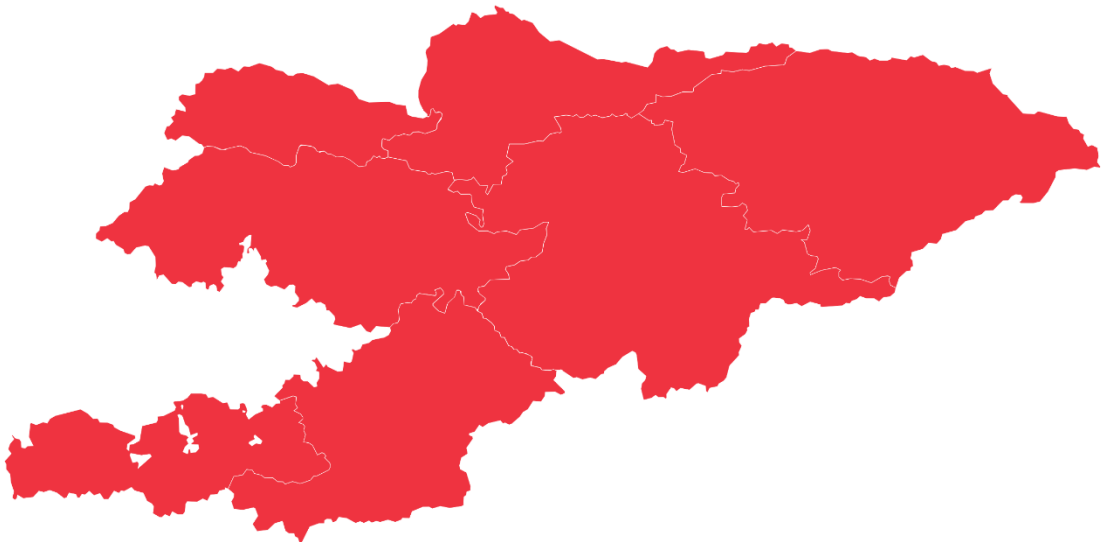




ENABLING PV in Kyrgyzstan



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Table of Contents

Objectives of the ENABLING PV project	4
Executive Summary	5
1. Introduction to Kyrgyzstan's Energy Sector	7
1.1 Country Overview	7
1.2 Electricity Generation	8
1.3 Electricity Demand	9
1.4 Structure of the Electricity Sector	9
1.4.1 Key Government Ministries and Agencies	9
1.4.2 Key Energy Companies	11
1.4.3 Other Market Stakeholders	12
1.4.4 General Assessment of the Electricity Sector Status	14
1.5 Electricity Markets, Prices, Tariffs, and Costs	15
2. Factors for PV Development: Potential and National Strategies	16
2.1 Solar Energy Potential and Current Market Status	16
2.2 Relevant Strategies, Concepts, and Programs	18
2.2.1 National Energy Program and Energy Development Strategy until 2025	18
2.2.2 Green Economy Development Program 2019-2023	19
2.2.3 National Development Program until 2026	19
2.2.4 National Development Strategy 2018-2040	19
2.2.5 National Goals for Greenhouse Gas Emissions	19
3. Regulatory Environment for PV: Incentives, Barriers, and Standards	20
3.1 Incentives for Renewable Energy Sources	20
3.1.1 Feed-In Tariff	20
3.1.2 Land Allocation	21
3.1.3 Additional Incentives for Renewable Energy Producers	21
3.2 Barriers to PV Development	22
3.2.1 Absence of Legally Binding Targets	22
3.2.2 Focus on Hydropower	23
3.2.3 Lack of Implementation Legislation	24
3.2.4 Cost-Related Risks	24
3.2.5 Other Barriers	25
3.3 Standards for PV Project Development	24
3.4 Trade and Investment Conditions	25
3.5 Financing PV Projects	26
4. Conclusion	27
5. References	28

Objectives of the ENABLING PV project

Solar photovoltaic (PV) is one of the fastest-growing sectors in the global energy industry, and it has been developing not only in advanced countries but also in other regions. A key driver of this growth is the increasing competitiveness of PV electricity due to continuous cost reductions, even in the face of supply chain disruptions in 2020-2022. The number of markets and business models operating in different countries has significantly expanded in recent years, with each project and the regulatory framework varying from one country to another.

It is in this context of the rapidly evolving international solar PV markets that the consulting company eclareon and the German Solar Association (BSW-Solar) initiated a joint research project in 2013, named "ENABLING PV". The aim is to promote the dissemination of those PV applications in foreign markets whose potential has not yet been fully exploited. To this end, we organise round tables in our partner countries that bring together local actors with German and local PV companies as well as with experts from science and education. As a basis for this, we provide the latest information on the potential applications of PV in the partner countries in our ENABLING PV studies. Based on this, pilot installations or training measures are discussed, planned and implemented together with local stakeholders.

The first report on Kyrgyzstan was released in 2018, acknowledging the country's efforts in developing hydropower and its immense untapped potential in solar energy. In 2023, a study updated study was conducted by eclareon, reflecting the impressive changes in national energy policy and regulatory frameworks for renewable energy that occurred in just a few months. The regulatory landscape is actively undergoing reforms at present.

In the context of cooperation between Kyrgyzstan and Germany, it is essential to monitor these trends, provide support to market stakeholders and encourage open and substantive dialogue among them.

We would like to thank our Senior Advisor Dr Yury Melnikov for preparing this study and look forward to the next bilateral ENABLING PV round table which will take place in Bishkek in December 2023.

Berlin, 16 November 2023



Christoph Urbschat
Managing Director eclareon GmbH



Julian Scheider
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Executive Summary

Kyrgyzstan, situated in Central Asia, is a landlocked nation with an exceptionally clean power sector, deriving more than 90% of its electricity from hydropower sources. Despite this, Kyrgyzstan carries the status of a net energy importer due to its need for fossil fuels. The country has consistently faced an energy supply-demand gap, with just one new power station becoming operational in the 21st century. This increase in demand has been driven by households, which are predominantly located in rural areas. The variation between low-water and high-water years, due to the dependence on hydropower, triggers instability in energy supply, resulting in recurring energy crises.

The primary long-term challenge facing Kyrgyzstan's policymakers is ensuring energy security and eliminating infrastructure limitations to foster economic growth by harnessing the vast potential of renewables and modernizing outdated energy infrastructure. This objective aligns with the commitment to carbon neutrality by 2050, as announced by President Japarov during the COP-26 in Glasgow in 2021.

The difficulty in attaining these objectives is primarily rooted in prolonged underinvestment in the energy sector over the years, the existence of extremely low electricity tariffs (the lowest compared to neighboring nations), and a significant government debt of \$4.2 billion accrued by financially struggling energy companies. In the summer of 2023, Kyrgyzstan declared a state of emergency in the energy sector, which is set to last until the end of 2026.

Following the political crisis of 2020 and a significant leadership overhaul in both the executive and legislative branches of Kyrgyzstan, the country has embarked on a series of reforms that have had a profound impact on the energy sector. These reforms aim to streamline the management structure of the electricity sector, introducing new government entities to replace the old ones, while eliminating redundancy and adopting a "one-stop-shop" approach.

Renewable energy sources, with a particular focus on hydropower, have been designated as a top national priority. High-ranking government officials have underscored the imperative nature of transitioning to renewables. This commitment is substantiated by recent legislative measures enacted in the past few months.

Nonetheless, the solar PV sector in Kyrgyzstan has not experienced significant development, despite the country's considerable solar potential, which surpasses that of Germany by 1.5 times. The total solar capacity potential far exceeds the existing power infrastructure. According to various estimates, within available sites located close to electricity consumption centers, power grids, and infrastructure, utility scale PV plants with a total capacity ranging from 0.7 to 2.2 GW can be introduced in the Issyk-Kul, Talas, Chui regions, and near the city of Osh. A total pipeline of PV projects, supported by memorandums of understanding, includes approximately 15 projects across the country with planned implementation timelines extending to 2028, boasting a cumulative capacity of 4 GW. These projects have garnered interest from investors in China, Russia, the UAE, and multilateral development banks.

Yet, the successful realization of these ambitious plans hinges on overcoming numerous barriers. Investor risks in the PV sector remain high due to regulatory gaps and inconsistencies, the absence of a long-term energy strategy with clearly defined targets,

insufficient implementation of legislation, a historic focus on hydropower, financial obstacles, and a need for greater awareness among policymakers and market participants.

Positive signals include the introduction of a 25-year green tariff, the establishment of a Green Energy Fund as a centralized body for support of renewables, and the simplification of land allocation procedures. The strengthening and expansion of these trends will create more opportunities for PV project investors and developers, increasing the number of viable business cases. Collaboration between Kyrgyzstan and Germany has the potential to catalyze these efforts.

1. Introduction to Kyrgyzstan's Energy Sector

1.1 Country Overview

The Kyrgyz Republic is a land-locked country located in Central Asia with an area of 199,951 sq km.¹ The country has an estimated population of 6.8 million, Gross Domestic Product (GDP) of \$10.9 billion, with an estimated GDP per capita of USD 1,607 (2022).² Kyrgyzstan shares its northern border with Kazakhstan, its southern border with Tajikistan, its eastern border with China, and its western border with Uzbekistan.

Kyrgyzstan, an energy-deficient country, has seen a net energy import of 50-100 PJ per year for the past 20 years (IEA, 2023)³. The energy sector constitutes around 4% of the GDP, with a heavy dependence on hydropower resources. Kyrgyzstan relies heavily on hydropower plants for electricity, and imports oil products and natural gas, mainly from Russia and Kazakhstan. Historically, the region's energy and water supply was closely tied to the operation of large hydropower plants and reservoir levels, impacting neighboring countries such as Uzbekistan, Tajikistan, and Kazakhstan. Coordination among these nations became more challenging after gaining independence in the early 1990s (OSCE, 2022)⁴. Today, the aging infrastructure and climate change further complicate energy security, as changing river flow patterns affect the sector (UNECE, 2023)⁵.

The alternation between low-water and high-water years, with a difference in hydropower production of approximately 2 TWh/year, results in uneven energy production in Kyrgyzstan and regularly recurring energy crises. These challenges have arisen amidst increasing energy consumption and the absence of new power stations being commissioned. The most energy-deficient regions in the country are Chui, Talas, and Issyk-Kul, heavily reliant on external supplies of all forms of energy resources, including electricity.

In July 2023, a state of emergency was declared in Kyrgyzstan by the President, effective from August 1, 2023, until December 31, 2026. This decision is justified by the urgent need to address the energy crisis in Kyrgyzstan, brought about by climate challenges, insufficient water runoff in the Naryn River basin, and a shortage of power generating capacity in the face of rapidly growing electricity consumption (President of the Republic of Kyrgyzstan, 2023)⁶.

¹ CIA, 2023. The World FactBook: Kyrgyzstan. Available at: <https://www.cia.gov/the-world-factbook/countries/kyrgyzstan/summaries>.

² World Bank, 2023. The World Bank in the Kyrgyz Republic: Context. Available at: <https://www.worldbank.org/en/country/kyrgyzrepublic/overview>

³ IEA, 2023. Energy Statistics Data Browser: Kyrgyzstan. URL: <https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=KYRGYZSTAN>

⁴ OSCE, 2022. Advancing Energy Security in Central Asia. URL: <https://www.osce.org/occea/513787>

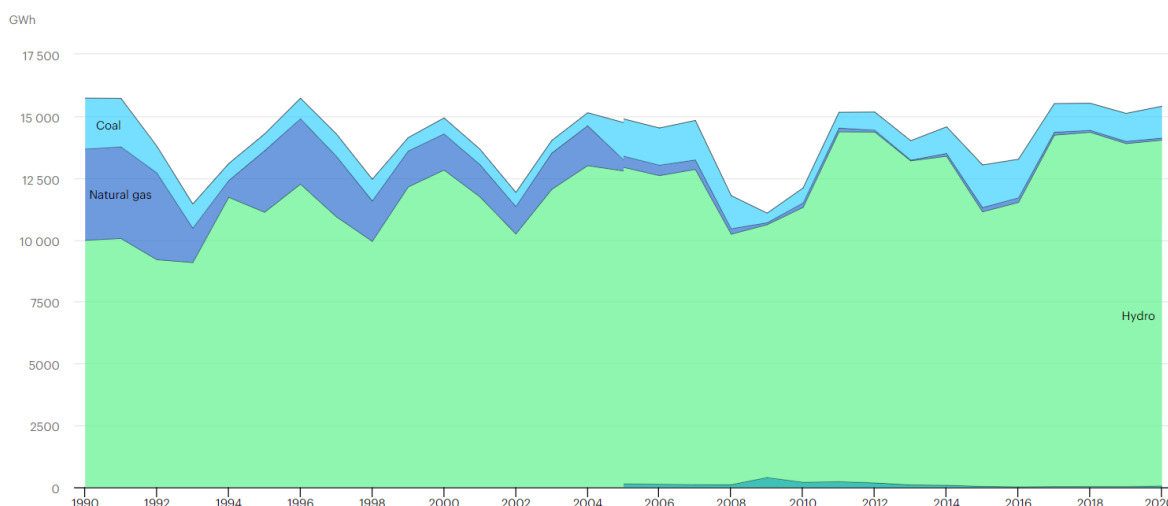
⁵ UNECE, 2023. Sustainable Hydrogen Production Pathways in Eastern Europe, the Caucasus and Central Asia. URL: https://unece.org/sites/default/files/2023-03/EN_Sustainable%20Hydrogen%20Production%20Pathways_final_0.pdf

⁶ Decree of the President of the Kyrgyz Republic No. 178 dated July 24, 2023, regarding the state of emergency in the energy sector of the Kyrgyz Republic. [URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/435085>]

1.2 Electricity Generation

In Kyrgyzstan, electricity is primarily generated from hydropower plants, followed by thermal power stations operating mostly on coal. In 2020, the country produced approximately 15.5 TWh of electricity, of which 14 TWh came from hydropower (Figure 1).

Figure 1: Electricity generation by source in Kyrgyzstan



Source: IEA, 2023

In Kyrgyzstan, seven out of the nine largest power stations are hydroelectric power plants, with the exception of thermal power plants in Bishkek and Osh, which are also vital for district heating in these cities (Table 1).⁷

Table 1: Key Power Plants in Kyrgyzstan

Capacity (MW)	Commissioning date	Power plant	Source
1200	1975	Toktogul	hydro
800	1982	Kürpsay	hydro
450	1987	Tash-Kumyr	hydro
240	1992	Shamaldysay	hydro
180	1961	Uch-Kurgan	hydro
40	1970	At-Bashi	hydro
120	2010	Kambarata-2	hydro
812	1961	Bishkek	thermal power plant
50	1966	Osh	thermal power plant
3945			Total Capacity

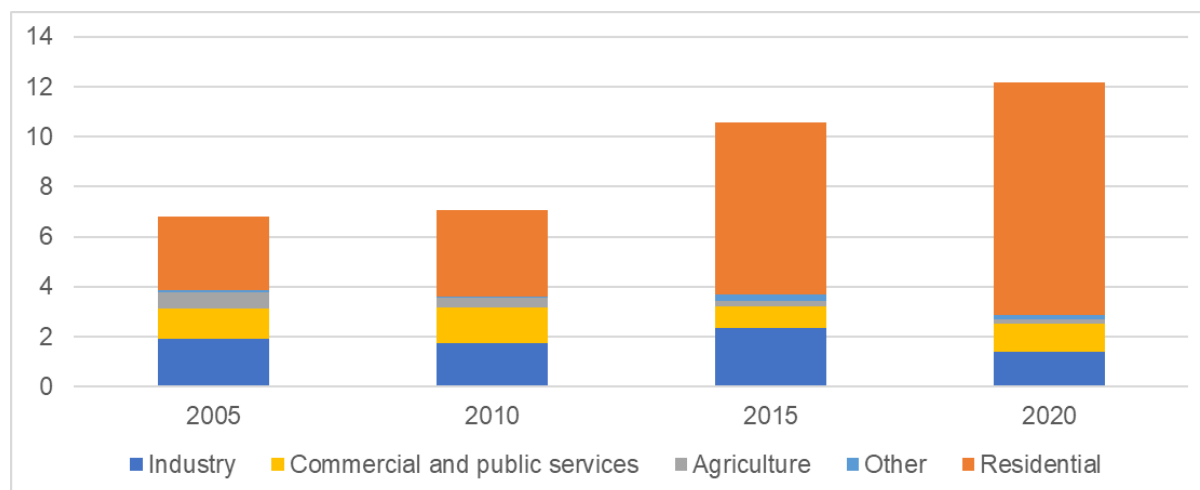
Source: Ministry of Energy, ADB (2022)

⁷ Ministry of Energy, Asian Development Bank (ADB). Master Plan for Complex Development of the Energy Sector of the Kyrgyz Republic. March 2022. URL: https://minenergo.gov.kg/media/uploads/2022/12/07/mp-kr-finalreport-rev5_v2_en_website_hQEeGIO.pdf

1.3 Electricity Demand

Electricity consumption in Kyrgyzstan reached 12.2 TWh in 2020, with households accounting for over 75% of this consumption. As Figure 2 illustrates, over the past 5 years, electricity consumption has grown by 15%, and households represent the fastest-growing segment, while there is no notable growth in the industrial, agricultural, and service sectors.

Figure 2: Electricity consumption by sector in TWh from 2005 to 2021



Source: eclareon analysis based on IEA (2023)

The increase in residential sector consumption can be attributed, among other factors, to the use of electricity for heating during cold periods of the year, driven by a growing population. Approximately 60% of dwellings in the country are located in rural areas, and around 80% of all dwellings are single-family houses. The primary source of heating is coal, but electricity accounts for more than 10% (World Bank & ESMAP 2023)⁸. The low cost of electricity and the availability of domestic heating appliances incentivize households to use electric heating during cold periods, adding a significant additional load to the energy system. Regulators are planning to restrict or even prohibit electric heating in cases where households have alternatives (such as coal or natural gas)⁹.

Kyrgyzstan is interconnected with neighboring countries through electrical grids and engages in electricity imports and exports. Net flows in 2015-2020 often resulted in a net import, with the exception of 2017. In 2020, the net import amounted to about 0.2 TWh (IEA, 2023). Electricity losses in the transmission and distribution grids were approximately 6% and 12%, respectively, in 2019 (Ministry of Energy & ADB, 2022).

1.4 Structure of the Electricity Sector

1.4.1 Key Government Ministries and Agencies

The structure of the energy sector in Kyrgyzstan is currently undergoing a reform process. Significant changes have taken place in the past 1-2 years, largely initiated by the political

⁸ World Bank; ESMAP (2023). *Toward a Framework for the Sustainable Heating Transition in Europe and Central Asia* (English). Washington, DC: World Bank Group. <http://documents.worldbank.org/curated/en/099092023140527206/P1777440fed3230ce089060ff8ce59c9f5e>

⁹<https://economist.kg/novosti/2023/09/05/mineniergho-planiruiet-zaprietit-eliektrootoplieniie-priedstoiashchiei-zimoi>

crisis (revolution) in 2020, which led to changes in the leadership of the government and parliament.

The Ministry of Energy plays a central role in the management of the energy sector. It is responsible for developing and implementing the state's energy policy and energy security¹⁰. The Ministry is also designated as the authorized government body for the development and support of renewables. During the period of the state of emergency in the energy sector declared by the President (until the end of 2026), the Minister of Energy has been granted exclusive authority to coordinate the work of deputy ministers from various other ministries, including agriculture, natural resources, and environmental protection, as well as directors of certain state institutes and organizations, and heads of local government administrations involved in energy projects. The Minister of Energy is also empowered to make proposals for the dismissal of these officials in cases of non-compliance with the provisions of the state of emergency (President of the Republic of Kyrgyzstan, 2023).

The Green Energy Fund, established in November 2022, is a state fund created to accumulate financial resources for the financing of green energy and energy efficiency projects¹¹. The fund is overseen by an Advisory Council chaired by the Prime Minister of Kyrgyzstan and includes the Vice Prime Minister and five key ministers. In August 2023, amid the state of emergency in the energy sector declared by the President, the Green Energy Fund was granted the right to perpetual land use for areas suitable for renewable energy projects, as well as the authority to transfer these lands to investors through a "one-stop" principle¹².

The Ministry of Energy and the Green Energy Development Fund are likely to become key stakeholders in Kyrgyzstan's energy sector (including renewables) in the coming years.

Parallel ministries and agencies under the authority of the Cabinet of Ministers of the Republic of Kyrgyzstan also influence the regulation of the energy sector.

The State Agency of Architecture, Construction, and Housing and Communal Services (Gosstroy) is responsible for implementing energy-saving and energy efficiency policies in the construction sector. The Ministry of Economy and Commerce is responsible for setting and monitoring policy frameworks that promote the development of a green economy. The Ministry of Natural Resources, Environmental Protection, and Technical Supervision, through its Climate Finance Center, facilitates the attraction of financial resources from climate funds and supports the development and implementation of climate adaptation and mitigation projects.

The Coordination Council on Climate Change, Environment, and Sustainable Development, headed by the Chief of the Presidential Administration of Kyrgyzstan, serves as an advisory body coordinating with the Cabinet of Ministers. It contributes to the formulation and preparation of recommendations and proposals for state bodies on climate change, environmental, and sustainable development issues.

¹⁰ <https://minenergo.gov.kg/>

¹¹ Regulations on the Green Energy Fund under the Cabinet of Ministers of the Kyrgyz Republic. Approved by the Resolution of the Cabinet of Ministers dated November 14, 2022, No. 621. URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/159620?cl=ru-ru>

¹² Resolution of the Cabinet of Ministers No. 429 dated August 28, 2023, On the Development of Renewable Energy Sources. URL: <https://www.gov.kg/ru/npa/s/4468>

In the Kyrgyzstan parliament, known as the Jogorku Kenesh, the Committee on Fuel and Energy Sector and Subsoil Management is responsible for the legislative process related to the energy sector. This committee plays a crucial role in shaping energy-related laws and regulations.

Within the Ministry of Energy, several entities are involved in various aspects of regulating the energy sector:

1. The National Energy Holding (OJSC) is responsible for managing energy assets on behalf of the Ministry.
2. The Department for the Regulation of the Fuel and Energy Complex oversees licensing and tariff-setting for electricity, heat energy, and natural gas.
3. The Department of Renewable Energy Sources develops and implements state policies related to renewables.
4. The Scientific Research Institute of Energy and Economics and the Energy Analytical and Computational Center are engaged in research and analysis of energy markets and the economy of Kyrgyzstan. They provide scientific support to the Ministry in decision-making and policy development.
5. The State Inspection for Energy, Mining Supervision, and Industrial Safety monitors safety in the energy and industrial sectors (Unison Group, 2022)¹³.

1.4.2 Key Energy Companies

The aforementioned "National Energy Holding" controls four energy companies¹⁴:

- National Electric Grid of Kyrgyzstan JSC, including nine branches. This power grid company operates as a system operator, handling electricity transmission and distribution across all voltage levels, operational and dispatch control, and the management of intergovernmental electricity flows¹⁵.
- Electric Stations JSC, managing the country's nine largest power stations, consisting of 7 hydropower and 2 thermal power plants with a total capacity of 3.9 GW and an annual output of approximately 12-14 TWh. The company also includes the subsidiary "Bishkekteploset" which manages the centralized heating supply of the country's capital, Bishkek¹⁶.
- Chakan GES JSC, responsible for several small hydropower plants in the Chu Valley, including the Alamedin Cascade and the Bystrovskaya plant with a combined capacity of around 38.5 MW¹⁷.
- Kyrgyz Energy Settlement Center JSC, which manages a unified database for electricity accounting (Metering Data Management System), develops electricity and power balances, assesses losses, and serves as the foundation for settlements between participants in the electricity market.

All major market stakeholders in electricity generation, transmission, distribution, and retail are either directly or indirectly state-controlled, and the management structure is undergoing

¹³ Unison Group, 2022. Analysis and Assessment of Renewable Energy Technology Utilization in Kyrgyzstan and Its Contribution to Climate Change Mitigation. URL: <https://movegreen.kg/2022/09/25/analiz-i-otsenka-tehnologij-ispolzovaniya-vie-v-kyrgyzstane-i-ih-vklad-v-smyagchenie-posledstvij-izmeneniya-klimata/>

¹⁴ National Energy Holding, 2023. Available at: <https://nehk.energo.kg>

¹⁵ National Electric Grid of Kyrgyzstan, 2023. Available at: <https://nesk.kg>

¹⁶ Electric Stations JSC, 2023. Available at: <http://www.energo-es.kg>

¹⁷ Chakan GES JSC, 2023. Available at: <https://www.chakang.es.kg>

reform. In June 2023, the CEO of the National Energy Holding, Taalaibek Baigaziev, transitioned to the position of Deputy Minister of Energy, announcing plans for the dissolution of the National Energy Holding due to inefficiencies¹⁸.

Formally, any company can enter the electricity market by obtaining licenses for generation, transmission, and distribution. Notably, the law exempts the licensing requirement for renewable electricity generation, as well as for self-consumption with capacities up to 1 MW¹⁹. Despite this, private companies independent of the state have struggled to gain a significant foothold in the sector throughout years of reform. Moreover, regulators are prioritizing the reduction of private power distribution grid companies²⁰.

Contracts for electricity supply between generating and distribution companies, as well as between distribution companies and end consumers (including major industrial consumers and independent power producers), are standardized and defined by the state²¹.

Tariffs for electricity are established and calculated by the Department for the Regulation of the Fuel and Energy Sector. Independent suppliers may also offer electricity on the market at unregulated prices. However, the regulator specifies both the volumes and minimum prices for independent suppliers²².

1.4.3 Other Market Stakeholders

In the development of Kyrgyzstan's energy sector, various international organizations, associations, engineering companies, universities, consulting firms, and other stakeholders play a significant role. Below is information about stakeholders related to the renewable energy sector (Table 2).

Table 2: Other Stakeholders of the Electricity Market (in alphabetical order)

Association "Women in Energy Kyrgyzstan"	Founded in 2022, the primary mission of the association is to unite women working in the energy sector, providing a platform for promoting gender balance principles, fostering international collaboration, educational and mentorship initiatives, with the goal of increasing the number of female leaders in the energy field. ²³
Association of Renewable Energy Sources	Established in 2010, the Association of Renewable Energy Sources is a union of legal entities focused on renewable energy, energy efficiency, and climate change. Its primary goal is to promote renewable energy development through collaboration with government bodies, local authorities, national and international companies, and associations. The association also engages in the development of investment projects in the renewable energy sector (Green Energy, 2023a ²⁴).
Center for Renewable Energy and Energy Efficiency Development (CREED)	Established in 2012 with the support of the UNDP/GEF project "Development of Small Hydropower Plants" and "Improving Building Energy Efficiency" in the Kyrgyz Republic. Specializes in providing technical assistance to developers of small-scale projects in the fields of energy-efficient buildings, photovoltaics, bioenergy, heat pumps, and more (CREED, 2023 ²⁵).

¹⁸https://24.kg/obschestvo/268659_teper_ofitsialno_taalaybek_baygaziev_naznachen_zamministra_energetiki

¹⁹ Law No. 195 of October 19, 2013, "On the Licensing and Permit System in the Kyrgyz Republic" (with amendments as of August 2023). Available at: <http://cbd.minjust.gov.kg/act/view/ru-ru/205058>.

²⁰ <https://kloop.kg/blog/2023/01/22/v-kyrgyzstane-sokratili-kolichestvo-chastnyh-energeticheskikh-raspredelitelnyh-kompanij/>

²¹ Government Resolution No. 576 of August 22, 2012, "Rules for the Use of Electric Energy" (with amendments as of December 2018). Available at: <http://cbd.minjust.gov.kg/act/view/ru-ru/93715>.

²² Ibid

²³ <https://www.womeninenergy.kg/>

²⁴ https://www.greenenergy.kg/index.php?dispatch=companies.view&company_id=104

²⁵ CREED, 2023. URL: <http://creed.net/>

Climate Network Kyrgyzstan	Established in 2009, the Climate Network Kyrgyzstan unites 16 non-governmental expert organizations working together to advance environmental policy in Kyrgyzstan and integrate climate change issues into national policy.
Green Alliance of Kyrgyzstan	An initiative that brings together businesses and civil organizations in Kyrgyzstan to implement and promote green economy and sustainable development principles. In 2023, the alliance consisted of over 50 members.
Green Energy Kyrgyzstan Marketplace ²⁶	Online marketplace established by the CREED as a part of the UNDP-OFID project "Development of Small and Medium-sized Enterprises for Energy Access". It serves as a hub for suppliers, manufacturers, experts, educational institutions, and financial organizations in the renewable energy, green technology, and energy-efficient solutions sector in Kyrgyzstan. The platform offers advantages to consumers, including access to information on green technologies and renewable energy sources, expert advice, price comparisons, customer reviews, product ratings, information on demonstration systems, flexible payment options, and the ability to order equipment delivery, installation, and maintenance. It is currently expanding to include suppliers from Tajikistan and Uzbekistan with support from the EU SWITCH Asia Initiative, aimed at promoting energy efficiency and renewable energy in the tourism sector in Central Asia, implemented by ACTED.
Kyrgyz State Technical University named after I. Razzakov, Faculty of Energy, Department of RES	This department has been active since 2013, providing master's and bachelor's degrees in hydro energy, alternative energy sources, and management. Faculty members have received training in Germany, Sweden, the UK, Malaysia, Russia, China, Kazakhstan, and Iran ²⁷ .
Kyrgyz State Technical University named after Razzakov, Research Institute of Energy and Communications (NIEiS)	Founded in 2000, this institute engages ²⁸ in a wide range of scientific research in the field of energy, including long-term perspective studies on the country's energy balance up to 2035, considering the increasing share of renewable energy sources. The institute is involved in developing a new National Energy Program up to 2035
Kyrgyz Sustainable Energy Financing Facility (KyrSEFF)	Established in 2012 by the European Bank for Reconstruction and Development (EBRD) to support local financial intermediaries in financing small sustainable energy projects in the region. In 2023, KyrSEFF announced the launch of a \$50 million credit line for its third phase with grant subsidies for borrowers and free technical consultancy (KyrSEFF, 2023 ²⁹).
New-Tek LLC	New-Tec LLC is a Kyrgyz-German company established in 2015 in partnership with Babek Ltd and the German SCHMID Group. The company owns a PV module production facility with an annual capacity of approximately 50 MW for the Kyrgyzstan and Central Asian markets.
Unison Group	Unison Group is a strategic consulting firm specializing in sustainable energy and climate change, based in Bishkek. Since 2002, the company has provided consultancy services to the Kyrgyz government, financial institutions, donors, and civil society organizations on critical issues and prospective opportunities for sustainable development in Kyrgyzstan and Central Asia. ³⁰
USAID, Power Central Asia project (2020-25)	USAID partners with the Ministry of Energy to reform the energy sector, address renewable energy integration challenges, select project sites, develop Power Purchase Agreements, and pilot small-scale projects like rooftop solar. USAID also aided in establishing a Gender Council and creating web platforms for improved services and transparency ³¹ .

²⁶ <https://www.greenenergy.kg/about-our-company-ru/>

²⁷ <https://kstu.kg/fakultety/ehnergeticheskii-fakultet/vozobnovljaemye-istochniki-ehnergii>

²⁸ <https://kstu.kg/bokovoe-menju/nii/zagolovok-po-umolchaniju-2/dokumenty>

²⁹ <https://www.kyrseff.kg/novaya-iii-faza-kyrseff-budet-podderzivat-proe/>

³⁰ <https://www.unisongroup.org/en/content/about-unison-group>

³¹ <https://www.usaid.gov/central-asia-regional/fact-sheets/usaid-power-central-asia>

1.4.4 General Assessment of the Electricity Sector Status

The overall condition of the country's electricity sector is assessed as critical, not only by national stakeholders³² but also by international organizations.

In June 2022, the World Bank's Board of Executive Directors approved a \$50 million project to support the Kyrgyz Republic in addressing critical challenges in its electricity sector³³. The project will run through 2028. The project, known as the Electricity Sector Modernization and Sustainability Project, is financed through the International Development Association (IDA) with highly concessional terms. Half of the funding is provided as a grant, while the other half is a credit with minimal administrative fees and long repayment terms. Additionally, the project is co-financed by the Swiss State Secretariat for Economic Affairs, providing an additional \$8 million in grant funding.

Key drivers for this project include the Kyrgyz Republic's energy deficit, significant losses in the sector, outdated infrastructure, and heavy sector debt. The country faces an energy deficit, especially during winter, with high demand and insufficient generation capacity. Technical losses in the distribution network are about 20 percent, and much of the infrastructure is outdated, leading to frequent supply disruptions. The Kyrgyz Republic also maintains one of the world's lowest electricity tariff rates.

The project focuses on four main areas: rehabilitating and upgrading distribution networks, digitalizing the distribution network, strengthening social protection systems, and institutional development to support energy sector reform. The project's goal is to put the Kyrgyz Republic's electricity sector on a sustainable path, improving financial performance, ensuring reliable electricity supply, and providing support for vulnerable groups.

1.5 Electricity Markets, Prices, Tariffs, and Costs

In Kyrgyzstan, it is premature to speak of a fully-fledged electricity market, as all key energy stakeholders are under state control (see above), and tariffs for electricity generation, transmission, and distribution are regulated by a state entity. The role of independent electricity suppliers providing electricity at unregulated prices is currently limited (in addition, unregulated tariffs are, in fact, partially regulated in terms of price and sales volumes).

The Department for the Regulation of the Fuel and Energy Complex determines tariffs for energy companies annually using a "cost-plus" methodology³⁴:

- Capital and operating expenses of the enterprise are determined to assess the necessary gross income.
- The gross income obtained is allocated among groups of electricity consumers.
- The tariff for each group of consumers is established based on the share in the total gross income of the energy company and the share in electricity consumption.

³² <https://www.azattyk.org/a/32587681.html>

³³ World Bank, 2022. The Electricity Sector in the Kyrgyz Republic to Improve its Efficiency with World Bank Support. URL: <https://www.worldbank.org/en/news/press-release/2022/06/23/the-electricity-sector-in-the-kyrgyz-republic-to-improve-its-efficiency-with-world-bank-support>

³⁴ Methodology for Determining the Cost Price and Setting Tariffs for Electrical Energy. Approved by Order No. 4 of the State Agency for Regulation of the Fuel and Energy Complex on 24.11.2016, with amendments as of December 2022. URL: <https://regultek.gov.kg/ru/electronic-library/contains/34>

This approach, among other things, allows for the organization of cross-subsidization among different consumer groups through a system of subjective increasing and decreasing coefficients – for example, reducing the tariff for households at the expense of a proportional increase in the tariff for industrial consumers.

As a result, electricity prices (tariffs) in Kyrgyzstan are regulated by the state at a very low level. Prices for households and industry in Kyrgyzstan are among the lowest in all UNECE countries and are 1.5 to 3 times lower than in neighboring Uzbekistan, Kazakhstan, Azerbaijan, and Georgia (dena, 2022)³⁵.

Low electricity prices enable addressing social tasks by supporting low-income households. However, chronic deficits in the finances of energy companies and low transparency have created conditions for the constant growth of accumulated accounts payable. In 2020, Kyrgyzstan's national debt was estimated at \$4.5 billion, of which approximately \$2 billion consisted of debts of energy companies. The peak repayments on loans were estimated for 2025-2030 at about 50% of energy company revenues annually³⁶.

³⁵ dena, 2022. Status and Perspectives of Renewable Energy Development in the UNECE Region. September 2022. URL: <https://www.dena.de/en/newsroom/publication-detail/pub/report-status-and-perspectives-of-renewable-energy-development-in-the-unece-region/>

³⁶ <https://www.akchabar.kg/ru/article/economy/tarify-v-energootrasli/>

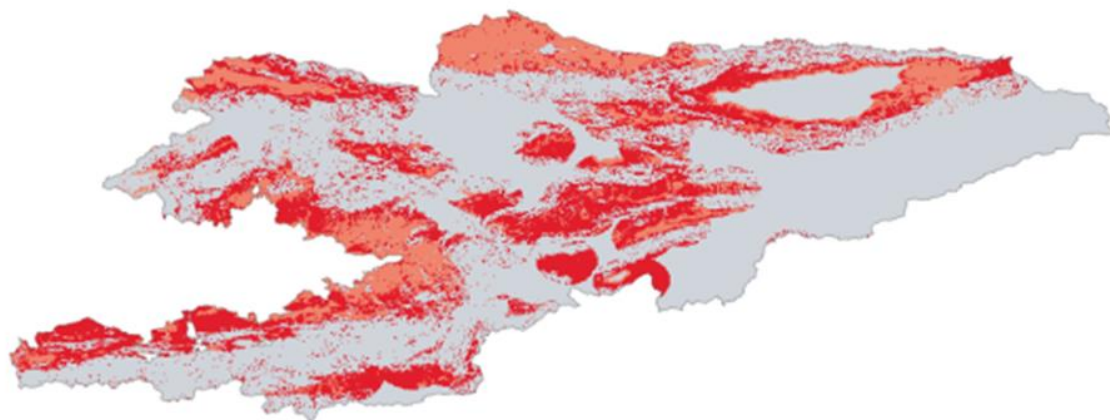
2. Factors for PV Development: Potential and National Strategies

The PV sector development in Kyrgyzstan is in its early stages and, unlike hydropower, it has not been a primary focus for stakeholders. In this regard, the situation is similar to neighboring Tajikistan but significantly differs from Kazakhstan and Uzbekistan, which have already commissioned their first utility-scale PV plants and are implementing extensive solar energy development programs.

2.1 Solar Energy Potential and Current Market Status

The average solar PV potential in Kyrgyzstan is approximately 4.1 kWh/m², which is nearly 1.5 times higher than that of Germany. It is estimated that about 0.055% of the country's total area would need to be utilized for PV plants in order to generate the equivalent of the annual electricity consumption. In this scenario, the Levelized Cost of Electricity (LCOE) could be around \$0.1 per kWh (ESMAP, 2020³⁷). The potential of solar energy in the country is estimated at 267 GW (OSCE, 2022).

Figure 3: Zoning of Solar PV Practical Potential in Kyrgyzstan



Zoning of Solar PV Practical Potential in Kyrgyzstan (red is used to indicate locations suitable for utility-scale PV plants without significant land-use constraints, pink is for areas suitable with some constraints, and gray is for regions where utility-scale PV plants would be impractical due to identifiable physical obstacles). Source: ESMAP (2020).

Cluster analysis using GIS systems reveals that areas optimal for introduction of utility-scale PV installations and close to roads and power grids are concentrated in the southern Osh region along the Kyzyl-Suu river. In these optimal locations, which are within approximately 1.5 km of existing infrastructure, it is possible to install power plants with a capacity of around 650 MW. These areas are situated near the city of Osh and could help meet its electricity needs (IRENA, 2022a)³⁸. By 2030, Kyrgyzstan may require over 800 GW of PV

³⁷ ESMAP. 2020. Global Photovoltaic Power Potential by Country. Washington, DC: World Bank.

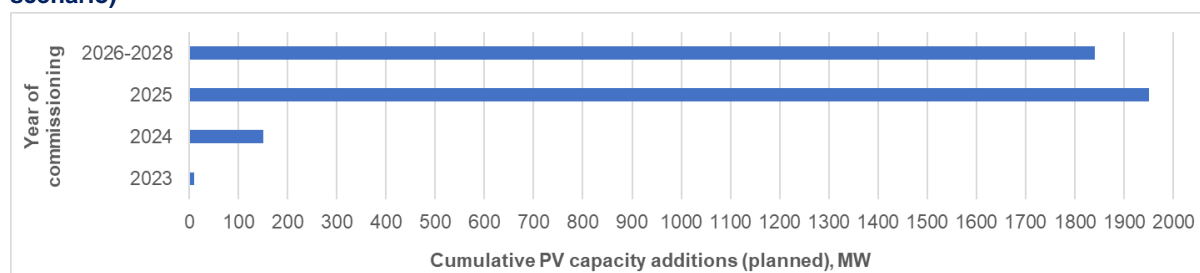
³⁸ IRENA (2022a). Renewables readiness assessment: The Kyrgyz Republic, International Renewable Energy Agency, Abu Dhabi.

capacity to replace outdated thermal power plants and achieve climate goals (CAREC Institute, 2022)³⁹.

The potential of solar energy remains largely untapped. In 2022, no large-scale solar power plants were operational in the country (IRENA, 2023)⁴⁰. Under the UNIDO project "Reliable Energy Supply for Rural Health Posts," in collaboration with UNDP and WHO, 1.5-3 kW PV plants were installed in 19 rural health posts across all regions of the country. The objective is to ensure uninterrupted medical services for the residents (UNECE, 2018)⁴¹.

As of October 2023, approximately 15 potential large PV projects with a combined capacity of around 4 GW are in the early development stages, primarily at the MoU or early engineering phase (for comparison, the total installed capacity of all operating power stations in Kyrgyzstan in 2021 was 3.945 GW). The list of these projects has not been officially published but is discussed in the media following a social media post by Prime Minister Japarov (Japarov, 2023)⁴². Investors from China, Russia, the UAE, and other countries are involved in these discussions.

Figure 4: Capacity additions of potential PV plants in the government’s pipeline in Kyrgyzstan (optimistic scenario)



Source: eclareon analysis based on data published by the Prime Minister (Zhapparov, 2023)

In 2023, the commissioning of an 80 kW plant at the I. Razzakov Kyrgyz Technical University is possible.

Overall, the pipeline of projects totaling 4 GW with implementation by 2028 appears unrealistic given the current state of the country's power sector and the regulatory environment for PV projects. For example, concerning the 300 MW Bishkek-Solar project with an expected commissioning year of 2025, the investor has not yet made a decision - as of September 2023, the investor "is awaiting financial guarantees from the government,"⁴³

³⁹ CAREC Institute, 2022. Sustainable Pathways to Energy Transition in the CAREC Region: A Governance Perspective. March 2022. URL: <https://www.carecinstitute.org/publications/sustainable-pathways-to-energy-transition-in-the-carec-region-a-governance-perspective/>

⁴⁰ IRENA (2023), Renewable energy statistics 2023, International Renewable Energy Agency, Abu Dhabi.

⁴¹ UNECE, 2018. "The Kyrgyz Republic: Energy sector review in 2018", United Nations Economic Commission for Europe, Geneva, https://unece.org/fileadmin/DAM/project-monitoring/unda/16_17X/A2.1_Implement_Natl_CS/KGZ-EnergySectorReview_e.pdf.

⁴² Zhapparov, 2023.

[https://www.facebook.com/akylbek.japarov/posts/pfbid02v421YifkyMA7zjH4CdzhQXfswEVxjmkuYwqdUk45C4DE7foUDbEuNRHkgFSY1MI?__cft__\[0\]=AZXO74Uml2PqrWUFO7nu_fxlaBXmd81UYMQu8aoQ3v9Fq86mUIEcGMLuEjZ07H1xA05HdHhISHgnVX5prNtSI1VAhsUPuHFwfaCYtYjAsFv8IRERD_zaetoaoc9V7Q2mvY0&__tn__=%2CO%2CP-R](https://www.facebook.com/akylbek.japarov/posts/pfbid02v421YifkyMA7zjH4CdzhQXfswEVxjmkuYwqdUk45C4DE7foUDbEuNRHkgFSY1MI?__cft__[0]=AZXO74Uml2PqrWUFO7nu_fxlaBXmd81UYMQu8aoQ3v9Fq86mUIEcGMLuEjZ07H1xA05HdHhISHgnVX5prNtSI1VAhsUPuHFwfaCYtYjAsFv8IRERD_zaetoaoc9V7Q2mvY0&__tn__=%2CO%2CP-R)

⁴³ <https://economist.kg/novosti/2023/09/21/stroitelstvo-solniechnoi-eliektrostantsii-bishkiek-solar-na-issyk-kulie-nachnietsia-poslie-priedostavleniia-fingharantii-ot-kyrgyzstana>

and there are discussions in parliament regarding the cancellation of the land allocation agreement to the investor⁴⁴.

Certain projects from this list may certainly be realized, but without an approved long-term energy development strategy, it is impossible to predict either the share of the most likely projects or the actual year of their commissioning. The draft National Energy Program until 2035, referencing the recent USAID Power Central Asia study, indicates the possibility of introducing PV power plants with a combined capacity of 1.2-2.2 GW by 2035 in the Issyk-Kul, Talas, and Chui regions. These stations are optimally located in terms of land availability and the potential for cost-effective grid connection⁴⁵.

2.2 Relevant Strategies, Concepts, and Programs

Since 2008, the Kyrgyz Republic has adopted a series of strategic documents related to renewable energy, including the PV sector.

2.2.1 National Energy Program and Energy Development Strategy until 2025

The National Energy Program for the years 2008-2010 and the Energy Development Strategy until 2025⁴⁶ consider renewables as a means to ensure energy security.

Overall, the key targets outlined in this document related to renewables have not been achieved. For example, by 2025, it was anticipated to reach an annual electricity production of 26 TWh in Kyrgyzstan, primarily through the full-scale commissioning of the Kambarata-1,2 hydropower plants, while also aiming for around 30 GWh per year of non-hydro electricity generation. In reality, the construction of the Kambarata-1,2 plants is currently on hold (with one unit of Kambarata-2 commissioned in 2010), and the non-hydro electricity generation remained at zero in 2022 (IRENA, 2023).

In June 2023, a draft National Energy Program for the period until 2035 was presented for public discussion. The document is currently under review by a working group composed of scientists and experts from the institutes of the Ministry of Energy and the I. Razzakov Kyrgyz Technical University.

2.2.2 Green Economy Development Program 2019-2023

The Green Economy Development Program in the Kyrgyz Republic for 2019-2023⁴⁷ prioritizes green energy as one of its focuses. It emphasizes reducing energy intensity of GDP by 4.5% by 2023 while simultaneously increasing access to reliable and modern energy supply for citizens and economic entities. The development of renewables is discussed in the program in the context of diversifying energy sources and advancing distributed power generation, including microgeneration. The program aimed to introduce at least 50 MW of renewables within the 2019-2023 period.

⁴⁴ <https://economist.kg/enierghietika/2023/09/27/iesli-bishkiek-solar-nie-nachniet-stroit-solniechnuiu-eliكتروstantsiiu-to-ia-prilozhu-usiliia-chtoby-im-annulirovali-doghovor-maksatbiek-sarybaghyshiev>

⁴⁵ Order of the Cabinet of Ministers of the Kyrgyz Republic on the Draft National Energy Program of the Kyrgyz Republic for the Period until 2035." (draft) URL: <http://koomtalkuu.gov.kg/ru/view-mpa/2827>

⁴⁶ Resolution of the Jogorku Kenesh of the Kyrgyz Republic dated April 24, 2008, No. 346-IV." Accessible at: https://base.spinform.ru/show_doc.fwx?rgn=23169.

⁴⁷ Resolution of the Government of the Kyrgyz Republic dated November 14, 2019, No. 605." Available at: <http://cbd.minjust.gov.kg/act/view/ru-ru/453438?cl=ru-ru>

2.2.3 National Development Program until 2026

The National Development Program of the Kyrgyz Republic until 2026⁴⁸ places hydropower at the forefront of economic development priorities. It identifies key projects, including hydropower plants introduction (Kambarata-1, Upper Naryn Cascade, Suusamyр-Kokomerен Cascade, Kazarmanskiy Cascade), an electricity interconnector between Kyrgyzstan, Tajikistan, Pakistan, and Afghanistan (CASA-1000), and the modernization of existing hydropower plants in the Toktogul Cascade. Solar and wind energy development is also mentioned in the program, though without specific quantitative targets.

2.2.4 National Development Strategy 2018-2040

According to the goals set forth in the 2018-2040 National Development Strategy, the combined contribution of small hydropower, solar, wind, and biogas power generation, as well as solar heating and heat pumps, will constitute a minimum of 10% of the overall energy mix by 2040 (President of the Kyrgyz Republic, 2018⁴⁹).

2.2.5 National Goals for Greenhouse Gas Emissions

The updated Nationally Determined Contribution (NDC) of the Kyrgyz Republic (UNFCCC, 2022)⁵⁰ sets the overall mitigation goal to unconditionally reduce GHG emissions by 16.63% by 2025 and by 15.97% by 2030, under the business-as-usual scenario. With international support, GHG emissions are projected to be reduced by 36.61% by 2025 and by 43.62% by 2030, under the business-as-usual scenario. The document mentions the development of renewable energy as a key means to reduce GHG emissions in the energy sector, which contributes to 60% of Kyrgyzstan's emissions.

President Japarov of Kyrgyzstan emphasized in his speech at COP26 in Glasgow in November 2021 that by 2050, Kyrgyzstan aims to achieve carbon neutrality through green development, with a focus on renewable energy, particularly hydropower, as the cornerstone of carbon-free economic growth (UNFCCC, 2021)⁵¹.

In January 2023, President Japarov issued an open letter via social media, proposing that the repayment of the country's \$4.2 billion debt be linked to the implementation of green energy projects. This proposal includes the development of several dozen medium and small hydropower plants (Japarov, 2023)⁵².

⁴⁸ Decree of the President of the Kyrgyz Republic dated October 12, 2021, No. 435."Accessible at: <http://cbd.minjust.gov.kg/act/view/ru-ru/430700>

⁴⁹ President of the Kyrgyz Republic, 2018. On the National Development Strategy of the Kyrgyz Republic for 2018-2040." Presidential Decree No. 221 dated October 31, 2018. URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/430002>

⁵⁰ UNFCCC, 2022. The updated Nationally Determined Contribution (NDC) of the Kyrgyz Republic / October 2021. URL: <https://unfccc.int/sites/default/files/NDC/2022-06/%D0%9E%D0%9D%D0%A3%D0%92%20ENG%20%D0%BE%D1%82%2008102021.pdf>

⁵¹ UNFCCC, 2021. Kyrgyzstan - High-level Segment Statement COP 26. URL: <https://unfccc.int/documents/309210>

⁵²

[https://www.facebook.com/japarov.sadyr/posts/pfbid0rg6YGMaEuWbYpQRqsZCSqGd8C66osa7bBF26QbNyiidijte2sGGb4uVw2T9d6ad9l?__cft__\[0\]=AZW1eA0qi5eppMLXKxZJ9NQfJL_FAiRltyFGMLdo2qBY-OqrvvFQ09BTRIQciN77NtBzgy7Z3JfITgZmUeTI_Xhiyja6HYEDFRvsOo5tmDyAGRxb5qSyMSTW3NVPRvpOB5Q&__tn__=%2CO%2CP-R](https://www.facebook.com/japarov.sadyr/posts/pfbid0rg6YGMaEuWbYpQRqsZCSqGd8C66osa7bBF26QbNyiidijte2sGGb4uVw2T9d6ad9l?__cft__[0]=AZW1eA0qi5eppMLXKxZJ9NQfJL_FAiRltyFGMLdo2qBY-OqrvvFQ09BTRIQciN77NtBzgy7Z3JfITgZmUeTI_Xhiyja6HYEDFRvsOo5tmDyAGRxb5qSyMSTW3NVPRvpOB5Q&__tn__=%2CO%2CP-R)

3. Regulatory Environment for PV: Incentives, Barriers, and Standards

3.1 Incentives for Renewable Energy Sources

To support the development of renewable energy in Kyrgyzstan, the "Law on Renewable Energy" was initially enacted in 2008. In 2022, a revised version of the law with the same title was adopted, and the latest amendments were made in August 2023⁵³ (referred to as the RE Law hereafter).

3.1.1 Feed-In Tariff

By legislation, a specific electric power company in Kyrgyzstan is mandated to engage in the compulsory purchase of renewable electricity from suppliers. Renewable electricity that is not consumed on-site or by immediate consumers must be procured by this designated company as per the regulator's instructions, by entering into an appropriate Power Purchase Agreement (PPA), irrespective of the power grid company responsible for the physical connection of the renewable power plant. According to preliminary information, the Ministry of Energy has designated the "National Electric Networks of Kyrgyzstan" for this role as the "single purchaser" (Saaduev, 2023)⁵⁴. The supply and payment for renewable electricity are given precedence in accordance with the PPA, which is established during the preferential period. Additional costs incurred by power companies in relation to the procurement of renewable electricity are factored into the medium-term electricity tariff policy for end consumers, and are covered by funds allocated by the authorized institution appointed by the Kyrgyzstan Cabinet of Ministers, likely the Green Energy Fund.

The tariff is determined by multiplying the "standard electricity tariff" by a coefficient of 1.3, regardless of the renewable energy technology used. In Kyrgyzstan, electricity tariffs for households and commercial consumers are set by the State Agency for Regulation of the Fuel and Energy Sector under the Government of the Kyrgyz Republic. This tariff varies depending on the national tariff policy for electricity, which provides little long-term transparency and planning security for investors and project developers.

The tariff for renewable electricity is guaranteed for a preferential period, which is set at 25 years for wind and solar power plants and 15 years for small hydropower plants, according to the Law on RES. After the preferential period, power plants receive compensation for the renewable electricity at a new tariff. This tariff is set at the average tariff for end consumers of the distribution company for the previous year.

For renewable power plants built outside the capacity quota system (presumably referring to power plants not planned for introduction by the regulator due to power grid constraints etc.), the increased tariff does not apply. In this case, the tariff is determined as the maximum standard tariff for end consumers minus the electricity transmission tariff. This tariff is valid

⁵³ Law of the Kyrgyz Republic No. 49, dated June 30, 2022, "On Renewable Energy Sources." URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/112382>

⁵⁴ Saaduev M. Legal aspects of implementing projects in the field of renewable energy / September 2023. URL: <http://www.k-a.kg/ru/pravovye-aspekty-realizatsii-proektov-v-sfere-vozobnovlyaemoi-energetiki>

for the "payback period," which the regulator determines based on project cost estimates (State Agency for Regulation of the Fuel and Energy Complex, 2018).

Tariffs for renewable electricity are subject to annual indexation, taking into account changes in the exchange rate of foreign currency to the Kyrgyz currency (soms), based on a methodology yet to be developed by the regulator.

3.1.2 Land Allocation

Traditionally, land allocation for renewable energy projects in Kyrgyzstan followed general procedures compared to other projects. This caused uncertainty for investors due to various reasons, including restrictions on agricultural and forest land use, unclear long-term lease procedures, overlapping regulatory authorities, and complex land allocation processes.

In 2023, amidst the energy sector's state of emergency declared by the president, reforms began in this area. The Green Energy Fund gained the right to indefinite land use for renewable energy projects, as well as the authority to transfer this land to investors under a "one-stop shop" principle. An inventory of these lands across the country involving several ministries was supposed to be conducted, although the timeframe for completion is not specified.

In August 2023, the Cabinet of Ministers approved the construction of RES projects within water protection zones and along water bodies. Additionally, the transfer of land from the state forest fund to energy users for RES projects is allowed based on a competition conducted by the Green Energy Fund.

The swiftness of these changes, on one hand, demonstrates the legislators' intention to swiftly advance in addressing the long-standing and significant issue of allocating land for renewable energy projects. However, on the other hand, it raises doubts regarding the future legal enforcement practices, given conflicts with existing laws and resolutions that, as of October 2023, remain unchanged. Contradictions arise in matters concerning the transfer of land usage rights to the Green Energy Fund and the legal consequences of land non-utilization (Saaduev, 2023).

3.1.3 Additional Incentives for Renewable Energy Producers

- Producers of renewable electricity **are exempt from the obligation to obtain a license for electricity production**, unlike producers of electricity from other sources.
- The Renewable Energy Law **ensures equal grid access for all renewable electricity producers**, requiring power grid companies to facilitate non-discriminatory connection for power plants and guarantee smooth electricity transport to end consumers. Producers, however, must **meet quality standards and cover the grid connection costs**, in accordance with Article 12 of the Renewable Energy Law.
- The Renewable Energy Law gives **priority to renewable electricity in creating dispatch schedules for electricity supply and consumption** within Kyrgyzstan's unified power system.
- Energy companies failing to meet the obligations defined by legislation **must compensate losses (lost profits) to renewable electricity producers** (Article 16, paragraph 2, of the Renewable Energy Law).

- The Renewable Energy Law **recommends considering renewable energy technologies in building design**. Responsible organizations are advised to explore the potential use of solar and other renewables (Article 10, paragraph 2 of the Renewable Energy Law). This provision is not mandatory; it's a recommendation.
- Renewable energy producers **enjoy tax and customs benefits**, including a 5-year income tax exemption from plant commissioning and VAT exemption on imported specific construction goods (according to the Tax Code⁵⁵).

3.2 Barriers to PV Development

There is a wide spectrum of legal, organizational, and institutional barriers seriously impeding renewables development, including the PV sector.

Existing government programs and strategies declare support for renewable energy development, and public statements from Kyrgyzstan's top officials follow this trend. However, the focus in these declarations is almost always on hydropower, including large projects initiated several decades ago. In 2021, the Kyrgyz Republic assessed nine major power generation development projects (comprising eight hydropower and one fossil-fueled power plant) as well as 63 small-scale hydropower plant projects, with a combined value of \$12.5 billion (EDB, 2021). Thus, there were no active projects in solar energy development during this period.

3.2.1 Absence of Legally Binding Targets

Kyrgyzstan lacks legally binding targets for renewables deployment in the short, medium, and long term. While there is a tentative goal set for 2040 (10% of the overall energy mix), it lacks robust regulatory support, detailed breakdown, and accountability for stakeholders in case of non-achievement. Analysis of the National Energy Development Strategy 2008-2025 reveals that goals in such documents are not consistently met.

The unclear future perspective on renewable energy, coupled with the absence of clear, legally binding targets in the field of renewables, elevates the risk of investment returns and discourages investments in PV and other renewable energy projects in Kyrgyzstan.

3.2.2 Focus on Hydropower

Existing government programs and strategies declare support for renewable energy development, and public statements from Kyrgyzstan's top officials follow this trend. However, the focus in these declarations is almost always on hydropower, including large projects initiated several decades ago. In 2021, the Kyrgyz Republic assessed nine major power generation development projects (comprising eight hydropower and one fossil-fueled power plant) as well as 63 small-scale hydropower plant projects, with a combined value of \$12.5 billion (EDB, 2021)⁵⁶. Thus, there were no active projects in solar energy development during this period.

⁵⁵ Tax code of the Kyrgyz Republic. Entered into force by law No. 4 on 18 January 2022. URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/112340>

⁵⁶ EDB, 2021. Vinokurov E. et al. Investment in the Water and Energy Complex of Central Asia. Reports and Working Papers 21/3. Almaty, Moscow: Eurasian Development Bank.

3.2.3 Lack of Implementation Legislation

Kyrgyzstan's Renewable Energy Law acts as a foundational framework, offering a broad legal foundation for the utilization and backing of renewable energy. Nevertheless, it necessitates additional refinement and clarification to establish more comprehensive regulations. Furthermore, discrepancies between the renewable energy legislation and other regulatory statutes lead to procedural ambiguities, uncertainties concerning responsible entities, and the duration of processes. Examples include:

- **Outdated Long-Term Energy Development Plan:** the foundational long-term plan for energy sector development, the National Energy Program 2008-2025, is outdated and in need of an update. A new version with a planning horizon up to 2035 is reportedly in development.
- **Lack of Established PPAs Practices:** there is no well-established practice for entering long-term Power Purchase Agreements (PPAs), and a standard PPA format is likely under development by the Ministry of Energy.
- **Undefined Tender Procedure:** there is no defined procedure for renewable energy tenders (auctions). Green tariffs have not been a significant driver for renewables deployment in Kyrgyzstan, and there have been negative experiences with past auctions, particularly for small hydropower plants that did not yield successful results.
- **Absence of Microgeneration Sector Restrictions:** current regulatory frameworks do not differentiate between rooftop and utility-scale PV power plants for certain indicators and actions.
- The mechanism for the **mandatory purchase of renewable electricity** by a dedicated electricity company, as well as entering into long-term electricity transportation contracts **is not described in detail**;
- There is a **lack of distributed energy policy instruments** such as net metering and wheeling (IRENA, 2022a).

3.2.4 Cost-Related Risks

The levelized cost of electricity (LCOE) for utility-scale PV on key global markets in 2022 ranged from \$0.037/kWh (India, China) to \$0.058-0.092/kWh (USA, Japan). The UAE achieved \$0.026/kWh, although it operates in a significantly smaller market (IRENA, 2022b)⁵⁷.

For comparison, renewable electricity providers in Kyrgyzstan received a tariff of 4.43 soms/kWh until August 2023, which equates to \$0.05/kWh at an exchange rate of 89.32 soms/\$ (Saaduev, 2023). While this level may be attractive for certain projects, the linkage of tariffs to annually changing rates for end consumers introduces risks for investors and hinders sector development. Additional uncertainty and risks for renewable energy investors stem from the annual tariff indexation (the exact indexation rate is unknown in advance) and the lack of transparency in setting tariffs after the 25-year preferential period.

Grid connection expenses have a detrimental impact on PV projects in Kyrgyzstan. According to the Renewable Energy Law, these costs are the responsibility of the plant owner and are determined by the technical connection conditions established by the power grid company. Importantly, they are not contingent on the renewable energy investor. This issue is exacerbated by the substantial physical deterioration of the power grid infrastructure

⁵⁷ IRENA (2022b), Renewable power generation costs in 2022, International Renewable Energy Agency, Abu Dhabi.

in Kyrgyzstan. As a consequence, these expenses are incorporated into the project's CAPEX, ultimately diminishing its profitability.

3.2.5 Other Barriers

The absence of an approved long-term development strategy outlining scenarios for deployment of new power plants (including renewables), power grids, and other infrastructure creates an additional challenge. Investors in renewable energy cannot swiftly and easily access information about potential sites for future power plants that are optimal in terms of their physical, environmental, legislative, and legal limitations, as well as grid connection costs. The quest for such sites demands both time and financial investments, which, in the current regulatory framework, are primarily the responsibility of the investor.

Furthermore, the development of the PV sector in Kyrgyzstan faces impediments, including a lack of local expertise, a limited number of local technology suppliers, low public awareness and stakeholder understanding of the advantages of renewables. Capacity building in renewable energy is crucial for both public and private stakeholders. Inadequate skills and expertise present challenges at every stage of renewable energy implementation, from policy development to project construction and operation (IRENA, 2022a).

In open discussions, participants in Kyrgyzstan's renewable energy sector have highlighted additional barriers (Unison Group, 2022):

- Political instability within the nation.
- Bureaucracy and corruption in the public procurement system.
- Widespread public distrust in the judicial system.
- Lack of transparency in the administration of the energy sector.
- Challenges in securing financing for entrepreneurs interested in renewable energy investments.
- Inadequate expertise among domestic companies across different market segments.
- Limited public awareness.
- A feeble mechanism and an underdeveloped framework for public-private partnerships in the country.

3.3 Standards for PV Project Development

Investors can obtain the right to develop a PV project in Kyrgyzstan through a dedicated competition (auction) organized by the Ministry of Energy or, for large projects, through investment agreements. The practice of organizing and conducting auctions is still evolving, but the Ministry of Energy and the Green Energy Fund are the primary regulators responsible for granting rights to investors for project development. Investors should engage with these authorities at the early stages of project planning.

The current regulatory framework includes the following key stages for PV project development:

- 1) Development of a **Pre-Feasibility Study and Preliminary Environmental Impact Assessment (EIA)**

The Pre-Feasibility Study aims to determine key project parameters such as capacity, location, land area, and more. The Preliminary EIA is conducted to comprehensively analyze potential project impacts, assess alternative options, and develop an environmental management plan. Both studies are carried out by

Kyrgyzstan-based companies holding licenses for power plants design⁵⁸. Reports on the Pre-Feasibility Study and Preliminary EIA serve as the basis for communicating with regulators regarding land allocation⁵⁹.

2) **Obtaining Land Rights** (Ownership or Temporary Use Rights)

This stage is regulated by the Land Code of the Kyrgyz Republic⁶⁰ and is expected to be significantly streamlined in accordance with regulatory acts adopted in 2023, governing land allocation for renewable energy projects through the Green Energy Fund.

3) **Establishment of the Green Tariff**

4) **Development of Project Design and Cost Estimates (Basic Engineering), and EIA**

This stage is carried out by Kyrgyzstan-based companies with licenses for power station design. Specialized government bodies are involved in this process during data collection and the assessment of finalized documentation. Regulator-approved documentation forms the basis for obtaining construction permits.

5) **Construction of the PV Facility and Its Grid Connection**

Construction is conducted by licensed local companies, following a similar pattern to the design phase. Grid connection is regulated by the power grid company, which defines the connection terms and conditions.

6) **Acceptance and Commissioning of the Constructed PV Facility**

7) **Obtaining Authorization for Electricity Sales**

8) **Conclusion of a Contract with the Data Collection and Processing Center for Electricity Metering Services.**

3.4 Trade and Investment Conditions

Since gaining independence in 1991, Kyrgyzstan has experienced political instability with presidential overthrows in 2005, 2010, and 2020. In the latest presidential elections in 2021, Sadyr Japarov was elected with 79% of the vote. The political situation has stabilized, and the presidential system of governance has solidified. The most recent parliamentary elections took place in November 2021. In February 2023, all six former Kyrgyzstan presidents held a meeting on neutral territory.

Economic growth rates have decreased from 6.3% in 2022 to 3.9% in the first half of 2023 (compared to the previous year). This decline is attributed to slower growth in agriculture and reduced gold production due to stockpiling in 2022. Remittances in US dollars decreased by 24% (compared to the previous year), leading to an estimated 0.3% reduction in consumption. From a demand perspective, growth was supported by government spending and investments, while net exports had a negative impact. Inflation reached approximately 10.5% in June 2023, primarily due to moderate decreases in fuel prices, food, and tariffs for electricity and utilities (World Bank, 2023).

⁵⁸ Government Resolution No. 260 of 31.05.2001 (with subsequent amendments). Available at: <http://cbd.minjust.gov.kg/act/view/ru-ru/6849>.

⁵⁹ Regulation on the conditions and procedure for implementation of activities on generation and supply of electric energy using renewable energy sources. Approved by the Resolution of the Cabinet of Ministers of the Kyrgyz Republic No. 583 dated October 24, 2022 URL: <http://cbd.minjust.gov.kg/act/view/ru-ru/159589>

⁶⁰ Land Code of the Kyrgyz Republic No. 45 dated 06.02.1999 (with subsequent amendments dated August 2022). Available at: <http://cbd.minjust.gov.kg/act/view/ru-ru/8?cl=ru-ru>.

A current account deficit of approximately 29% of GDP is expected in 2023 and is projected to slightly decrease in 2024-2025 as external demand for non-gold goods improves and service exports increase. Budget deficit is expected to rise slightly in 2023 due to the full impact of increased public sector wages and social benefits. However, fiscal conditions are expected to strengthen in 2024-2025, thanks to higher revenues from the mining sector, containment of spending on goods and services, and reduced capital expenditures (World Bank, 2023).

Sustaining economic growth will require institutional and structural reforms to improve conditions for private sector development, job creation, stimulate international trade, and support financially sustainable energy production (World Bank, 2023).

An investment risk analysis conducted in 2021 within the framework of the Energy Investment Risk Assessment (EIRA) indicated that the overall risk level in the considered areas in Kyrgyzstan is low, although there is potential for improving regulatory efficiency. Among the three assessed risks, the risk of violating state obligations was rated the lowest, compared to unpredictable policy and regulatory changes, as well as discrimination between domestic and foreign investors (EIRA, 2021)⁶¹.

3.5 Financing PV Projects

In Kyrgyzstan, a practice of financing PV projects has not yet fully developed. However, an analysis of banking trends and project financing practices in the energy sector can provide insights.

The financial market in Kyrgyzstan is underdeveloped, and local banks have limited support for renewable energy projects. The banking sector is relatively weak, with banking assets as a percentage of GDP standing at 49.7%. Out of the 23 banks operating in the country in 2023, five hold 58% of the market's total assets. Industrial and construction financing accounts for approximately 10% of the credit portfolio (National Bank of the Kyrgyz Republic, 2023)⁶².

Kyrgyzstan recorded the lowest levels of capital investment in the water-energy sector among Central Asian countries in 2016-2020, averaging around \$0.1-0.3 billion or 1.2% of GDP annually. The required level of investment is estimated at 5.7% of GDP (EDB, 2021).

Active attraction of foreign direct investments into the water-energy sector was observed in Kyrgyzstan from 2015 to 2017, ranging from 9% to 15% of the total investment volume. The maximum foreign direct investment in the water-energy sector reached \$136.7 million in 2015. Multilateral development banks provided approximately \$790 million for 12 projects with blended financing to compensate for elevated risks and high capital costs. Over 80% of this funding was secured from the ADB and the Eurasian Fund for Stabilization and Development. Nearly all of these projects focused on hydropower plant modernization (EDB, 2021).

⁶¹ EIRA, 2021. Energy Investment Risk Assessment: Kyrgyzstan Profile. URL: <https://eira.energycharter.org/country-profiles/13-countries/34-kyrgyzstan.html>

⁶² National Bank of the Kyrgyz Republic, 2023. Trends in the development of the banking sector.. URL: <https://www.nbkr.kg/index1.jsp?item=80>

4. Conclusion

The energy sector in Kyrgyzstan is characterized by outdated, inefficient, and highly hydropower-dependent infrastructure inherited from the country's Soviet past. Despite the regulatory framework for modernizing the sector and developing renewable energy in the country beginning to take shape over 15 years ago (Kyrgyzstan was one of the first in the region to adopt a law on renewable energy), it is still premature to claim that the prerequisites for practical implementation are in place.

The state monopoly allows the government to set low electricity tariffs that are welcomed by consumers. However, these low prices hinder the inflow of investments into the energy sector and ultimately pose a threat to Kyrgyzstan's energy security. The country has immense potential for the development of solar energy, with an average solar PV potential of approximately 4.1 kWh/m², nearly 1.5 times higher than that of Germany. It is estimated that only about 0.055% of the country's total area would need to be utilized for PV plants to generate the equivalent of annual electricity consumption. However, as of 2023, there is not a single utility-scale PV power plant in the country.

New green tariff rules and a simplified land allocation system are becoming the main drivers for the long-awaited start of the PV sector development in Kyrgyzstan. Policymakers are hopeful about the realization of several potential utility-scale projects with a combined capacity comparable to the entire country's power system. Yet, these expectations are unlikely to materialize due to several barriers. The country lacks the implementation legislation that provides detailed procedures for project delivery and resolves legislative inconsistencies. Fundamental elements such as long-term power purchase agreements (PPAs), tender procedures, and a long-term energy strategy are also absent. Investors worldwide are hesitant to take risks in an environment of constantly changing rules. High risks translate into high capital costs and, ultimately, high levelized cost of electricity (LCOE), reducing the competitiveness of investment projects.

Another growth area is distributed energy resources based on rooftop PV and net metering, which currently remain largely outside the regulatory field and support measures. This sector can be crucial for Kyrgyzstan, given the high percentage of rural residents, including those in remote areas, and the decentralized nature of electricity demand.

The traditional focus of Kyrgyzstan's stakeholders on hydropower is understandable, given the country's vast hydropower potential and its long history of hydropower use. However, solar energy offers several advantages, particularly independence from river conditions and the constant decrease in technology costs.

Positive signals include the fact that Kyrgyzstan's leaders have shown political will to steer the economy towards green development and achieve NetZero goals, and the speed of decision-making in the energy sector has noticeably increased since 2020. The country has a relatively wide circle of local professionals and associations ready to support the development of renewable energy. International organizations and multilateral development banks are already making invaluable contributions to assessing the potential of renewable energy, aiding in the development of a regulatory framework, and financing specific investment projects. All of this instills cautious optimism and faith that Kyrgyzstan will soon join the global movement towards rapid PV deployment.

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