

The Kyrgyz Republic: Energy Sector Review in 2018

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Executive summary

Since the early 1990s, the Kyrgyz Republic has been implementing state policy aimed at the socio-economic development of the country including increasing the efficiency of the energy sector, as well as the creation of relevant regulatory framework, institutional infrastructure, and execution of relevant government programs. Following these measures' results, qualitative changes in the country were achieved.

At the present development path, the economy of the Kyrgyz Republic shows moderate growth rates and can be described mainly as a service economy. The largest share in the GDP structure of the Kyrgyz Republic is constituted by the spheres delivering services. In the total volume of GDP in 2017, the share of services amounted to 48.0 %, industry - 18.2 %, agriculture - 12.3 %, and construction - 8.2 %. Based on the results of the last five years, GDP increases annually by 4-5 %. The average annual real growth of GDP consistently exceeds the same average indicator for the Eurasian Economic Union (EAEU) countries (up to 5%) as determined by the method and recommendations of the Eurasian Economic Commission (EEC). The average annual rate of inflation remains in the range of 5-7 %.

Over the past 5 years, the level of poverty in the country has been significantly reduced. By the end of 2016, the poverty level was 25.4 % having decreased by 12.6% comparing to 2012. Also, the level of extreme poverty for the period of 2012–2016 decreased significantly from 4.4% to 0.8%. The World Bank has excluded the Kyrgyz Republic from the number of poor countries and included to the category of developing states with an average income level.

Indicators of the Kyrgyz Republic in the international ratings, such as Doing Business (77th place in 2018), World Economic Forum Global Competitiveness Index (102nd place in 2018), Transparency International (135th place in 2017) have been also improved.

Energy sector has always been a strategic sector of the Kyrgyz Republic directly affecting the living standards of the population and all economy sectors. In the energy sector, hydropower energy plays a vital role in the formation and development of the energy base of the Kyrgyz Republic, the share of which in the total volume of energy resources is 52.6 %. The development of hydropower energy in the energy sector is a priority direction in the socio-economic development of the country in the medium and long term development plans. The energy sector accounts for about 5.5 % of GDP and 16 % of industrial production, and generates about 10 % of state budget revenues.

The Kyrgyz Republic has huge reserves of clean energy. The hydropower energy potential of large and small rivers is estimated at 142.5 billion kWh that is currently used only at the level of 10 %.

Renewability of hydropower energy resources and unconventional energy sources, a small degree of their use, obvious environmental advantages compared with fossil fuels, and the extremely high potential capacity of the main water resources give grounds to the viability and high economic efficiency of building large and small hydroelectric power plants. More than 90 % of electricity in the country is produced by hydroelectric power plants (HPP). The rest of the electricity is generated by thermal power plants. However, small and medium energy sector is not actually involved.

The growth of electricity consumption is greater than the growth of new energy capacity. At the same time, the daily consumption of electricity in the winter period is three times higher than in summer. This is explained by the decrease in the use of natural gas, coal and fuel oil due to a significant increase in their prices that have led to the use of electricity for heating and hot water. Long-term operation of the energy industry in financial and technical constraints led to technical deterioration of equipment the level of which averages to 60 % including the deterioration degree of hydroelectric units of the Toktogul HPP - 78.8 %, Bishkek Thermal power plant (TPP) main equipment – 84 %. For the electricity transmission, equipment deterioration is 36 %, in the area of electricity distribution - 45.3 % while the pre-crisis threshold value for deterioration of fixed assets is 15 % and the crisis threshold value - 25%.

The high level of commercial losses restricts the possibility of capitalization of the electric power industry and reduces the abilities for implementing its technological modernization, as well as attracting foreign direct investment for its development.

The energy sector could receive substantial benefits from investment and become a driving force of growth in the future, but this sector is in stagnation due to the suspension of reforms. The sector has a rating of 1.7 out of 4 by the EBRD energy index that is one of the lowest among the surveyed countries. In order to resolve the whole range of issues relating to this sector, the Government of the Kyrgyz Republic aims at the sustainable development of the energy sector and ensuring the country's energy security, delivering to the economy and the population reliable and modern energy supply, and improving the country's export potential.

Introduction: Status of national energy sector

Basic Information

The Kyrgyz Republic has a small area (198.5 thousand sq. Km.) and population (6.1 million), it is a low-income Central Asian country with no access to the sea and bordering with Kazakhstan, China, Tajikistan and Uzbekistan. The Kyrgyz Republic is situated within the mountain range of the Tien-Shan and Pamir-Alai occupied more than 80% of the country's territory. Most of the country is located in a temperate zone and only its southern areas are located in the subtropical zone. The climate is continental with relatively low rainfall and wide fluctuations in temperature throughout the year.

The Kyrgyz Republic has rich water resources amounted to 50 billion m³ s per year of mountain rivers' surface runoff, 13 billion m³ of potential groundwater reserves, 1 745 billion m³ per year of lake water, and 650 billion m³ of glaciers. There are flows formation of such large rivers as the Naryn - 807 km, the Chu - 380 km, the Talas - 200 km, the Sary-Jaz, the Karadarya, the Chakad and others which streams join the Syrdarya and Amudarya basins.

The Kyrgyz Republic has mineral resources but the reserves of oil and natural gas are very small; the country imports oil and gas. Mineral resources consist of significant deposits of coal, gold, uranium, antimony, and rare earth metals. The industry structure is underdeveloped, the main industries are: small mechanical engineering (electric motors, transformers), light industry (processing of cotton and wool, textiles, food industry), building materials (cement, glass, slate), shoes, furniture, mining and energy.

The Kyrgyz Republic is one of the states with hydropower resources with potential of 142 billion kWh and actual use of about 10%. The Kyrgyz Republic takes 3rd rank in the CIS countries after the Russian Federation and Tajikistan. The high availability of hydropower resources has enabled the rapid development of the country energy sector that has become a major electricity producer in the Central Asian region since the beginning of the 1980s supplying the Central Asian United Power System of over 50% of the electricity generated.

The electric power industry of the Kyrgyz Republic is the main sector of the real sector of the economy with share of 5.5 % of GDP, and 16 % of industrial production. For the moment, the level of development of all potential reserves of water resources in the country is on average about 10% mainly in the Naryn river basin with the Toktogul HPPs having the highest level of development - almost 50% in terms of output and power capacity. The energy potential of the rivers of Kyrgyzstan ranges from 140 to 160 billion kWh per year.

However, the presence of a large amount of hydropower potential does not indicate the self-sufficiency of energy resources in the country. Forecasted reserves of fossil fuels are in remote

mountainous areas and the extracted volume of fuel provides the country with 4.04 % of coal, 2.49 % of oil, and 0.29 % of gas. HPPs electricity generated meets energy demand by 53.6 %. To meet the country's needs, almost 40 % of the fuel is imported from neighboring countries. This includes petroleum products that cannot be still replaced by electricity generated by HPPs. Thus, based on the country's fuel and energy balance, The Kyrgyz Republic cannot ensure its energy independence from neighboring states.

Therefore, energy sector is a basic sector of the Kyrgyz economy determining the increased requirements for meeting the country's growing domestic demand for electricity and heat, as well as exporting electricity to the CIS countries. In this connection, it is necessary to create conditions for the modernization of energy facilities and to promote socio-economic development goals of the country.

History of the energy sector development

Until 1917, the electric power industry in the Kyrgyz Republic as a separate industry almost did not exist. In 1913, there were only 5 small electric power plants with a total capacity of 265 kWh: Kyzyl-Kiya coal deposit TPP (121 kWh), two HPPs in Osh city (120 kWh), the Bishkek diesel TPP (16.5 kWh), and the Karakol diesel TPP (7.5 kWh).

In 1929, the Small Alamedin HPP (410 kWh) was built. Since 1923, electric power has been used to illuminate the streets and since 1930 it has been used in agriculture. In 1940, the total capacity of power plants in Kyrgyzstan was 19.6 thousand kWh. The number of generated energy was 51.6 million kWh.

After getting independence by the country, on the basis of existing energy facilities in 1993 the “Kyrgyzgosenergoholding” company was established that performed its activities on the self-supporting principle and consisted of 16 different enterprises involved in the production, transmission and distribution of electricity and heating energy. The company also included three joint stock companies specializing in design and construction work.

Since 1996, corporate management of companies was introduced, and “Kyrgyzgosenergoholding” was transformed into a joint-stock company “KyrgyzEnergo” acted as a governing body and natural monopolist in the electricity industry having the exclusive right to produce electricity and deliver it to final consumers. The situation of competition absence in the market conditions for the sector of production and consumption of electricity needed reforms to be implemented.

Therefore, in 1997, the Government of the Kyrgyz Republic developed and adopted the Program on denationalization and privatization of the JSC “KyrgyzEnergo” according to which this company was split into several companies depending on their functions. The electricity supply

chain from its production to delivery to end-users was divided into the following parts: generation, transmission and distribution of electricity.

The structure of the energy sector of Kyrgyzstan as of 2018

In 2001, in accordance with the Program on denationalization and privatization of the JSC “KyrgyzEnergo”, the Government of the Kyrgyz Republic completed the restructuring of the electric sector on the basis of its functional characteristics: generation, transmission and distribution of electricity. Thus, as a result of the restructuring in the Kyrgyz energy sector, the following 8 companies were established: (1) generating companies: JSC “Electric Power Plants”, JSC “Chakan HPP”; (2) transmission company JSC “National Electric Network of Kyrgyzstan”; (3) electricity distribution companies by regions: JSC “SeverElectro, JSC “VostokElektro”, JSC “OshElectro, JSC “Jalal-Abad Elektro”; (4) JSC “BishkekTeploset” to provide heating energy to consumers in Bishkek city. The main share in all newly formed JSC belongs to the state.

The development of energy sector is implemented in three directions where it is necessary to achieve certain following goals:

Generation:

- Provision of power reserve of 10 %;
- Increase the capacity of existing power plants in 2025 to 4,500 MW;
- Electricity generation up to 16-17 billion kWh.

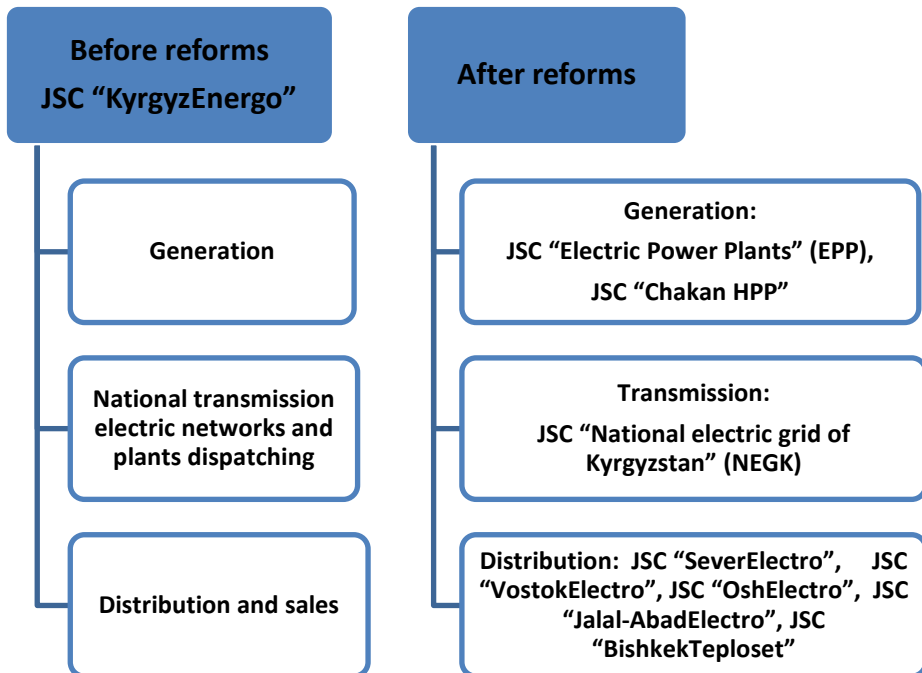
Transmission:

- Energy independence from neighboring countries;
- Provision of the necessary bandwidth of 110-500 kV for electric networks;
- Promotion of international electric communication projects (e.g. CASA 1000).

• Distribution of electricity by consumers:

- Quality customer service;
- Creation the possibility of technological connection to electric networks and elimination of connection restrictions;
- Reliable and uninterrupted power supply (e.g. Smart Grid).

Figure 1. Energy sector structure before and after reforms



In recent years, energy sector management structure was also revised. Main changes were as follows:

- Liquidation of the Ministry of Energy and Industry in 2015 with the transfer of its functions and powers of the new structure to the State Committee on Industry, Energy and Subsoil (SCIES) in 2016;
- Establishment of the State Agency for the Regulation of the Fuel and Power Complex under the Government of the Kyrgyz Republic (SARFPC) in 2014 for the purpose of economic regulation of the energy sector;
- Establishment of the JSC "National Energy Holding" with shares of the main energy companies transferred in 2016 aimed at the sector's management and efficiency improving;
- Establishment of the JSC "Kyrgyz Energy Payments Center" in August 2015 to improve financial transparency in the energy sector, develop and implement an automated system for preparing balances of generation, transmission and distribution of electric energy.

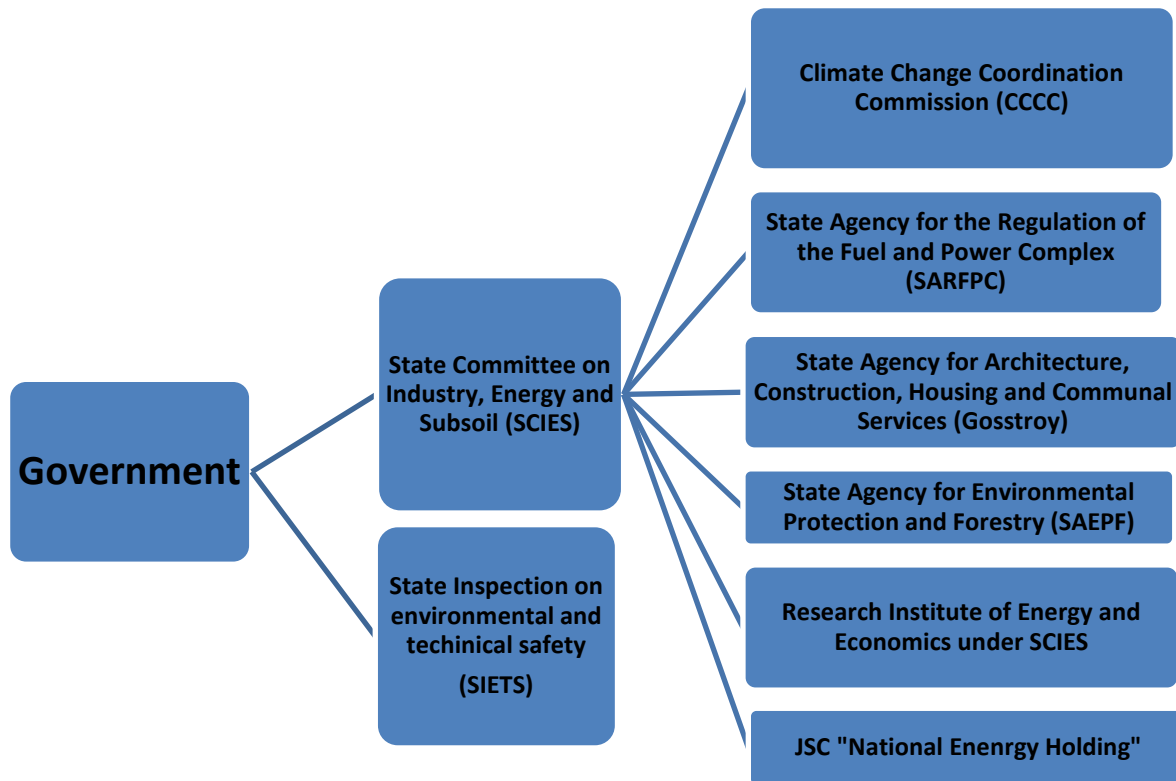
For the moment, there are constructed and operated following power plants:

- JSC Electric Power Plants: Toktogul HPP (capacity of 1200 MW), Kurpsay HPP(800 thousand kW), Tash-Kumyr HPP (450 thousand kW), Shamaldy-Say HPP (240 thousand kW), Uch-Kurgan HPP (180 thousand kW), Kambar-Ata 2 HPP (for 120 thousand kW), At-Bashy HPP (40 thousand kW), Bishkek TPP (660 MW), and Osh TPP (50 MW);

- JSC “Chakan HPP”: 9 small HPPs including 8 HPPs of the Alamedin cascade (29.7 MW) and Bystrovka HPP (8.7 MW);
- Private small HPPs: Tegirmenty HPP (3 MW), Issyk-Ata HPP (1.6 MW), Kalinin HPP (1.4 MW), Ak-Suu HPP (0.5 MW), and Kyrgyz-Ata (0.25 MW).

At the same time, the deterioration of power equipment is over 50%, in a crisis state - 25%. The shortage of funds in power companies caused by tariffs below cost limits the ability to complete the work on the modernization and reconstruction of existing energy facilities and the construction of new ones. In addition, the demand for energy continues to grow leading to difficulties in provision of economy development with energy resources, especially in the autumn-winter period with overload in the networks due to an increase in the consumption of electricity by the population by almost 3 times as compared with the summer period.

Figure 2. Energy sector management structure as of 2018



Production and consumption in the energy sector of the Kyrgyz Republic

JSC “Electric Power Plants” generated 3.323 billion kWh in January-November 2017, it is more by 2.671 billion kWh or 25% more than in 2016 (10.651 billion kWh), including:

- HPPs electricity generation amounted to 12.335 billion kWh that is 3.067 billion kWh more than in 2016 (9.268 billion kWh) due to the favorable situation on the accumulation of water in the Toktogul reservoir;
- TPPs electricity generation amounted to 987.2 million kWh that is 395.6 million kWh less than in 2016 (1,382.8 million kWh) due to an increase in HPPs generation.

JSC “Chakan HPP” produced 174.1 million kWh in January-November 2017, it is 0.3 million kWh or 0.2% more than in 2016 (173.8 million kWh).

Heating power production in January-November 2017 was amounted to 1,776.9 thousand Gcal, it is 243.8 thousand Gcal or 16% more than in 2016 (1,533.1 thousand Gcal).

The accumulation of the Toktogul reservoir as of December 1, 2017 amounted to 897.48 m with a volume of 18,747 billion m³, it is more by 2,115 billion m³ compared to the same period in 2016 (16,632 billion m³ with a filling point at 889, 68 m).

Table 1 below shows that fuel-power balance of the country is negative as import exceeds export on average 5 times for the period from 2005 to 2016. Although, overall sector losses show a downward trend they are on average 14 % of production volume for the same period.

Table 1: Fuel-power balance, thousand TFOE (incl. own processing products)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Resources, Total	13456	14065	14979	13350	12561	12659	15090	16376	15794	15557	15359	15036
Production	10444	10628	10967	8845	8390	9132	11397	11517	10836	11413	10425	10642
Import	2455	2877	3465	3935	3409	2880	2921	4208	4069	3332	4067	3022
Other supplies	56	56	130	141	158	89	99	98	68	-	-	-
Balances at the beginning of the year	501	504	417	429	604	558	673	553	821	812	867	1372
Distribution	13456	14065	14979	13350	12561	12659	15090	16376	15794	15557	15359	15036
Consumed within the country	9946	10462	11097	10217	9793	10026	12008	13165	13256	12502	12488	12546
Export	1045	1290	1629	1018	1002	789	1187	872	419	349	503	410
Losses	1948	1908	1828	1532	1171	1197	1338	1531	1240	1378	996	957
Balances at the end of the year	517	405	425	583	595	647	557	808	879	1328	1372	1123

Table 2 presents more detail data on electricity balance of the country where the most part of electricity is supplied to the industrial production needs and population.

Table 2: Electricity power balance, mln. kWh

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Resources	14891,8	14536,4	14835,3	11892,7	11143,9	12189,7	15368,7	15343,9	14011,3	14857,7	13758,8	13449,0
Production	14891,6	14527,2	14831,7	11790,3	11092,3	12073,9	15194,8	15166,6	14011,3	14571,5	13029,5	13118,3
Import	0,2	9,2	3,6	102,4	51,6	115,8	173,9	177,3	0,0	286,2	729,3	330,7
Distribution	14891,8	14536,4	14835,3	11892,7	11143,9	12189,7	15368,7	15343,9	14011,3	14857,7	13758,8	13449,0
Electricity supplied, incl.	7095,5	7192,2	7672,7	7334,0	7134,5	7447,3	9131,8	10143,0	10510,8	11327,0	10907,4	10594,7
conversion into other energy forms	211,3	275,9	255,7	217,5	229,2	238,4	233,3	235,2	231,3	261,2	243,7	167,4
directly as energy:	6884,2	6916,3	7417,0	7116,5	6905,3	7208,9	8898,5	9907,8	10279,5	11065,8	10663,7	10427,3
for industrial production	1873,9	1768,6	1848,2	1855,7	1702,4	1710,5	1941,7	1938,3	1958,3	1876,9	2080,0	1850,0
for construction and drilling work	59,0	58,9	107,6	171,6	191,4	53,5	58,2	47,1	81,5	64,6	310,3	126,8
for transport	85,4	54,2	63,5	39,5	52,4	129,8	185,6	316,6	41,6	231,8	174,3	44,9
for agriculture	654,8	544,4	591,8	593,8	605,1	377,0	259,3	222,3	254,0	247,6	225,3	227,0
for communal, housing and cultural needs (incl. supply to the population)	4138,6	4431,5	4700,5	4378,8	4322,7	4882,9	6394,6	7340,5	7870,1	8588,2	7796,6	8079,4
for other works and needs	72,5	58,7	105,4	77,1	31,3	55,2	59,1	42,7	74,0	56,7	77,3	99,2
Losses in public electric networks	5135,0	4661,7	4583,3	3690,2	2758,3	2914,8	3389,2	3360,6	3123,5	3458,3	2667,6	2655,2
Export	2661,3	2682,5	2579,3	868,5	1251,1	1827,6	2847,7	1840,3	377,0	72,4	183,8	199,1

In terms of territorial division, the largest volume of fuel and power production is in the Jalal-Abad, Naryn and Chui regions of the country.

Table 3: Fuel and power production by regions, thousand TFOE (incl. own processing products)

	Resources, total	Including		
		Production	Import and other supplies	Balances at the beginning of the year
Overall in the country: *	15036,4	10642,3	3022,1	1371,9
Batken region	132,1	111,8	2,2	18,1
Jalal-Abad region	8129,3	8071,4	6,0	51,9
Issyk-Kul region	49,8	15,2	3,4	31,2

Naryn region	561,9	493,5	0,0	68,3
Osh region	900,6	344,2	0,0	556,4
Talas region	12,7	1,4	9,1	2,2
Chui region	1174,2	726,6	211,1	236,5
Bishkek city	3915,2	844,0	2699,1	372,1
Osh city	160,7	34,2	91,3	35,2

* incl. activities of individuals

Oil and gas are produced in the Fergana Basin. Multiple-layer oil and gas deposits are confined to Jurassic and Cretaceous aleurolite-siltstone rocks, Paleogene carbonate-terrigenous reservoir rocks, and Neogene gravel-sand deposits. In total, 14 fields were identified including 7 oil fields, 4 oil and gas fields, 2 gas and 1 oil and gas condensate.

Recoverable reserves are: oil - 13 million tons, gas - 6.5 billion m³. Since the beginning of the development, more than 10 million tons of oil and more than 7.5 billion m³ of gas have been produced in the Fergana Basin's part lying in the territory of the Kyrgyz Republic. The highest oil production amounted to 320 thousand tons / year and gas - 380 million m³ / year.

Future increasing hydrocarbon reserves in the Kyrgyz Republic are associated with the study of pre-Mesozoic sediments of the Fergana Basin, as well as with the in-depth study of the Alay, Naryn, Aksai and other intermountain basins.

Table 4 Oil balance, thousand tons

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Resources	90,4	96,9	148,6	204,4	100,3	109,4	86,8	87,7	92,8	94,0	113,0	173,0
Production	77,9	70,8	68,5	71,1	77,3	83,3	77,4	78,9	83,5	82,0	107,1	145,3
Import	5,1	15,9	69,1	125,7	10,8	14,8	0,6	6,3	0	4,9	1,3	14,7
Balances at the beginning of the year	7,4	10,2	11,0	7,6	12,2	11,3	8,8	2,5	9,3	7,1	4,6	13,0
Distribution	90,4	96,9	148,6	204,4	100,3	109,4	86,8	87,7	92,8	94,0	113,0	173,0
Consumption within the country	80,2	83,7	136,8	134,9	79,0	97,1	81,1	75,5	82,7	80,0	97,4	148,9
Losses	-	2,2	2,2	4,5	4,0	3,5	1,5	3	1,9	2,7	2,6	3,4
Export	-	-	2,0	52,7	6,0	-	1,7	0	1,1	6,6	-	7,2
Balances at the end of the year	10,2	11,0	7,6	12,3	11,3	8,8	2,5	9,2	7,1	4,7	13,0	13,5

Coal. For the moment, about 70 deposits and coal manifestations are currently known in the country. They are grouped into four basins (South Fergana, Uzgen, North Fergana, and Kavak) and three coal-bearing areas (Alay, Alabuka-Chatyrkul, and South-Issyk-Kul). Coal deposits are composed of Triassic-Jurassic deposits represented by the alternation of clays, argillites,

aleurolites, sandstones and conglomerates with layers of coal. Industrial coal seams are confined to the lower part of the section, to the rocks of the early Jurassic age.

There are 1 377 486 thousand tons of coal on the balance including 76 % in categories A + B + C1 and 24 % in category C2. The main share of their reserves is for underground mining. Many coal mines and cuts in the 90s of the last century were closed, and currently 65-70% of coal consumed is exported. The most promising sites for development are the Kara-Keche and Minkush fields with explored reserves of 435 and 116 million tons.

Table 5: Coal balance, thousand tons

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Resources	1912,8	1847,4	1943,1	2530,0	2414,1	2277,2	2507,4	3160,5	3244,1	4220,8	4525,7	4384,5
Production	335,3	321,3	395,1	484,8	606,9	574,9	830,7	1163,9	1407,9	1803,3	1928,7	1851,3
Import	981,3	932,7	1123,1	1545	1139,7	1120,3	1036,3	1401,3	1069,5	1297,0	1379,5	799,1
Balances at the beginning of the year	596,2	593,4	424,9	500,4	667,5	582,0	640,4	595,3	766,7	1120,5	1217,5	1734,0
Distribution	1912,8	1847,4	1943,1	2530,0	2414,1	2277,2	2507,4	3160,5	3244,1	4220,8	4525,7	4384,5
Consumption within the country	1254,9	1257,7	1310,7	1741,5	1703,9	1592,2	1826,5	2015,8	2009,0	2756,5	2551,8	2202,8
Losses	29,4	130,2	33,4	16,3	28,8	24,7	0,6	188,2	4,4	5,4	3,0	0,5
Export	8,8	34,8	99,0	103,8	18,4	19,9	85,0	189,7	110,2	241,4	236,8	341,1
Balances at the end of the year	619,7	424,7	500,0	668,4	663,0	640,4	595,3	766,7	1120,5	1217,5	1734,1	1840,1

The largest share of the consumption of fuel and energy resources is accounted for the supply to the population, wholesale and retail trade, water supply and wastewater treatment, waste treatment and production of secondary raw materials, and health care sector.

Table 6: Consumption by type of economic activity in 2016

	Coal, thousand tons	Oil, thousand tons	Gas, mln. m3	Fuel oil, thousand tons	Diesel fuel, thousand tons	Gasoline, thousand tons	Electricity, mln. kWh	Heating energy, thousand Gcal
Overall in the country: *	2202,8	148,8	282,0	147,0	481,5	925,6	10594,6	2683,6
Agriculture, Forestry and Fisheries	1,4	0,0	0,1	0,0	3,5	1,6	230,2	0,1
Mining	709,2	33,9	3,8	0,2	30,7	1,6	130,2	1,5
Manufacturing industries	266,9	114,9	62,9	103,3	56,6	17,4	947,1	223,9
Provision (supply) of electricity, gas, steam and air conditioning	962,4	-	209,8	41,6	67,5	149,6	8011,7	2156,9

Water supply and wastewater treatment, waste treatment and production of secondary raw materials	0,1	-	0,0	-	2,9	2,2	206,5	0,6
Construction	1,6	-	3,7	0,6	76,1	101,3	127,5	4,2
Wholesale and retail trade; car and motorcycle repair	132,2	-	0,0	0,0	230,2	627,0	64,2	2,1
Transport and storage of goods	6,5	-	0,1	0,2	7,0	4,7	47,0	3,4
Activities of hotels and restaurants	0,0	-	0,0	-	0,9	0,1	29,2	3,0
Information and communication	0,1	-	-	0,0	0,5	2,6	83,3	7,7
Financial intermediation and insurance	0,3	-	0,0	-	0,2	0,8	11,3	4,4
Real estate operations	3,5	-	0,0	0,1	0,2	0,4	42,4	0,9
Professional, scientific and technical activities	1,5	-	0,1	0,9	1,6	2,0	49,0	14,6
Administrative activities	0,2	-	-	-	0,1	0,5	5,1	0,2
Public administration and defense; compulsory social security	91,8	-	1,2	-	3,1	10,2	327,9	84,3
Education	8,4	-	0,2	-	0,2	1,2	92,8	95,9
Public health and social services	16,3	-	0,0	-	0,2	2,1	170,5	73,8
Arts, entertainment and recreation	0,3	-	0,1	-	0,0	0,1	15,1	5,9
Other service activities	0,0	-	0,0	-	0,1	0,2	3,5	0,3

* including supply to the population

Renewable energy sources. The ideas of sustainable development and "green economy" fit perfectly to the development of the Kyrgyz Republic. Currently, a number of projects on transition to a "green economy" are being implemented in Kyrgyzstan. For example, under the Energy Saving for Sustainable Future Project, the SPARE Clean Energy Program addresses the development of domestic regional energy, its alternative forms, and improvement of the reliability and quality of energy supply. A special place among these topics is occupied by the issues of rational use of energy resources and energy saving.

The country has the following potential in renewable energy sources: small hydropower plants - 5-8 billion kWh / year, wind power plants -44.6 million kWh / year (with an average annual wind speed of up to 12 m / s), solar power plants -490 million kWh / year (more than 250 sunny days per year), biomass power plants –1.3 billion kWh / year. However, the practical use of renewable energy in Kyrgyzstan is less than 1%.

For the moment, there are no large solar power plants in the country; small solar panels are used mainly in small enterprises and in households. Under the UNIDO project "Reliable energy supply of rural health post" together with UNDP and WHO, solar power plants with capacity of 3 kW and

1.5 kW were installed in 19 rural health posts in all regions of the country in order to ensure continuous provision of medical services to the population.

Today, the main problems in the implementation of projects for the introduction of renewable energy sources are the lack of an appropriate regulatory framework (insufficient methodology for calculating tariffs, mechanisms for connecting and selling electricity) and low tariffs for electricity.

Legislative framework of the energy sector

To ensure the functioning of the energy sector in the new conditions and taking into account the ongoing economic reforms, the laws of the Kyrgyz Republic “On energy” 1996, “On electric power industry” 1997, “On oil and gas” 1998, “On coal” 1999 Year, “On Energy Saving” 1998, “On Renewable Energy Sources” 2008, “On Energy Efficiency of Buildings” 2001, “On the Special Status of the Toktogul Hydroelectric Power Station Cascade and the National High-Altitude Power Line” of 2002, and other relevant by-laws regulating the activities of the industry. In addition, there are a number of international agreements that regulate the sector.

Current Kyrgyz Republic Development Program for the period 2018-2022 "Unity. Trust. Creation" aims at the sustainable development of the energy sector and ensuring the country's energy safety, provision with reliable and modern energy supply to economy and population, as well as improvement of export potential.

According to this program, Government of the Kyrgyz Republic plans to reconstruct existing generating facilities and achieve expected capacity increase by 2027 at the level of 702.68 MW. In addition, CASA-1000 interregional project will provide a practical transition to the construction phase of the 500 kV transmission line facilities, 477 km in length, from the Datka sub-plant to the Sughd-500 (Tajikistan). Works on the integrated development of coal deposits and increasing the share of consumption of domestic coal together with ensuring the minimization of the environmental impact of such projects and the most efficient technologies will continue.

In order to strengthen energy self-sufficiency, the Government will encourage the development of distributed energy production in individual renewable energy installations (small hydropower plants, solar systems, geothermal, wind and biogas plants), local consumption and the exchange of such energy to reduce network losses and network load.

Analysis of best practices in sustainable energy in the beneficiary country

During the last years, the Government of the Kyrgyz Republic has been implementing various reforms, programs, and projects in the energy sector aiming at improving energy facilities. Following the results, the Kyrgyz Republic has achieved significant success.

Investments to the energy sector

First of all, it is necessary to note that large investment projects aimed at ensuring the energy security of the republic were implemented such as modernization of power lines in the south part of the country with the construction of the 500 kV Datka substation and the reconstruction of electrical networks in Jalal-Abad, Osh and Batken regions, construction of a 500 kV Datka - Kemin power line and a 500 kV Kemin substation in Chui region. In addition, several projects are being implemented for the construction of new energy facilities and equipment rehabilitation.

The Kyrgyz Republic has completed a project on rehabilitation of the Bishkek TPP (capacity increase accounted to 300 MW, electric capacity - to 18.8 %, and thermal power capacity - to 30.4 %) with generation of 1740 million kWh of electricity per year; it was financed by the ExImbank of China in the amount of \$ 386 million. One of the important aspects of rehabilitation was the possibility of using local coal as a fuel for TPP and the introduction of an automated process accounting system.

Currently, there are other projects in this sector such as reconstruction of the At-Bashy HPP completion of which is planned in 2021 (capacity increase will be about 1.68 MW or 4.2%) with generation of 157.5 million kWh of electricity per year; it is financed by the Government of Switzerland in the amount of 19.82 million Swiss francs.

Rehabilitation project of the Toktogul HPP is expected to increase capacity by 240 MW or 20% allowing extending the operation period for further 35-40 years with generation of 4,940 million kWh of electricity per year; it is financed by ADB and EDB in the amount of \$ 383.6 million.

For the project on commissioning the second hydropower unit of the Kambarata - 2 HPP scheduled for completion in 2021, sources of funding have been identified and preparatory activities have been started (capacity increase will be 120 MW or 20%) with generation of 950 million kWh of electricity per year; it is funded by EDB in the amount of \$ 110 million.

The project on construction of the Upper Naryn HPP Cascade is planned completion by 2021 with a future capacity of 135 MW and generation of 942.4 million kWh of electricity per year, and investment of at least \$ 230 million.

The construction of 11 small HPPs across the country is expected for completion by 2021 with a capacity of 161 MW and investment of at least \$ 335 million.

There are also other projects regarding introduction of an automated data monitoring and accounting system (ASCAEE), a communication system and a dispatching control and data collection system (SCADA) such as ADB Energy Sector Rehabilitation Project completed by signing the Act on the completion of the implementation of the ASCAEE and SCADA systems on February 28, 2018. For the moment, final adjustment of the system is being implemented taking into account the comments noted and the accuracy of the information received on the ASCAEE and SCADA is being checked.

State programs

The Government of the Kyrgyz Republic has been adopted and implemented relevant state programs aimed at increasing energy efficiency and energy saving, as well as changes in tariff policy and institutional and regulatory framework.

One of the recently adopted programs is the Development Program of the Kyrgyz Republic for the period 2018-2022 «Unity. Trust. Creation» aimed at “sustainable development of the energy sector and ensuring energy security of the country, providing the economy and population with reliable and modern energy supply and developing the country's export potential”¹.

Key actions for the implementation of this Program beside those aimed and further modernization and construction of energy facilities are as follows:

- Development of Concept for the Development of the Fuel and Energy Sector by 2030;
- Development of Medium Term Tariff Policy for the period 2018-2021;
- Ensure full collection of payments for supplied electricity for all categories of consumers;
- Reduce electricity losses in distribution companies;
- Development of Regulation on calculating technical losses in electrical networks;
- Ensure the launch of a domestic production of metering devices;
- Development a regulatory legal act regulating the design of electrical networks;
- Development of Regulation on the recultivation of land disturbed due to the subsoil use.

The Energy Sector Development Strategy for 2012-2015 and the Action Plan for Energy Sector Reforms for 2013-2014 outline the essence of the main reforms in this sector. The Development Strategy outlines key areas for strengthening the governance, transparency and accountability of

¹ Development Program of the Kyrgyz Republic for 2018-2022 «Unity. Trust. Creation»

the energy sector and its companies. These steps include commitment to cost recovery policies and the development of tariff methodologies. The Action Plan anticipates amendments to the Law on Energy defining the functions of policy development, economic regulation, as well as the introduction of transparent and competitive sector transactions and the creation of targeted deposits for electricity exports.

More recent reforms focused on improving financial viability of the energy sector, as well as improving regulatory systems and transparency. These reforms included changes in the institutional and regulatory framework of the sector, as well as changes in the methodology for setting tariffs, tariff structures and medium-term revenue planning.

Institutional reforms

One of the key achievements is decentralization of energy sector management. In 2001, in accordance with the Program on denationalization and privatization of the JSC “KyrgyzEnergo”, the Government of the Kyrgyz Republic completed the restructuring of the centralized electric sector on the basis of its functional characteristics: generation, transmission and distribution of electricity. Thus, as a result of the restructuring in the Kyrgyz energy sector, the following 8 companies were established.

In recent years, energy sector management structure was also revised. Main changes were as follows:

- Liquidation of the Ministry of Energy and Industry in 2015 with the transfer of its functions and powers of the new structure to the State Committee on Industry, Energy and Subsoil (SCIES) in 2016;
- Establishment of the State Agency for the Regulation of the Fuel and Power Complex under the Government of the Kyrgyz Republic (SARFPC) in 2014 for the purpose of economic regulation of the energy sector;
- Establishment of the JSC “National Energy Holding” with shares of the main energy companies transferred in 2016 aimed at the sector’s management and efficiency improving;
- Establishment of the JSC “Kyrgyz Energy Payments Center” in August 2015 to improve financial transparency in the energy sector, develop and implement an automated system for preparing balances of generation, transmission and distribution of electric energy.

Key objectives of the State Committee on Industry, Energy and Subsoil in the energy sector are as follows:

- Coordination of formation and maintenance of the state system of long-term forecasting of demand and supply in terms of wholesale and retail transactions, including the development of the electricity balance forecast;
- Development of programs for the future development of the electric power industry;
- Participation in the development of territorial planning schemes of electric power facilities;
- Monitoring in order to predict the possible shortage of electrical capacity, preparation and implementation of recommendations for the creation of favorable conditions for investment in the construction of electric power facilities in order to prevent a shortage of electrical power;
- Monitoring and preparation of recommendations on adjustment of strategic documents for the electric power industry development;
- Development of measures to ensure the achievement of the goals of the electric power industry, regulations in the field of development of the electric power industry in the medium and long term, measures for the modernization and reconstruction of power plants, substations, power lines and other electric power facilities.

The State Agency for the Regulation of the Fuel and Power Complex under the Government of the Kyrgyz Republic is in charge of the followings:

- Licensing of activities in the energy sector;
- Development of tariff methodologies and setting tariffs for electricity, heating and natural gas;
- Development and monitoring of the reporting and performance of companies in the energy sector;
- Conduction of awareness raising campaigns;
- Development of grievance procedures for consumers and industry companies;
- Implementation of new revenue sharing mechanism.

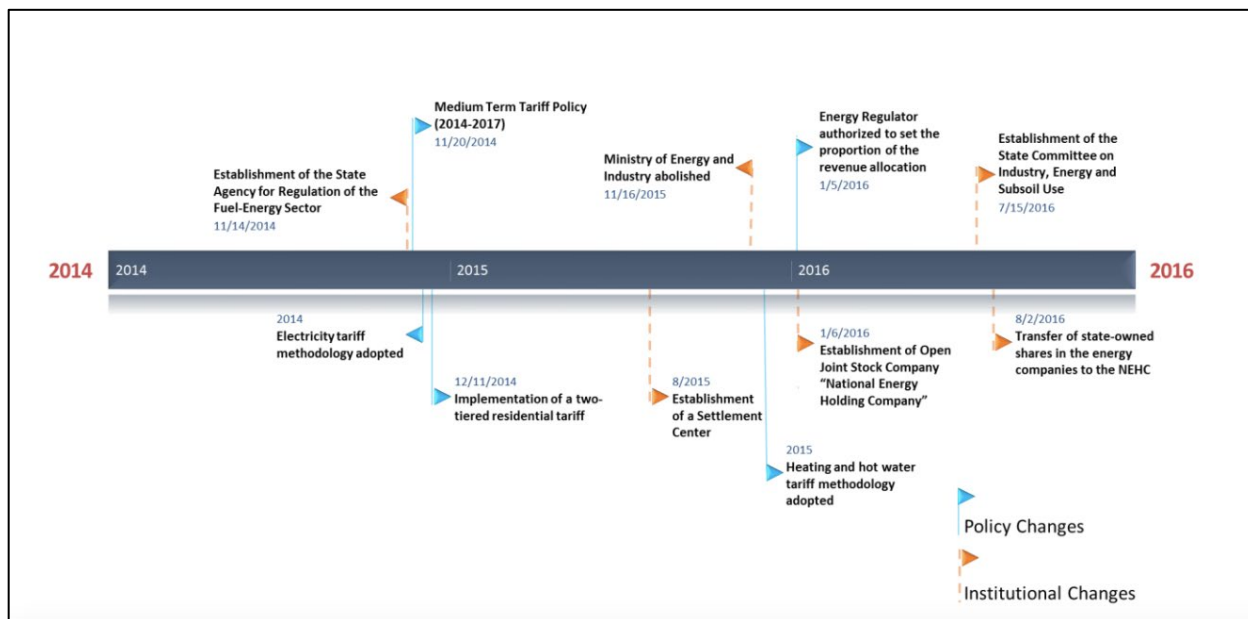
The JSC “National Energy Holding” owns 100 % of shares of JSC “Kyrgyz Energy Settlement Center” and JSC “Chakan HPP”, as well as 80.42 % of shares of JSC “Electric Power Plants”, JSC “National electric networks of Kyrgyzstan”, four distribution companies and JSC “BishkekTeploset”. The key function is to serve the Boards of Directors of subsidiary energy companies.

The JSC “Kyrgyz Energy Payments Center” is an independent company providing services using a centralized information and analytical system for collecting, processing, validating, analyzing data on electricity flows and losses, compiling electricity balances, performing calculations for all

participants in the electricity market on the monitoring of mutual settlements between participants of the electricity market. The main tasks are as follows:

- Improving the efficiency of interaction between participants in the electricity market of the Kyrgyz Republic;
- Increasing transparency in the electricity sector;
- Streamlining the activities of participants in the electricity market.

Figure 3. Reforms in the energy sector²



International cooperation

At the level of international cooperation, the Kyrgyz Republic involved in the following main projects.

Under the framework of the EAEU, activities on forming a common market for fuel and energy resources (gas, oil, electricity) are being implemented. The decision of the Supreme Eurasian Economic Council No. 20 dated 12/26/16 approved the “Program for the Formation of a Common Electricity Market of the EAEU”, based on the creation of a supranational electricity market and characterized by the possibility of maintaining the existing models of the electric power markets of the EAEU member countries during their integration. The Program anticipates ensuring non-discriminatory access of the subjects of the internal market of the member states to the common electricity market and to the services of natural monopolies. Entry of the Kyrgyz Republic to the Union's common market will make possible for Kyrgyz suppliers and consumers to trade

² Source: WB Report, Analysis of the Kyrgyz Republic’s Energy Sector, 2017

electricity freely on the centralized trading platform of the EAEU. This market scheme will enable the Kyrgyz energy system to buy and sell more efficiently energy generation both during the period of own generation deficit and the period of surplus from/to consumers of the common market.

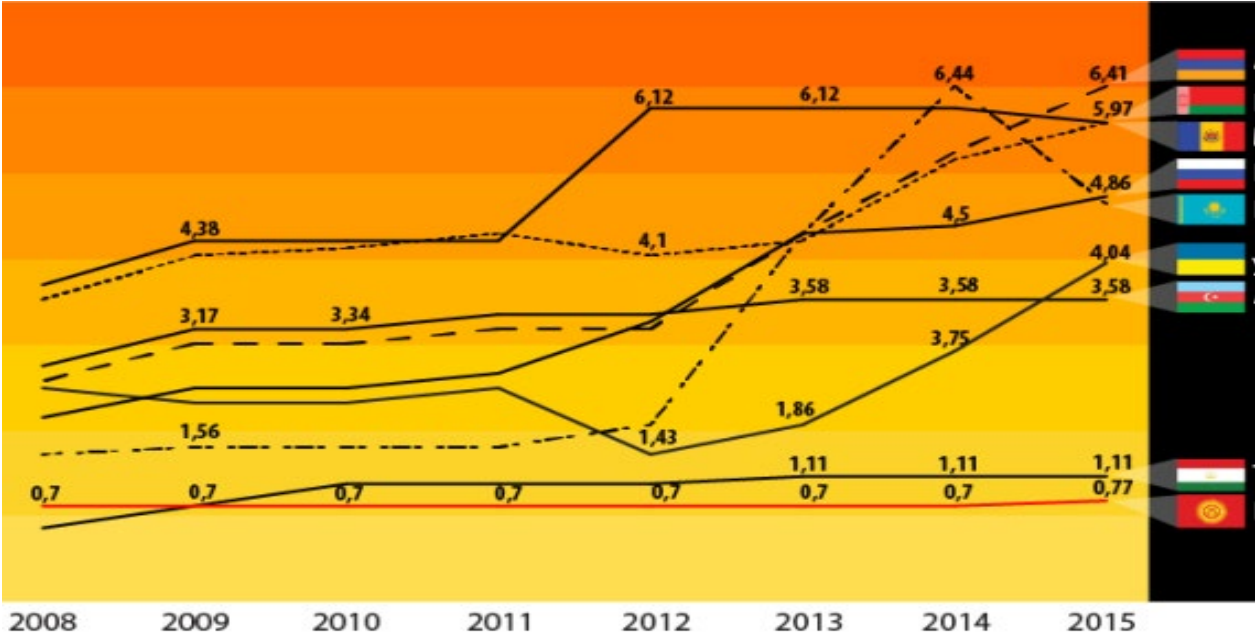
Currently, the Kyrgyz Republic and Tajikistan together with the countries of South Asia (Pakistan, Afghanistan) implement the project CASA-1000. From this project Kyrgyzstan will be guaranteed volumes of electricity supply (guaranteed exports for 15 years), while water resources in the production of electricity (from May to September) will be sent downstream countries. Commercial Electricity supplies under this project are expected from 2021-2022.

In addition, one of the promising areas for the export expansion is cooperation with China in terms of trade and transmission of electricity to the Kashgar region with construction of a 500 kV overhead line Datka - Torugart - China (Kashgar).

Tariff policy

Current electricity tariffs in the Kyrgyz Republic are the lowest ones among CIS countries as shown in the Figure 4 below.

Figure 4. Electricity tariffs for the population in CIS countries 2008-200153



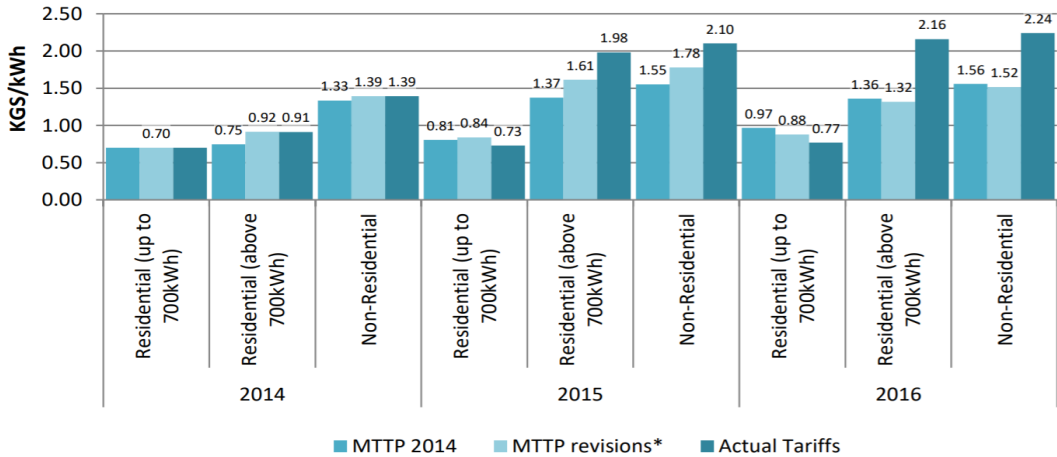
In addition to above mentioned activities, the Government of the country has been working on tariff policy. Reforms during the 2000s focused on changes in the level and structure of tariffs

³ Source: JSC “National Electric Network of Kyrgyzstan”

accompanied with unsuccessful attempts to match revenues with the cost of services. From 1999 to 2002, there were four stages of tariff increases. In 2003, the six-level residential tariff was replaced by a two-level tariff. Tariffs were unchanged until 2006 till the one-level tariff of 0.62 KGS per kWh was introduced. In 2008, tariffs were increased and the Government adopted a Medium Term Tariff Strategy (MTTS) based on the principles of full cost recovery, constant provision of services, and possibility of subsidies for low-income households to be distributed through state social assistance programs. However, MTTS was not implemented. In 2009, the Government approved an increase in residential tariffs for the next year. However, population reaction and political disorders caused the abolition of such tariffs increase in 2010.

The new methodologies for setting tariffs for electricity and heat at the end of 2014 and 2015 were developed. These methodologies were designed to help planning a predictable cost recovery path for the sector. Tariffs were increased in December 2014 for the first time since 2008 in accordance with Medium Term Tariff Policy for 2014-2017 aimed at orderly growing and predictable tariff rate for heating and electricity services. In 2015, a two-level tariff for residential services was implemented to protect low-income customers. Households pay a lower tariff for consumption up to 700 kWh and a higher tariff for all additional consumption. But this new tariffs turned out to be ineffective because larger users and owners of non-residential premises are carrying the increase in tariffs as lower residential tariff has not been increased as planned. In the second half of 2017, there were attempts to increase tariffs by 10 %, but was canceled by the Government. Currently, the policy for 2018-2021 has not yet been adopted. More detailed information on tariffs changes is shown in the Figure 5 below.

Figure 5. Tariffs reform in the energy sector⁴



⁴ Source: WB Report, Analysis of the Kyrgyz Republic’s Energy Sector, 2017

Measures performed by the Government mentioned above have positive impact and led to improved state of the energy sectors, higher revenues, lower sector deficits and losses. However, there are still many challenging issues in the energy sectors hampering its further development.

Analysis of gaps in implementing sustainable energy practices and existing challenges for their implementation in the Kyrgyz Republic

To date, the Kyrgyz Republic does not use entirely the potential of the existing energy sector. The situation is like that population of the country has broad access to electricity and low prices but the energy sector suffers from financial difficulties and deterioration of its facilities being almost totally obsolete.

Despite significant impact of reforms conducted, energy sector of the country still faces serious challenges listed below:

- *Excess demand for energy over its supply, dependence on natural and climatic conditions*

Meeting the growing demand for electricity by ensuring uninterrupted access to energy resources at a reasonable price is one of the main areas of energy safety. To ensure energy safety for the country it is necessary to forecast balance of power and electricity, build an integrated and balanced policy in energy sector to meet full satisfaction of the country's economic needs for electricity and power, achieve high reliability, stability, as well as create possibilities for exporting electricity.

These measures are important, especially, when facing problems of seasonality and winter supply and demand gap. Recently demand has become more seasonal with winter peaks growing compared to the average load. Energy consumption during winter months becomes three times more than in summer and accounts for 67% of total demand.

Increase in electricity consumption by households for heating purposes determines the seasonality of demand side. Population without access to hot water supply use other options to meet their heating needs such as coal-powered systems, electric and gas heaters.

- *Impact of imports*

Dependence on import affects negatively energy sector as cost of imports are added to the total cost of services. Recently the Kyrgyz Republic due to internal shortage in energy production was forced to import from neighboring countries in order to meet domestic needs. Production and import costs are main components of tariffs setting for end-users amounted to 43% of the average cost while transmission costs were amounted to 19 % and distribution costs - to 37 %.

- *Deterioration of energy facilities caused by the lack of operating capital and investments, weak payment collection*

For the moment, up to 80% of emergency shutdown occurs due to failures in networks and about 50% of the networks facilities are operated over their technical lifetime and their deterioration degree is often critical. The energy facilities produced mainly in 1960-1980s lag behind in terms of technical and operational issues and require increasing funding for its maintenance. Cancellation of equipment production in the country led to problems with the purchase of spare parts. In addition, existing facilities are not meet innovation requirements to get reliability of power supply and meet the constant growth of electrical energy consumption.

The budgets of domestic energy JSCs are approved with a deficit. For instance, the approved budget deficit of the JSC “National Electric Network of Kyrgyzstan” for 2017 in the amount of 1444.5 million KGS was formed after cost alignment to the level of the actual cost of 2016. The approved budget deficit in 2017 taking into account forecasted depreciation in the amount of 1557.7 million KGS will amount to 3002.2 million KGS. Given that the main source of income is the tariff for electric power transmission an increase in the tariff for electric power transmission is required in order to reduce deficit and achieve profit and profitability.

It is obvious that energy sector improvements can be achieved only through the implementation of innovation methods based on the technological achievements, use of new efficient, reliable and durable materials and facilities, as well as comprehensive monitoring and control systems.

- *Unreliable supply and low quality of service*

Obsolete energy facilities create risks of unreliable and low quality supply. Heating sector’s facilities were commissioned 20-50 years ago and are in poor condition. Generating assets of TPPs are operated at a level of 20-50 % of their capacity and network losses often exceed 25% of the generated energy.

The main challenging period is winter when available generating capacity less than growing population needs. For example, during 2009-2012 there were reported two failures per hour. In December 2012, a breakdown at the Toktogul HPP led to a power failure throughout the country. In 2013, the companies experienced an average 1 disruption per month. A failure in the winter of 2015 led to a reduction in electricity consumption in the North and South. Recent breakdown at the Bishkek TPP in 2018 caused problems with insufficient temperature in houses and premises and indignation among population.

The access to electricity is well (almost 100% of the population has access to electricity) while the connections of new houses and premises still remain expensive compared to other countries of the region and take longer period amount on average up to 125 days.

Another issue is weak customer service in terms of billing services and consideration of customers' appeals, especially, grievance mechanism and emergency shutdown management.

- *Lack of qualified personnel*

For the moment, energy sector is not fully staffed by qualified personnel and requires carefully developed HR policy. Involvement of new qualified personnel is problematic since there is a shortage of young qualified people in the energy sector given the low level of universities training that provide only a minimum amount of theoretic knowledge and do not match with real requirements. In addition, low salary level in energy companies leads to staff turnover getting higher over the last years.

Due to the mentioned above, there is a lack of quality planning activities. In order to get the result from financial and economic activities, it is necessary to plan quality activities to achieve the goals set for the energy companies. Key role is to conduct systematic work to identify the main problems hindering the development of the company, develop relevant resolving solutions, and assess the possible consequences. The reliability of planning depends on the accuracy of the available information and forecasts regarding the further development such as data from past periods of activity, prediction of negative impacts of external and internal factors, timely response to current and future changes in the sector, etc.

Today, improving the system of internal planning in energy companies requires a wide application of information and communication technologies and automatization of business processes. It is necessary to introduce internal standards to establish common approaches to planning and management processes, taking into account international experience

- *Financial condition*

Energy sector is still largely dependent on government support. Despite relative growth, the sector's revenues are still less than energy production costs. This deficit is associated with low tariffs. The debt of the energy sector on average exceeds 90 billion KGS (about 20% of GDP). Given the continuing gap in cost recovery and sector needs for new investments, it is unlikely that energy companies will pay off debt.

Reducing technical and non-technical losses is important to reducing the deficit, but tariff reforms do not offer greatest potential for improvement. For all companies, minimum cost recovery rates are the main source of financial loss each year.

- *Low tariffs and cost recovery gap*

Decision makers concerning about political reaction or unmet payment affordability are hesitant to raise tariffs. Low tariffs combined with high losses limit profit in the energy sector. Therefore,

energy companies are not able to provide adequate investments for maintenance and new energy infrastructure that leads to unreliable and poor quality of service.

Average tariffs for production, transmission and distribution of energy still remain below cost recovery levels. Increase in end-user tariffs is a major area for future reform but low generation and transmission tariffs also contribute to the financial instability of this sector.

In 2016, housing tariffs for consumption below 700 kWh accounted for only 39% of the level of cost recovery, tariffs for the pumping station and the Toktogul district are also lower than cost recovery, and these tariffs are only 4% and 0.4% of consumption, respectively. The huge burden of cost recovery compensation is shed on large consumers and owners of non-residential premises as higher tariffs cover 110% and 145% of cost recovery, respectively.

Tariffs for heating and hot water have the same situation; end-user tariffs were ranged from 33 to 63% of cost recovery in 2016. As in the case of electricity tariffs, housing consumption is significantly lower than cost recovery than tariffs for non-residential premises. More detail information on current energy sector tariffs is represented in the Table below.

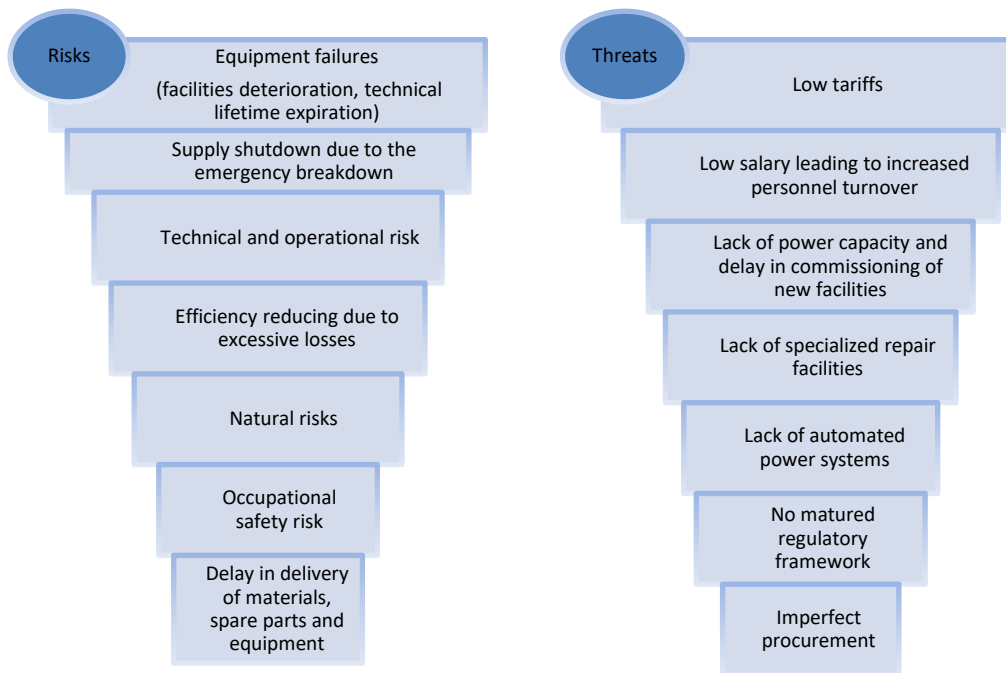
Table 7 Current energy sector tariffs for end-users as of 2018

Electricity tariffs, KGS/kWh (excluding taxes)			
Consumers	From 01/01/2015	From 01/02/2015	From 01/08/2015 till present time
Population, up to 700 kWh per month	0.7	0.7	0.77
Population, over 700 kWh per month	2.05	1.82	2.16
Population in high mountains and remote areas, up to 1000 kWh per month (from October till May only)	0.7	0.7	0.77
Population in high mountains and remote areas, over 1000 kWh per month (from October till May only)	2.05	1.82	2.16
Non-residential users (state, agriculture, industry. etc.)	2.19	1.97	2.24

Pumping stations	0.728	0.728	0.783
Special tariffs for Toktogul district, Jazyksuu village, karakul city, and Jalal-Abad region			
Population, up to 150 kWh per month	4.5	4.5	8.8
Pumping stations	8.9	8.9	8.9
Heating tariffs, KGS/Gcal (excluding taxes)			
Consumers	from 2015 till present time		
Population	1 134.76		
Industry users	1 695.1		
State users	1 695.1		
Other users	1 695.1		
Hot water tariffs, KGS/m³ (excluding taxes)			
Population (for heating purposes)	981.76		
Population (with water meters)	64.38		
Population (without water meters)	309.03 per person		
Other users (for heating purposes)	1695.1		
Industry users	97.19		
State users	97.19		
Other users	97.19		

Summarizing the above mentioned the following risks and threats for the energy sector can be formulated as shown in the Figure 6 below

Figure 6. Risk and threats of the energy sector



Outline of possible solutions for applying best practices from other countries

Energy sector plays a central role in the development of the country's economy, social and economic life of the population. For the Kyrgyz Republic, energy is a basic economy sector determining increased requirements for meeting the country's growing domestic demand for electricity and heating resources, as well as exporting electricity to the CIS countries.

One of the way to improve this sector is paying attention to international practices can be applied in the Kyrgyz Republic.

A brief overview of international experiences in the energy sector is described below.

Japan is one of the largest importers of energy resources in the world, the volume of which was increased after shutdown of nuclear power plant (NPP) in 2011. In Japan the level of energy intensity is one of the lowest in the world due to the use of most recent production technologies. The country aims at development of clean energy sources providing relevant subsidies to the sector and promoting less energy consuming production.

The energy saving policy is one of the key directions of the Japan Government to be implemented when constructing and designing new buildings. For instance, there were adopted energy saving standards in 1980 anticipating 40 % energy saving; and later they were increased by another 20% in 1997. The Government promotes and provides preferences to constructions companies

complying with energy saving standards and according to the Act on Energy Saving adopted in 1979 charges high penalties to those companies not supporting this policy. Along with the development of measures to reduce electricity consumption, the law ordered to rationalize the process of burning fuel, reduce heat losses during transportation, and minimize unused amounts of energy. In 2003, this law was expanded to other major energy consumers - large office buildings, department stores, hotels and hospitals. In order to promote energy saving policy among population, great attention is paid to teaching citizens how to save energy and helping in installation of solar panels.

Germany depends on energy exporting countries: export volume is about 80% from Norway, Holland and Russia. After recent conflict between Russia and Ukraine, the country started to revise its energy policy focusing on maintenance of stability of the mixed energy supply system, the stimulation of intra-German energy production through the use of coal and alternative energy sources, as well as the regulation and de-monopolization of the German gas transmission system.

One of the directions of saving energy is the provision of state subsidies stimulating environmentally friendly alternative forms of energy. Germany actively uses modern energy-saving technologies and alternative energy sources. Today, a third of all electricity is received from wind farms. For example, private investors are able to place on the roofs of public buildings solar panels and supply the received energy to the city network.

Since 2006 the EU Energy Performance of Buildings Directive has been interpreted in national law (regulation) relating to energy conservation. Since 2007, the administration of Berlin can buy only cars consuming no more than 6.5 liters of gasoline per 100 km; when purchasing computers and other electronic devices, the administrative offices have to buy those that consume the least amount of electricity.

It is important to note that the introduction of energy conservation in Germany is financed by banks and large corporations, and not by the state, e.g. German Energy Agency - Capital DENA LLC established in 2000 by the state and KfW financial institution.

Norwegian experience can be described as an energy efficiency process with all aspects of liberalized markets, targeted planning and environmental protection taken into account.

The development of energy efficiency programs in Norway began in the late 1970s. Later, the Government started to liberalize the electricity market, after 2000 the development of renewable energy was launched.

The main principle in the field of electricity in Norway since the late 1980s is that electricity prices should reflect its market value, High electricity prices, reflecting its real value, made investments in the energy efficiency sector more profitable.

Great attention was paid to the efficiency of energy-intensive industries (aluminum production, ferroalloys) and reducing the use of electricity for domestic heating, and investment support programs are being created for special demonstration and pilot projects.

In addition, Norway has been introduced educational programs to improve the skills of implementing energy efficiency programs and developing technologies in organizations responsible for building maintenance over the years.

Austria has a best experience of energy saving in the world. Since 1980, new building insulation requirements have been adopted based on very accurate consumption calculations of a long chain from producer to end-user. Use of solid fuels (minerals) considered as not profitable was gradually ceased to use since 2003 and energy production turned to use renewable energy sources.

The Government of Austria provides assistance to enterprises and population in energy saving issues through comprehensive structure of organizations. For instance, Austrian Energy Efficiency Agency develops methods and means for improving energy efficiency in industry, line ministries and other power structures provides federal subsidies in several areas such as enterprises for environmental protection and energy conservation (25%), investments for TPPs equipment (10 - 20%), grants to improve the thermal performance of old houses (25-30%), etc.

Sweden also has an effective energy saving and energy efficiency policy positively resulted in the high level of public consciousness regarding the benefits of energy efficient technologies and bioenergy.

The Government of Sweden actively applies economic incentives to promote the use of alternative and unconventional energy sources such as exemption from the energy tax for 5 years, state subsidies for the reconstruction of old buildings, and simplified procedure for getting construction permits for wind power plants. Also, it is mandatory to sale of alternative fuels besides traditional gasoline and diesel fuel.

Some municipalities has centralized heating and cooling systems of premises, including public places for people operated with heat pump stations, interest in which is steadily growing as they are very energy efficient and reduce the harmful effects on the environment.

Energy saving is a complex measures aimed at the implementation of organizational, scientific, industrial, technical, legislative and economic measures directed to the effective use of fuel and

energy resources and the involvement of renewable energy sources in economic circulation. As it is seen from above, the Government's commitment in energy saving plays vital role in energy sector development.

For the Kyrgyz Republic it is necessary **to increase the level of public confidence** not only by the conduction sound policies resulting in effective reduction of losses but also through the personal example of energy saving in public institutions, i.e. development for each organization an energy-saving policy and action plan on monitoring and gradually reducing energy consumption with appointment of person responsible for energy efficiency

For these purposes, a large-scale awareness raising campaign among employees of state institutions, business facilities and the public about the necessary energy saving measures should be conducted with the distribution of brochures, leaflets, consumption rates on energy saving.

In addition, the following measures can be implemented: (1) optimization of operation of electrical appliances with high energy consumption, shutdown of all electrical appliances without use and in standby mode; (2) shifting working time in order to adjust peak consumption, reducing working time by 1 hour per week; (3) implementation of monitoring of energy saving, etc.

Later, the same awareness raising campaign can be conducted among population accompanying by explanatory works and distribution of guidelines for energy-saving indicating measures lead to actual results; installation of light sensors, insulation of houses and apartments for autumn and winter; recommendations to use of energy-saving light bulbs, to turn off devices in standby mode and use electrical appliances properly, etc.

Another issue is **to expand the introduction of a modernized system of automated information-measuring system for control and metering of electricity (ASCAEE)** in order to reduce losses and optimize consumption. It is also necessary to encourage population to purchase and install devices for electricity metering by covering part of its costs, to introduce system of incentives/preferences to the population and enterprises saving energy and penalties for those who does not save energy.

The most effective method of energy saving is **the increase in tariffs** as energy sector reforming, maintenance of existing facilities and promotion of renewable sources are impossible without adequate investments. Changes in tariff policies leading to incentives for energy saving and energy efficiency can be as follows:

- Based on France practice, adoption of double level tariff depending on the time of consumption, i.e. more expensive tariffs during rush hours when the network load is high and lower tariff during the hours of the smallest network load;

- Application of seasonal tariff, i.e. in spring-summer period tariffs are lower than in autumn and winter;
- Introduction of regional tariff when rich regions have higher tariff than in poor ones;
- Differentiation of tariffs depending on phase inputs, i.e. user with a 1-phase input pays less than those with a 3-phase input.

Another option is **to use energy-saving technologies** and equipment with proven variable frequency drives working with reduced load for a part of time: fans, air conditioners, pumps, etc. Another type of efficient use of energy-saving technologies is the use of so-called Smart Grid systems reducing energy consumption.

Transition to renewable energy sources can be used like in Germany and France where the Government provide loans to households and individuals for the installation of solar panels. In the Kyrgyz Republic, biogas plants annually produce over 2 mln. m³ of biogas for household needs and the commercial sector, and the country receives 4.64 billion MW of solar radiation hours per year, or 23.4 kWh per square meter. The average duration of sunshine varies between 21,000 and 29,000 hours per year. Biogas and solar energy can be used by farmers, dairy farms, farms, bathhouses, laundries, mini markets, etc.

In case of the Kyrgyz Republic, this experience can be applied via providing loans for rural households to purchase biogas generators or solar panels.

Another option is **the Government support** to increase heat savings in residential and non-residential premises. State can provide loans to individuals and companies for heat saving: insulation of the roof, installation of double windows, etc. like in England, South Korea, Singapore, Hong Kong, Taiwan where homeowners can apply for interest-free loans or grants for rebuilding buildings and purchasing materials in accordance with existing standards and recommendations on energy saving.

The Kyrgyz Republic can promote **investments in energy saving activities** like in France, Germany, and the Netherlands where an accelerated depreciation rate applied gives possibility to the enterprises engaged in energy efficiency projects to depreciate investments faster than in other sector and to reduce tax debts in a short period.

Demonopolization of the energy sector like in Great Britain and USA over the last years by gradually involving new energy producing companies in the electricity production market, as well as creation of energy saving market can be applied in the Kyrgyz economy. This measure implies presence of competition and subsequent decrease in tariffs, as well as engagement in energy saving issues.

Like in Austria, it is also necessary **to conduct an energy audit to obtain data** on the use of resources and identify opportunities for savings, introduce energy-saving technologies, e.g. use of modern insulation materials, lighting upgrades, etc.

Improvement of corporate management in energy companies by the development, collection and analysis of key performance indicators is also needed.

Education of population on energy saving issues like in Japan and Norway is a good example to be implemented in the Kyrgyz Republic in order to change attitude of citizens toward energy importance and behave them to use electricity more efficiently.

Conclusions and recommendations

Taking into account the current state of energy sector in the Kyrgyz Republic, its challenging issues, the following recommendations can be provided.

At the policy level of the energy sector in order to change for better citizens' perception, the Government commitment should be shown by:

- Wide dissemination of draft laws and decisions, determination clear procedures to participate in decision making;
- Clarifying time frame for making decisions and receiving response, as well as creation of feedback system to interact with population and business, conduct public hearings in order to consider alternative opinions and provide reasonable reports;
- Wide media coverage of the energy sector, conduct information campaign in order to disseminate important policy issues.
- Increasing the transparency of the sector management and reducing corruption schemes by providing access to the annual and financial reports, feasibility studies, tender documents, selection criteria, etc.
- Establishing comprehensive public monitoring and evaluation mechanism, creation of structural network to increase sector potential and share experiences and information;
- Further rehabilitation of existing and construction of new energy facilities that is a priority to improve the reliability of electricity supply and reduce the shortage of electricity supply, reduce technical losses and avoid emergency shutdowns;
- Expansion of regional cooperation in energy issues;
- Wide implementation of energy saving policy among population;

At the regulatory level, it is necessary to:

- Develop consumers' financial discipline improvement mechanism in order to deal with non-payers;

- Develop incentives program to ensure energy savings;
- Develop a methodology for calculating and setting electricity tariffs with the participation of representatives of civil society aimed at closure of cost recovery gap;
- Increase the transparency of environmental issues by highlighting environmental impact assessment in the mass media;
- Implementation of business systems and management reforms to improve financial performance and quality of the energy supply, as well as reduce business losses;
- Assisting in the development of regional projects that are commercially viable and increase regional energy security;
- Introduction of effective compensation mechanisms for socially vulnerable citizens on electricity, heating, and gas tariffs;
- Creation of a mechanism for the formation of highly qualified staff;
- Introduction of pre-payment mechanism for electrical energy;

Separate measure should be taken to attract investment and give impetus to use renewable energy sources by:

- Development of the Concept of use of renewable energy sources;
- Fiscal incentives (subsidies, payments for energy production, benefits, tax exemptions, variable or accelerated depreciation);
- Government funding (capital investments, access to loans, government procurement tools);
- Promotion of green economy concept.