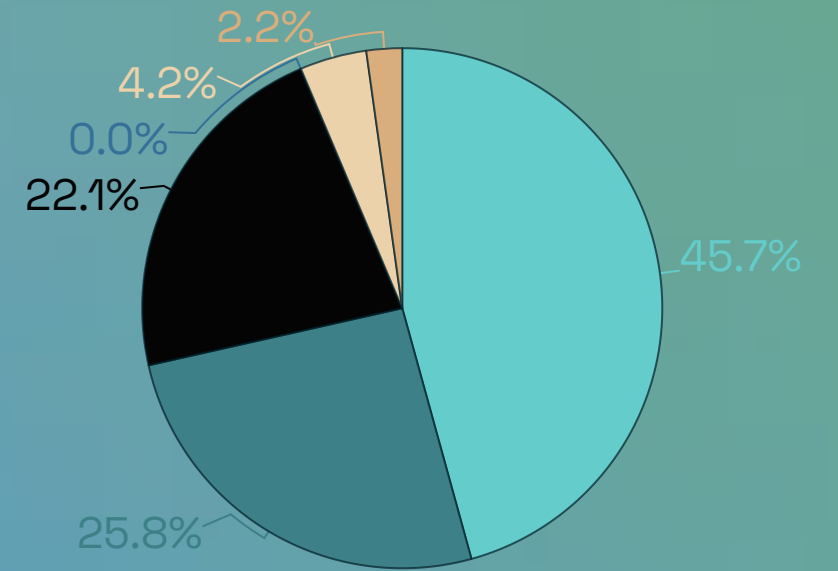
1. Fossil fuels dominate the energy mix. Renewable energy accounts for solely 0.9% of Uzbekistan's total energy supply whilst natural gas constitutes 85% of the share.
2. Uzbekistan must scale low carbon deep electrification across all sectors, currently natural gas accounts for 88% of power generation.
3. The Uzbek government project that total electricity generation must be doubled to 120 TWh in order to meet demand projections by 2030.

Current Energy mix

Energy Supply (% Total Energy Supply) (GWh) 2021



Final Energy Consumption by Sector (% Total Energy Supply) 2021



● Coal ● Oil ● Natural Gas ● Hydropower ● Biofuel

● Residential ● Industry ● Transport ● Commercial and Public Services ● Agriculture/Forestry ● Non-Energy Use

Coal

- Total Proven Reserves: 1.375 Mt in 2020
- Coal Production: 5.1 Mt in 2021
Net Coal Imports: 36.1% of total coal supply in 2021
- Importing Countries: Kazakhstan
Trends: The current program for 2020-2024 aims increase coal production to 13 Mt per year, eliminating the need for coal imports.
- Consumption by Sector: Industry (32.1%), Residential (54.5%), Commercial & Public Services (8.0%), non-specified (%), Transport (0.5%), non-Specified (2.7), Agriculture/Forestry (2.0%)
Emissions Contribution: 6.2% in 2021

Oil

- Total Proven Reserves: 600 million barrels
- Domestic Production: 60,000 barrels a day, at the current rate domestic oil reserves will be depleted in less than 35 years.
- Domestic Consumption: 90 thousand barrels a day in 2021
Oil Products Imports: 19.0% of total oil products final consumption in 2021
- Crude Oil Imports: 9.1% of total crude oil supply in 2021
- Import Countries: Russia, Kazakhstan
- Emissions Contribution: 10.7% in 2021
Oil-Products Sectoral Consumption: Transport (67.6%), Residential (11.0%), Non-Energy Use (8.2%), Industry (5.5%), Commercial & Public Services (5.0%), non-Specified (2.5%), Agriculture/Forestry (0.2%)

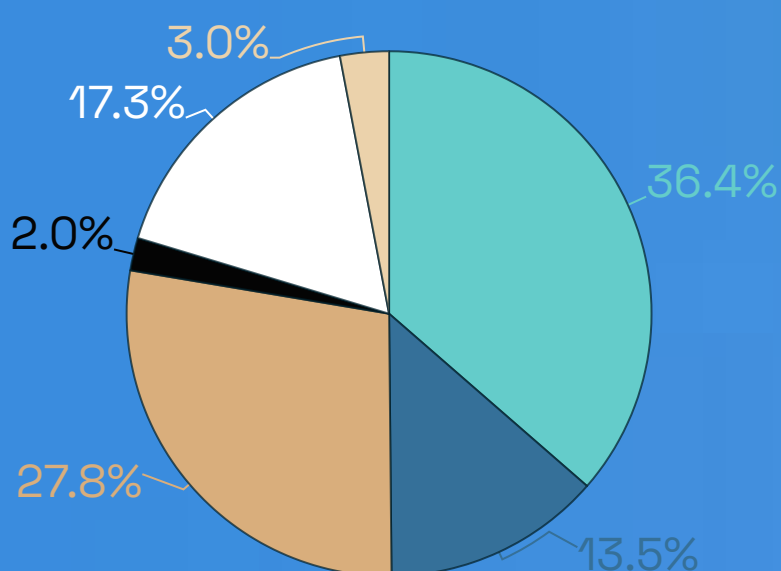
Gas

- Domestic Reserves: 800 bcm in 2021
Domestic Annual Production: 50.9 bcm in 2021, at the current rate domestic natural gas reserves will be depleted in less than 16 years.
- Domestic Consumption: 46.4 bcm in 2021
- Gas Exports: 3.1 bcm in 2020
Exporting Countries: China (80.5%), Russia (10.6%), Tajikistan (5.82%), Kyrgyzstan (1.71%), Afghanistan (1.36%)
- Emissions Contribution: 83.1% in 2021
- Consumption by Sector: Residential (44.4%), Industry (21.9%), Transport (16.3%), Commercial & Public Services (14.2%), Agriculture/Forestry (1.4%), non-Specified (1.7%)
- Gas Developments: Domestic demand is expected to rise by 30% to 65 bcm by 2030. Natural gas exports will be halted altogether by 2025, to prioritize domestic gas consumption, notably to produce petrochemicals.

Electricity

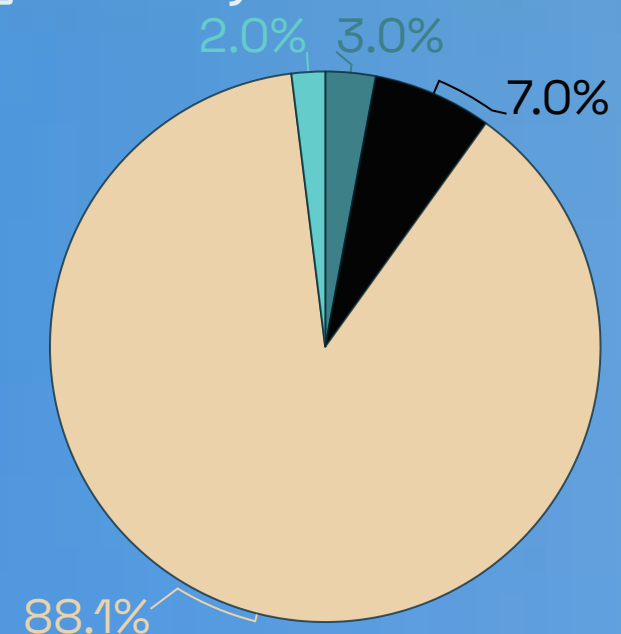
- Generation Capacity: 15.9 GW in 2021
- Price: \$0.05/kWh for industry, \$0.02/kWh for households
- Net Imports: 6.4% of total electricity supply in 2021
- Importing Countries: Turkmenistan (64.3%), Tajikistan (23.5%), Kazakhstan (12.2%)
Peak Demand: winter, mainly for heating, and summer, mainly for cooling. Up to 93% of thermal power capacity is used during this period.
- Electricity Developments: Construction of six thermal power plants with total capacity of 3.8 GW between 2020-2030.
- Sub-Sector Consumption: Iron and steel manufacturing consumes around half of the sectoral total, followed by chemicals and petrochemicals.
- Future Supply: The government expects total electricity generation to roughly double to 120 TWh by 2030

Electricity Consumption by Sector (% of Total Consumption) (GWh) 2021



● Industry ● Commercial and Public Services: ● Residential ● Transport ● Agriculture/Forestry ● Non-Specified

Electricity Generation (% Total Electricity Generation) 2021



● Coal ● Hydro ● Natural Gas ● Oil

Key Takeaways:

1. As per Uzbekistan's 2030 Green Economy Transition & Green Growth Program, Uzbekistan plans to increase the share of RES to at least 25% of the country's electricity supply by 2030. Consequently, the Uzbek government plans to expand renewable electricity generation capacity to 15 GW by installing 12 GW of variable renewable energy, 7.0 GW solar and 5.0 GW wind, and 1.5 GW of hydropower by 2030.

Energy Tarrif

The IEA estimates that in 2020, Uzbekistan's implied subsidies on natural gas, electricity and oil amounted to USD 3.8 billion, equivalent to 6.6% of the country's GDP. Indeed, historically, electricity production costs have been on average more than one-third above tariffs charged to end users. Particularly, natural gas and electricity subsidies create market distortions which disincentivize investments in renewable energy technology and energy efficiency as tariffs do not reflect the costs of energy production, transmission and distribution.

Consequently, because energy prices are not market based and as fixed assets are obsolete, power company financial conditions have been deteriorating. Indeed, the national Electricity Grid reported roughly USD 200 million in losses in 2021. Tariff reforms have therefore been ongoing to phase out subsidies by 2030. Yet, estimates suggest that during this phase out period, Uzbekistan will spend a further USD 55 billion in subsidies.

Just Transition & Social Pricing



Modern energy pricing mechanisms and policies are required to incentives investment into the energy sector whilst simultaneously not burdening the livelihoods of the Uzbek population. Thus, subsidies should be gradually phased off and accompanied with support mechanisms for vulnerable groups.

Low-carbon Energy

Technologies Potential

Hydropower

Hydrogen Potential (Thousand Tons per Annum): Minimum Scenario: 494, Maximum Scenario: 2,093

Key Constraint: Required CCUS capacity of 4 MtCO₂ in minimum scenario and 8 MtCO₂ in maximum scenario.

Potential Hydrogen Costs:

Green Hydrogen: \$2.5-3 per kg of Hydrogen

Blue Hydrogen: \$1.5-2 per kg of Hydrogen

Potential Consumption: Domestic hydrogen consumption in the transport and industry sectors given that they respectively account for 18.7% and 21.8% of total final energy consumption and are considered hard to abate.

Potential Export: Hydrogen may be potentially exported to neighboring China through the upcoming D-Line.

CCUS

Importance: Given Uzbekistan's significant use of natural gas and coal, the introduction of CCUS will be imperative.

Locations: Depleted oil, gas & coal deposits

No current data on Uzbekistan's CCUS potential is available.

Wind

Total Technical Potential: 360 Mtoe

Average Wind Speed: 8 m/s

Promising Wind Energy Potential Areas: Western Uzbekistan, particularly Karakalpakstan to the west of the Aral Sea.

Current Developments: Saudi Arabia's ACWA Power developed the 100 MW Nukus wind project in valued at USD 108 million for a tariff of USD 0.0257/kWh and is undertaking preliminary steps to develop an additional 1GW of wind power capacity.

Nuclear

Uranium Supply: 13th largest recoverable uranium reserves, 131,320 tons of Uranium, 1.6% of the global aggregate.

Uranium Production: 5th largest producers of uranium, with 3,500 tons produced in 2021.

Developments: Uzbek government signed an agreement with the Russian government in 2018 to co-develop a 2.4 GW Generation III+ nuclear power plant.

Hydropower

Technical Hydropower Potential: 2 Mtoe or 23.3 TWh

Total Energy Supply: 4.97 TWh in 2021

Total Installed Capacity: 1.85 GW in 2021

Flexible Generation: Not possible, hydropower is significantly influenced by irrigation needs.

Future Trends: Plans to increase hydropower capacity from 1.85 GW in 2021 to 3.4 by 2030.

Solar

Average Theoretical Solar Potential: 4.3 kWh/m²

Average Days of Sunshine: 320/365

PV Coverage Needed to Supply Current Electricity Demand: 0.11% of the country's territory.

LCOE Costs: Estimated at \$0.1/kWh.

Current Projects: In 2021, 10 large scale projects, totaling 2.0 GW, have been put out to tender and have achieved tariffs ranging between 0.017 and 0.027 USD/KWh, lower than the world average for solar PV installations.

Key Takeaways:

1. Energy system flexibility remains a major barrier towards enabling energy system resilience and decarbonization, yet integrated energy systems and electricity interconnectivity can constitute viable solutions.

Flexibility

The Uzbek power system lacks flexible generating capacity, resulting in challenges balancing supply and demand. Its baseload capacity is dominated by coal and gas power plants, which cannot quickly scale to meet demand fluctuations. Hydropower plants also provide limited flexibility due to their irrigation requirements. This inflexibility is likely to become a greater issue as more intermittent renewables are added to the system.

Benefits of Interconnectivity

1. Increase efficiency of electricity markets by optimizing the use of primary energy resources.
2. Increase reliability and efficiency of the respective power systems by sharing reserves and emergency support.
3. Improve conditions for integrating ever-increasing volumes of unstable RES based generation.

CASA - 1000

The Central Asia Electricity Transmission and Trade Project (CASA-1000) aims to help Tajikistan and Kyrgyzstan export surpluses of electricity to neighboring Kazakhstan, Uzbekistan, Afghanistan and Pakistan (funded by the World Bank).

When operational, the transmission network will integrate the power systems of Central and South Asia and enable parallel operations, mutually increasing energy system resilience.

Interconnectivity and Resilience

The planned grid construction in Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan is aimed at increasing reliability, power output and export (or transit) of electricity to neighboring countries. This unified energy system could help balance electricity baseloads and provide baseload flexibility by transferring electricity from one system to the other during peak demand, redistributing power from surplus areas to areas facing power shortages,

Network Interconnections

As shown in Figure 7, Uzbekistan's power system, built during the Soviet era, is integrated with the Central Asian Power System (CAPS) and the Afghan power system, allowing electricity flow between member states during surpluses and shortages. Its cross-border capacity is 4,150 MW, 27.6% of the country's installed capacity: 1,000 MW with Kazakhstan, 850 MW with Tajikistan, 450 MW with Afghanistan, 850 MW with Turkmenistan, and 1,000 MW with Kyrgyzstan.

Historically, net electricity trade was balanced near zero, but in 2019, Uzbekistan became a net importer. In 2021, Uzbekistan exported 2.15 TWh, mainly to Afghanistan, and imported 6.2 TWh, primarily from Tajikistan and Kyrgyzstan

Network Reliability

Uzbekistan's energy network urgently needs modernization. Outdated technology has reduced reliability and efficiency, with 12.5% distribution losses in 2019 and transformer loading exceeding 80% in 101 areas. The January 2022 blackout underscores the need to upgrade transmission infrastructure, especially with plans to expand the Central Asian Power System.

Map of regional electricity interconnection



UNECE's Contribution

UNECE's report on Energy Connectivity in Central Asia showcases an inventory of existing national energy systems and pathways for further developing interconnectivity to build energy system resilience.

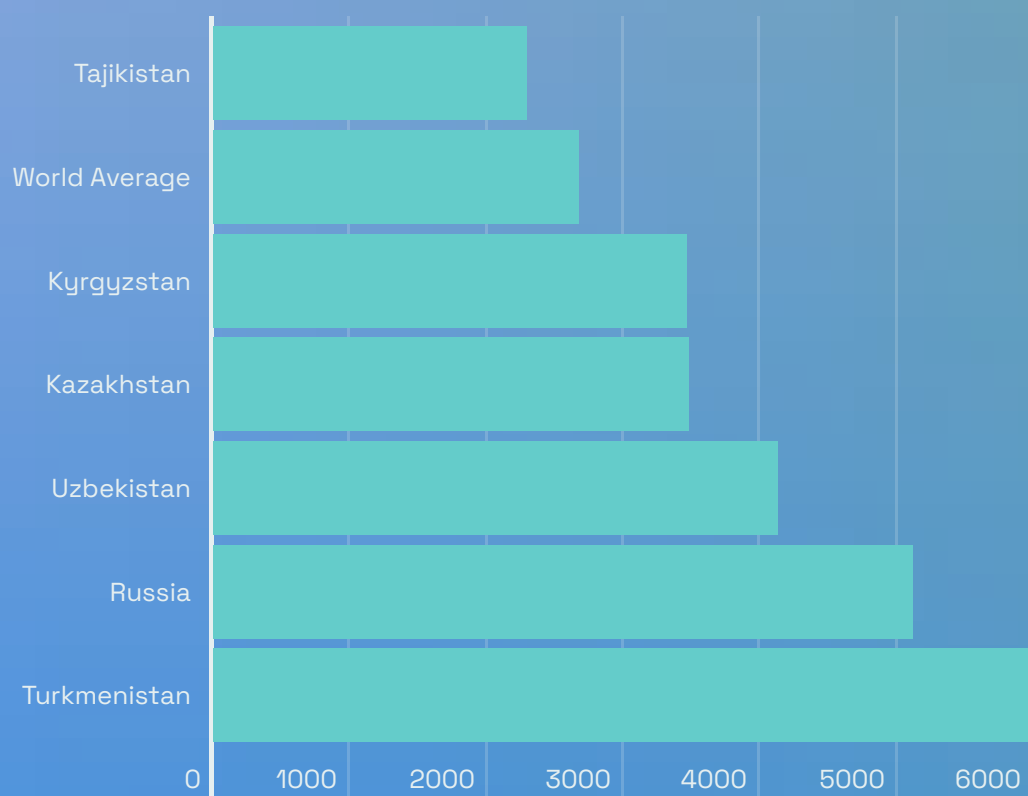
Source: USAID (2015), Central Asia Electric Grid.

Energy Efficiency

Key Takeaways:

1. Whilst electricity consumption per capita is low, around 45% less than the global average, Uzbekistan is one of the most energy intensive nations in the world with energy consumption per unit of GDP more than 50% above the world average.

Uzbekistan's Energy Intensity of GDP 2021



Agriculture

Agriculture consumes 17.3% of Uzbekistan's electricity, mainly for irrigation in outdated and inefficient pumping stations. The Ministry of Water Resources' concept for the Development of the water sector aims to replace 33% of the nation's pumping units and more than 50% of its motors with more-energy efficient equipment. Electricity consumption from the agricultural sector is expected to decrease from 9.6 TWh in 2021 to 7.0 TWh by 2025 and 6 TWh by 2030.



Industry

Industry accounts for 21.8% of energy consumption and 36.4% of electricity consumption. Most industrial infrastructure and technology have been built during the soviet era and therefore it has considerable energy efficiency potential, estimated at 40%, notably in processing and manufacturing. Yet energy performance standards have not been introduced for industrial equipment. Audits are mandatory for industries above a certain consumption threshold and energy-intensive industries with public or state funding must deploy management systems.

Additionally, gas tariffs for certain industrial consumers have been steadily rising as part of the government's energy tariff strategy, to fund cross-subsidies for residential gas consumers and to incentives industries to operate more efficiently. However, there is limited data illustrating the success of these policies, as the higher costs of energy incurred by industrial energy consumers have been passed on to end-consumers.



Transport

Transport accounted for 18.7% of energy consumption and 14.0% of GHG emissions in 2021, with these numbers expected to rise due to increasing motorization and a lack of targeted efficiency policies. Uzbekistan's framework for transport energy efficiency is still developing, and although fuel-efficiency standards are absent, imports of certain vehicle classes (Euro-3 and Euro-4) are banned.

Uzbekistan's Green Economy Transition Strategy for 2030 aims to expand public transport and promote more efficient vehicles, including hybrids and electric vehicles. In the long term, the country may utilize its substantial hydrogen production potential to develop low-carbon transport, particularly in energy-intensive sectors like freight transport.



Residential

The residential sector accounts for 38.7 % of energy consumption and 27.0% of electricity consumption. Household energy use is relatively inefficient, with a specific energy consumption per square meter of living area almost three times higher than in European countries with similar climatic conditions (i.e., Spain). To date, however, there are no specific energy efficiency targets established for buildings. New and renovated buildings must comply to energy performance requirements and certificates in respect to heating and ventilation. All public and commercial buildings require energy audit passports, and all publicly funded projects require energy efficiency surveys.

Heating dominates Uzbek building energy consumption. The district heating systems, originating from the Soviet era, are outdated and inefficient. These inherited deficiencies are exacerbated by substantial underinvestment in maintenance, rehabilitation, and modernization of district heating assets over the past two decades, leading to a notable decline in the quality of district heating services. Consequently, the IEA asserts that 66% of heating networks and 24% of combined heat and power plants need replacement or reconstruction. Revamping outdated and inefficient heating systems and networks poses a significant policy-making challenge.

Critical Raw Materials

Key Takeaways:

1. Uzbekistan boasts the second largest reserves of CRMs in Central Asia, which the country can leverage to produce renewable energy infrastructure and generate export revenue.

CRM Importance

Currently many countries are considering objectives to increase their self-sufficiency on critical raw materials (CRMs) which are prerequisites for a just energy transition, with renewable energy national targets of up to 30%. Many of these CRMs are now essential components in high-tech sectors. These components include rare earth metals, as well as other metals like lithium, indium, tellurium, gallium, and platinum group elements.

According to IEA: "today's supply and investment plans for many critical minerals fall well short of what is needed to support an accelerated deployment of solar panels, wind turbines and electric vehicles/batteries."

CRM Reserves

Uzbekistan has the second-largest reserves of CRMs in Central Asia, boasting significant deposits of various minerals such as copper, molybdenum, and gold. Of the 71 mineral deposits which have been identified, only 16 are actively mined and are controlled by state companies. In 2019, critical materials made up more than 11% of total exports, with copper and zinc being the 4th and 9th largest export items respectively. Additionally, Uzbekistan is one of the world's largest producers of gold, constituting 30.8% of its total exports. Consequently, the country's mining strategy aligns with its ambitions to increase the processing of CRMs for both domestic and international industries, particularly in automotive and consumer electronics.

Uzbekistan's annual production of critical materials in 2019

Critical Material	Annual Domestic Production (Metric Tons)	Share of Global Production & Rank	Use (as components)
Tellurium	48	9.16	Solar Panels
Molybdenum	750	0.27	Wind Turbines
Rhenium	900	5.85	Added to components due to heat resistant properties
Cadmium	300	1.17	Solar Panels
Selenium	20	0.52	Solar Panels
Copper	100,000	0.49	Solar Panels, Wind Turbines, EV's, Batteries/Storage
Zinc	27,000	0.22	Solar Panels & Wind Turbines
Silver	260	0.99	Solar Panels
Lead	2,000	0.04	Solar Panels, Wind Turbines, EV's, Batteries/Storage

Coal Mines and Just Transition

Coal currently contributes to roughly 5% of Uzbekistan's energy mix. Nevertheless, the government plans to expand domestic coal production to limit coal imports. Given that many coal mines in Uzbekistan also contain Critical Raw Materials (CRMs), repurposing depleted and closed coal mines for CRM extraction could protect the interests of coal industry stakeholders, create new business opportunities and drive economic growth.

Policy options for Securing Access to CRMs in Kazakhstan



Promoting Circular Economy



Fostering Innovation and Cooperation



Increasing Investment



Strengthening Governance and Transparency



Diversifying Primary Sources

Frameworks for CRM Management

UNFC and UNRMS play crucial roles in promoting the sustainable and responsible development of CRMs. Considering the intricate interplay between the production, utilization, and recycling of CRMs and their impact on society, the environment, and the economy, comprehensive systems like UNFC and UNRMS are imperative for effective and integrated natural resource management.

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