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Analysis of the Kyrgyz Republic's Energy Sector

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Abbreviations

BTS	Bishkekteploset
CHP	Combined heat and power plants
CoS	Cost of Service
ECA	Europe and Central Asia
EPP	Electric Power Plants
GoKR	Government of the Kyrgyz Republic
IFI	International financial institutions
JSC	Joint Stock Company
KESC	Kyrgyz Electricity Settlement Center
KGS	Kyrgyzstani Som
KPI	Key performance indicators
LIC	Large industrial consumers
MEI	Ministry of Energy and Industry
MoE	Ministry of Economy
MTTP	Medium-Term Tariff Policy
NEHC	National Energy Holding Company
NESK	National Electrical Grid of Kyrgyzstan
O&M	Operating and maintenance
PPIAF	Public-Private Infrastructure Advisory Facility
TA	Technical Assistance
VE	VostokElectro

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The sector analysis presented in the report complements Technical Assistance (TA) provided to the State Regulatory Agency of the Fuel and Energy Complex in designing a tariff methodology and performance monitoring framework for the power and heating sectors. Funding for the TA and the report was provided by the Public-Private Infrastructure Advisory Facility (PPIAF). PPIAF, a multi-donor trust fund housed in the World Bank Group, provides technical assistance to governments in developing countries. PPIAF's main goal is to create enabling environments through high-impact partnerships that facilitate private investment in infrastructure. For more information, visit www.ppiaf.org

Executive Summary

Adequate and affordable energy supply is fundamental for economic growth, higher living standards, and social equity. The delivery of modern energy services helps to improve the quality of life for all citizens, expands opportunities for private businesses—and ultimately creates jobs. In the Kyrgyz Republic, energy is also a source of revenues when it can be produced in sufficient quantities to be exported, thereby helping to diversify the economy and open new markets.

Today, the Kyrgyz Republic is not making the most of its endowments and potential. While citizens enjoy universal access to electricity and low prices, the energy sector is financially distressed and its assets antiquated. Under these conditions, maintaining access to quality services is a challenge, and state support to the sector comes at the expense of other spending priorities (better roads, education and other key services) and deteriorating macro-stability in the face of a growing debt burden.

Substantial institutional reforms have occurred in the past three years. The principal reforms have included:

- The establishment of an independent sector Regulatory Agency in 2014.
- The creation of a Settlement Center in 2015, and the implementation of a transparent revenue allocation mechanism across sector entities.
- The formation of a National Energy Holding Company (NEHC), to which the shares of the principal energy companies were transferred in 2016, with the aim to improve the management and effective performance of the industry.
- The abolishment of the Ministry of Energy and Industry in 2015 with a transfer of policy making responsibilities to a new State Committee on Industry, Energy and Subsoil Use in 2016.

Substantial tariff reforms have taken place in the past three years; the first time since 2009 The new Regulator adopted tariff setting methodologies for electricity as well as heating and hot water services. There is now also a two-tiered residential tariff, with the lowest tier tariff applied to a monthly consumption threshold of 700kWh.[1] A Medium-Term Tariff Policy (MTTP) 2014-17 has been developed under the principles of cost recovery for the sector in the medium-term, but the policy has not been implemented consistently. The burden of tariff increases for electricity was shifted entirely to a small number of large residential consumers as well as to commercial and industrial users, while below cost-recovery tariffs in the residential segment were left intact. Heating tariffs followed the MTTP in 2014 and 2015, but reforms stalled in 2016 and no further tariff increase has taken place.

Despite improvements, the sector still faces daunting challenges. The primary challenges include the following:

[1] The socially oriented tariff up to 700kWh is sometimes referred to as lifeline tariff, but this terminology is used very loosely as a lifeline is meant to cover only basic needs; by contrast 700kWh exceeds average monthly household use in the Kyrgyz Republic and covers over 82% of residential consumption in the Kyrgyz Republic.

- **Inadequate supply reliability and poor quality of service.** Old and under-maintained assets put energy supply reliability and quality at risk. About 45 percent of available generation capacity is beyond its useful service life, and the similar state of transmission and distribution assets exacerbates the risk of network failures. Reliability is most problematic in the winter, as there is an emerging gap between available winter generation capacity and growing demand. In the district heating sector, most assets were commissioned 20 to 50 years ago, and are in poor condition. Generation assets (CHPs and heat-only-boilers) operate at 20-50 percent of their installed capacity and network losses often exceed 25 percent of the generation outputs.
- **Fragile financial condition.** Despite recent growth, sector revenues in 2016 were still 21 percent lower than the cost of energy production. This shortfall is primarily the result of low tariffs, and in particular the low residential tariff for consumption levels below 700 kWh. Losses, which have improved in recent years, are high and contribute to the revenue shortfall. The sector still relies heavily on Government support to meet spending requirements. The energy sector's debt exceeds KGS 90 billion (about 20 percent of GDP). Given the persistent cost recovery gap and the sector's considerable unmet need for new investment, repayment of this debt from energy companies to the State is unlikely.
- **Concerns about affordability and willingness to pay.** Electricity in the Kyrgyz Republic is relatively affordable compared to other countries in the region. Spending on electricity comprises only a small percent of households' total expenditure (between 2.3 and 2.6 percent of across quintiles). Nonetheless, energy affordability is a concern for poor consumers and policymakers, and the existing social safety nets are fragmented, offering only modest support to the poorest. Consumers' willingness to pay is also not necessarily aligned with ability to pay, and the desire to have better services. A recent survey on public awareness of energy reforms showed that the public continues to see high electricity prices as the major priority for Government to address (21 percent of surveyed households).[2]

Making the sector sustainable will mean aligning tariffs with costs, prioritizing investment and rehabilitation of assets, and further strengthening sector policy, governance and regulation. This study draws the following conclusions:

- **Tariff reforms cannot be delayed.** Closing the cost-recovery gap is essential to restoring the financial viability of the sector, reducing fiscal exposure, and ensuring that sector companies have funds to invest in service delivery improvements. The implementation of a new MTTP 2018-2021 must be followed with more consistency than the previous MTTP, and should focus on increasing revenues from residential consumers. Reducing the consumption threshold for subsidized electricity in the lowest consumption category, for example, can help. Reducing the consumption threshold from 700 kWh to 350 kWh would result in nearly a 20 percent reduction in the cost-recovery gap. Reaching full cost-recovery will, however, ultimately require residential tariff increases at all levels of consumption.

[2] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

- **Prioritizing investment and rehabilitation of sector assets.** Progress has been made in mobilizing external financing for the rehabilitation of existing sector assets, but demand is growing and additional investments will be needed to meet winter peak demand. Such investments must be carefully prioritized, on a least-cost basis, and include rehabilitation as well as new construction of generation, transmission and distribution infrastructure. Priority investments should also include the continued implementation and expansion of loss reduction measures. Such measures will reduce the generation needed to meet demand, thereby improving supply adequacy and reducing the probability of outages.
- **Strengthening policy, governance and regulation.** Future policy action should include the adoption of a least-cost sector planning process; the unbundling of NEHC's accounts for different generation companies; and improvements to the revenue allocation scheme, as the current scheme gives distribution companies little incentive to reduce losses and improve financial discipline by not rewarding them for such efforts. At the regulatory level, the development and adoption of a revised, cost-recovery level MTTP is important for the 2018-2021 period, together with staying the course on actual implementation of the MTTP. The energy sector Regulator will also need to strengthen its monitoring and enforcement of key performance and quality indicators. Longer term, the option of revising the energy and electricity laws to account for the changing nature of sector institutions (recently established Regulator, newly created NEHC and State Committee) should be considered to provide greater clarity on the remit of the entities and strengthen their decision-making capacity. Improvements at the economy-wide level are also needed. Better social safety nets are critically important to the tariff reform process, as to other parts of the economy. Cross-subsidies are a dull instrument for protecting the poorest; better targeting and delivery of subsidies is needed over the longer term.

Introduction

This report is intended to inform and support the ongoing reform efforts of the Government of the Kyrgyz Republic (GoKR) in the energy sector. The report covers the electricity as well as heating and hot water service delivery sub-sectors. In 2012, the Government approved the Power Sector Development Strategy, outlining key medium-term reform objectives. In 2013, it approved the Action Plan for Reforming the Power Sector to operationalize the Strategy. In 2014, Government put in place a Medium-Term Tariff Policy (MTTP) for electricity and heating, setting a path to full cost recovery and financial sustainability in the energy sector. The analysis in this report shows the impact of recent reforms, details remaining challenges, and presents potential solutions to those challenges.

The report is structured as follows:

- Section 1 provides background on the sector structure, and describes recent reforms.
- Section 2 details the impacts of these reforms on sector performance and public opinion.
- Section 3 highlights the remaining challenges that still need to be addressed, including service quality, financial viability, affordability and willingness to pay.
- Section 4 proposes possible solutions to these challenges, including continued progress on tariff reforms, prioritization of new supply and rehabilitation options, and strengthening governance and regulation.

1 Sector Background

Electricity supply in the Kyrgyz Republic is fueled by a mix of hydroelectric and thermal generators. Most of the hydroelectric system (the Naryn Cascade) is operated using water released from the Toktogul reservoir, located on the Naryn River in the Jalal-Abad Province. Toktogul's multi-year storage capacity allows for conservation of water in the wet season, for use during the winter heating season. Thermal generators include two combined heat and power plants (CHP), which provide electricity, and heat and hot water.

Table 1.1 shows the HPP and CHP generation capacity and output in the Kyrgyz Republic.

Table 1.1: Overview of the Power Generation Plants in the Kyrgyz Republic

	Generation Capacity (MW)	Generation Output (Million kWh)
HPPs		
Naryn Cascade		
Toktogul HPP	1,200	4,400
Kurpsai HPP	800	2,630
Tashkumyr HPP	450	1,555
Shamaldysai HPP	240	902
Uch-Kurgan HPP	180	820
Kambarata 2 HPP	120	500
Atbashy HPP	40	160
Total for JSC Power Plants	3,030	10,967
JSC Chakan GES	35	234
Total hydropower	3,065 (81%)	11,201 (86%)
CHPs		
Bishkek CHP	666	1,800
Osh CHP	50	0
Total thermal	716 (19%)	1,800 (14%)
Total for the Kyrgyz power system	3,781	13,001

Source: World Bank based on sector data.

Kyrgyzstan's electricity industry was restructured in the late 1990s. In 1999, Parliament approved the Program for Denationalization and Privatization of Kyrgyzenergo. The program's key features included the incorporation of Kyrgyzenergo as a joint stock company (JSC) and the unbundling of

the sector by function (generation, transmission, and distribution). Unbundling was completed in 2000, resulting in the creation of six power companies that remained natural monopolies:

- JSC Electric Power Plants (EPP) — national generation company
- JSC National Grid (NESK) — national transmission company
- SeverElectro (SE) — distribution company for Bishkek, Chui and Talas oblasts
- VostokElectro (VE) — distribution company for Issyk-Kul and Naryn oblasts
- OshElectro (OE) — distribution company for Osh oblast
- Jalal-AbadElectro (JE) — distribution company for Jalal-Abad oblast

There are also 16 wholesale buyers and resellers of electricity, and, 21 private companies which operate portions of the distribution network in certain areas of Bishkek.[3] One district heating company (JSC Bishkekteploset) and a small hydropower company (JSC Chakan GES) were also established.[4] The Kyrgyz Government owns nearly 95 percent of shares of the energy sector companies.

Reforms during the 2000s included changes to tariff level and structure, with failed attempts at aligning revenues with the cost of service. From 1999 to 2002 four tariff increases took place. In 2003, the six-tiered residential tariff was replaced with a two-tiered tariff. The tariffs then remained unchanged until 2006, when a single tier KGS 0.62/kWh tariff was introduced. In 2008, tariffs were increased and the Government adopted a mid-term tariff strategy for electricity, based on the principles of full cost-recovery, constant service delivery and the premise that subsidies for low income households were to be allocated through state social assistance programs. However, this strategy was never put into effect. In 2009 the Government approved residential tariff increases for the following year. However political unrest led to a reversal of this increase and a change in Government in 2010.

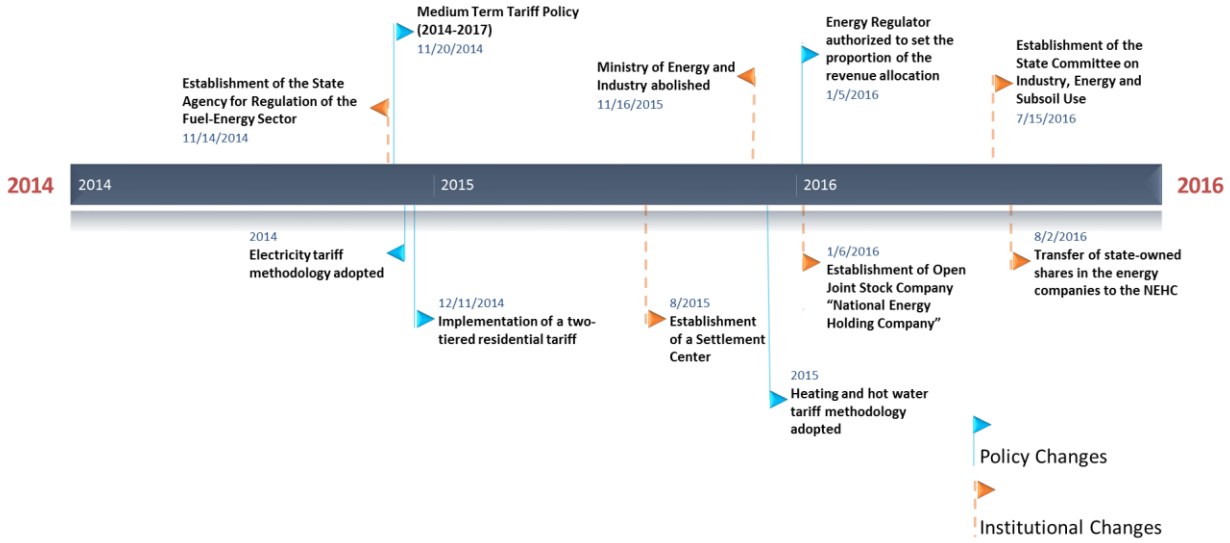
More recent reforms have focused on improving financial viability in the sector, and on improving regulation and transparency. Reforms have included changes to the institutional and regulatory framework of the sector, as well as changes to tariff setting methodologies, tariff structures and medium-term revenue planning.

Figure 1.1 shows a timeline of key reforms that have occurred in the past three years.

Figure 1.1: Timeline of Sector Reforms

[3] Before 2010 more of these wholesale resellers existed, but some have closed as part of Government efforts to reduce corruption associated with these companies.

[4] There is an additional state-owned heating company, Kyrgyzzhilcommunsoyuz in Bishkek, (heat-only boiler) which receives money from the Ministry of Finance and municipalities in the form of direct budgetary transfers. The analysis in this report does not include Kyrgyzzhilcommunsoyuz.



Section 1.1 describes the institutional and regulatory reforms made since 2014. Section 1.2 describes the tariff reforms.

1.1 Institutional and Regulatory Reforms

The Power Sector Development Strategy 2012-2015 and the Action Plan for Reforming the Energy Sector 2013-2014 outlined the major reforms in the sector. The Development Strategy sets out directions for strengthening the governance, transparency and accountability of the energy sector and its constituent companies. It also calls for the implementation of an MTTP, strengthening of social protection schemes, and energy investments including the expansion of regional trade and cooperation. The Action Plan defines the steps GoKR is taking to implement the strategy.[5] These steps include the establishment of a Settlement Center, a policy commitment to cost recovery, and development of tariff setting methodologies. The Action Plan also includes amendment of the Energy Law defining the functions of policy making, economic regulation, and anti-monopoly monitoring, along with the introduction of transparent and competitive procurement of fuel, and setting up of an escrow accounts for power export revenues. Many of these reforms had, as of end-2017, been implemented, namely:

- **Establishment of a Settlement Center.** The JSC Kyrgyz Electricity Settlement Center (KESC) was established in August 2015. The objective of the KESC is to improve transparency of the country's power and associated revenue flows.
- **Establishment of a Regulator.** The State Regulatory Agency for Energy and Fuel was established in November 2014, and put in charge of the economic regulation of the energy sector. The Regulator is responsible for the following activities:
    - Licensing for energy sector activities

[5] World Bank, "Kyrgyz Republic Partnership Program Snapshot," (2015) http://www.worldbank.org/content/dam/Worldbank/document/Kyrgyzrepublic-Snapshot.pdf.

- Developing tariff methodologies and setting tariffs for electricity, heating and natural gas
- Developing and supervising the performance reporting and monitoring framework for energy sector companies
- Conducting awareness-raising activities
- Developing procedures for consumer and sector company complaints and claims

- **New revenue allocation mechanism.** An independent revenue allocation mechanism was approved in 2016 to allow transparent allocation of sector revenues along the supply chain. This mechanism authorized the Regulator to determine the allocation of cash aggregated in the state-owned RSK-Bank (which holds a transit account with all revenues from distribution company end-users) to each company in the sector. The Regulator relies on the KESC to provide information on which to base the revenue allocation.
- **Establishment of the National Energy Holding Company (NEHC).** In August 2016, the state-owned shares of the energy companies were transferred to the NEHC. NEHC holds 100 percent of KESC and JSC Chakan GES shares, and 80.42 percent of other subsidiary company shares (JSC Electric Power; JSC National Grid; four distribution companies; and JSC Bishkekploset). As it is a new entity, NEHC's organization and functions are still evolving. However, its key function is to serve on the Boards of Directors of the subsidiary companies, holding the position of Chair as well as the majority of Board seats. The company Boards will have overlapping membership with the aim to unify strategies and objectives across the sector. The Boards are responsible for appointing the Managing Director of the respective company and key members of the company's Executive Board. The Boards will also approve strategies, set targets and performance indicators, and monitor progress. NEHC will take on the responsibility of internal audits (which was previously held by each subsidiary company).
- **Transfer of policy responsibilities.** In November of 2015, the Ministry of Energy and Industry, which was responsible for the formulation of policy and development strategies for the fuel and energy complex, was dissolved. Its functions were transferred to the Ministry of Economy (MoE). In summer 2016, the State Committee on Industry, Energy and Subsoil Use was established, and given responsibility for policy making functions in the sector.

Figure 1.2 depicts the current energy sector regulation and governance framework, including the new sector entities.

Figure 1.3 depicts the organizational and institutional structure of the sector. The primary functions of relevant entities within the sector (both old and new) are described in more detail in Appendix A.

Figure 1.2: Regulation and Governance of the Electricity Sector

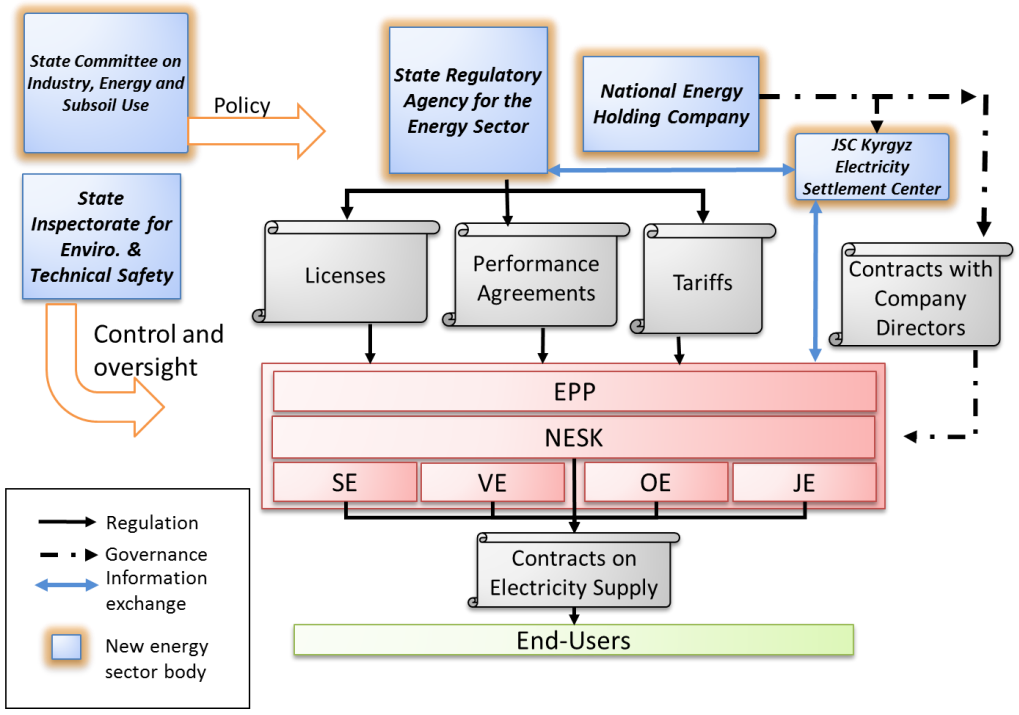
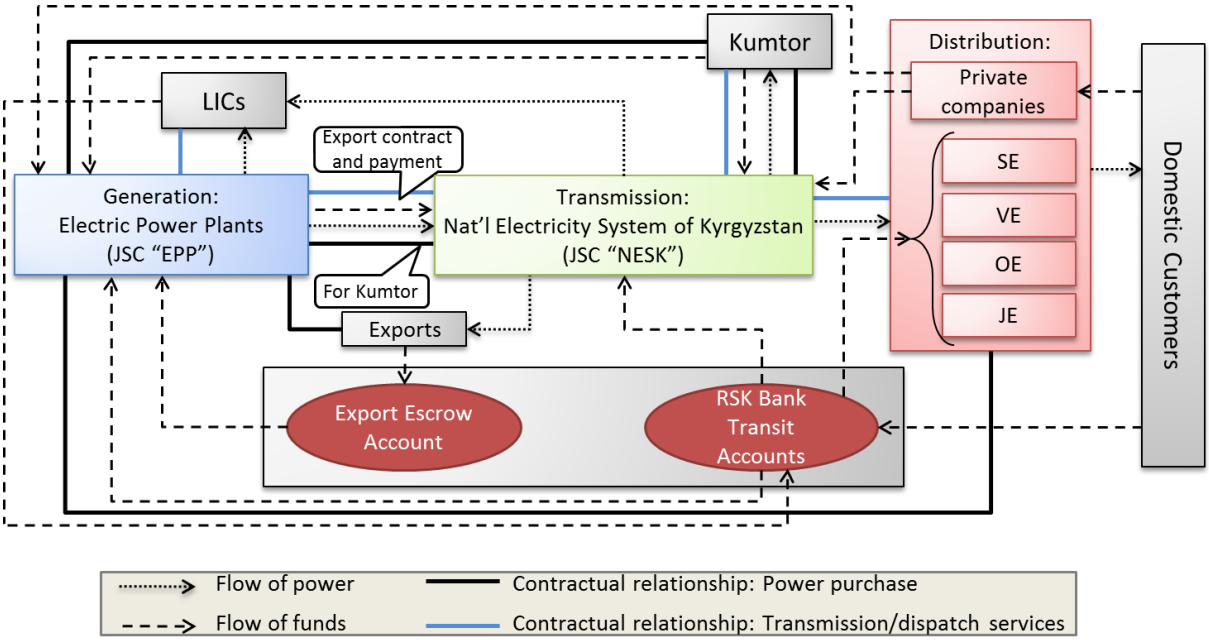


Figure 1.3: Organization and Institutional Structure of the Electricity Sector



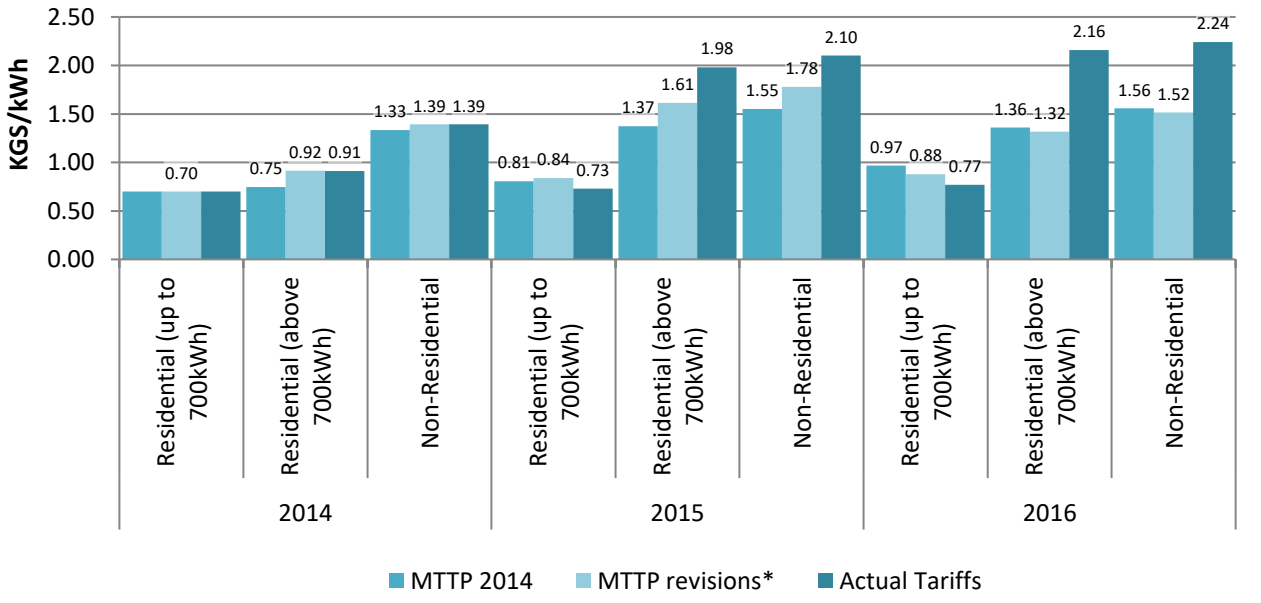
1.2 Tariff Reforms

The new Regulator developed tariff setting methodologies for electricity and heat in late 2014 and 2015, respectively. The methodologies were intended to facilitate a transparent and

predictable path to cost-recovery for the sector. Tariffs were increased in December 2014 for the first time in six years, as part of the newly approved MTTP 2014-2017. The MTTP envisioned a steadily increasing and predictable tariff path for heating and electricity services, intended to lead to cost recovery by 2018. A two-tiered residential tariff was implemented in 2015 to protect low income customers. Residential customers pay a lower tariff on all consumption up to 700kWh (hereafter also referred to as the "social tariff threshold"), and a higher tariff on all additional consumption.[6]

The tariff increases have helped improve the financial condition of the companies, but have not followed the MTTP, and have resulted in more cross-subsidization between customer groups than planned. The MTTP was repeatedly revised between 2014 and 2017. Current tariffs do not match the original MTTP (hereafter referred to MTTP 2014) or its revisions. Large and non-residential users are carrying the weight of the tariff increases because the lower residential tariff has not been increased as planned. Figure 1.4 shows weighted average actual end-user tariffs for each year, compared to the MTTP 2014 and MTTP revisions. Figure 1.5 shows the timeline of actual tariff increases over the past three years. A 10 percent tariff increase was planned for the second half of 2017 (a revision from the originally announced 29.8 percent increase), but was later reversed by the Government. A new MTTP 2018-21 was announced by the Regulator in early 2017.[7]

Figure 1.4: MTTP 2014 vs. Revisions and Actual End-Use Tariffs



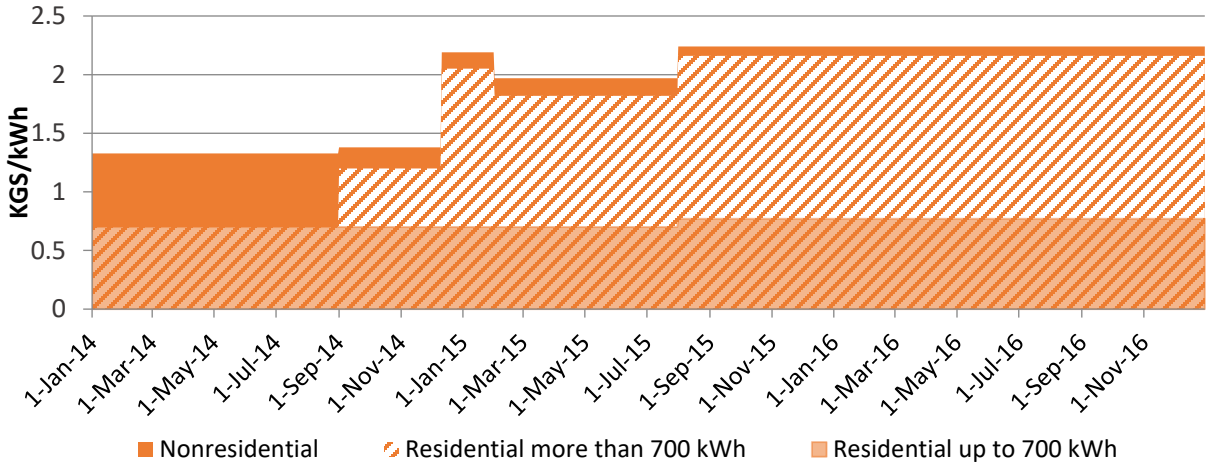
Source: World Bank analysis, using data provided by the Regulator.

[6] The socially oriented tariff up to 700kWh is sometimes referred to as lifeline tariff, but this terminology is used very loosely as a lifeline is meant to cover only basic needs; by contrast 700kWh exceeds average monthly household use in the Kyrgyz Republic.

[7] 24.kg News Agency, "Heating and electricity tariffs not to rise, Kyrgyz officials insist," (February 9, 2017). http://24.kg/english/44720_Heating_and_electricity_tariffs_not_torise_Kyrgyz_officials_insist/

*Note: MTTP 2014 was revised several times between 2014-16; revision tariffs and actual tariffs shown are a weighted average of all tariffs for the year, weighted by the number of days each tariff was in effect.

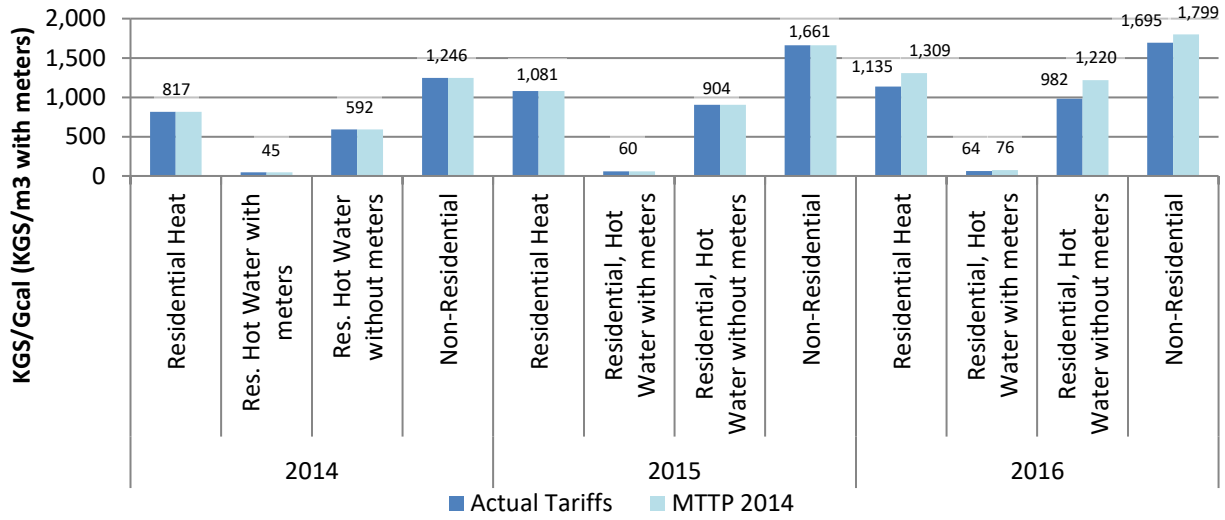
Figure 1.5: Timeline of Actual End-User Electricity Tariff Changes



Source: World Bank analysis, using data provided by the Regulator

Heating and hot water tariffs followed the MTTP 2014 tariff path in 2014 and 2015, but no increase was made in 2016 as envisioned in the original MTTP.[8] Figure 1.6 shows a weighted average of actual tariffs for each year in comparison to the MTTP 2014. Figure 1.7 shows a timeline of the actual tariff increases over the past three years.

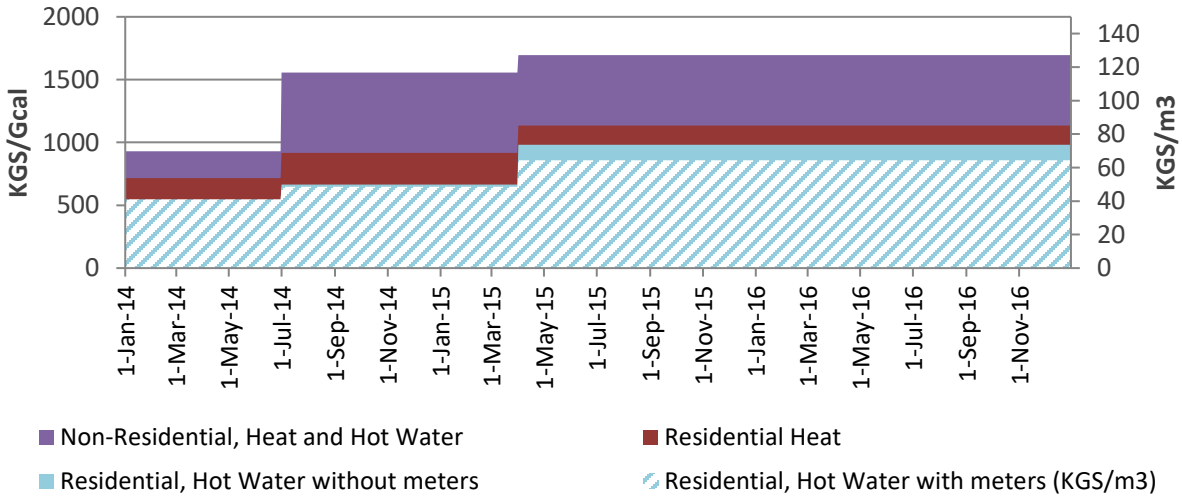
Figure 1.6: MTTP vs. Actual BTS End-Use Tariffs



Source: World Bank analysis, using data provided by the Regulator

Note: Actual and MTTP 2014 tariffs are a weighted average of all rates for the year, weighted by the number of days each rate was in effect.

Figure 1.7: Timeline of Actual End-User Heat and Hot Water Tariff Changes



Source: World Bank analysis, using data provided by the Regulator

[8] The MTTP was retroactively amended to reflect the lapse of the planned increase for 2016.

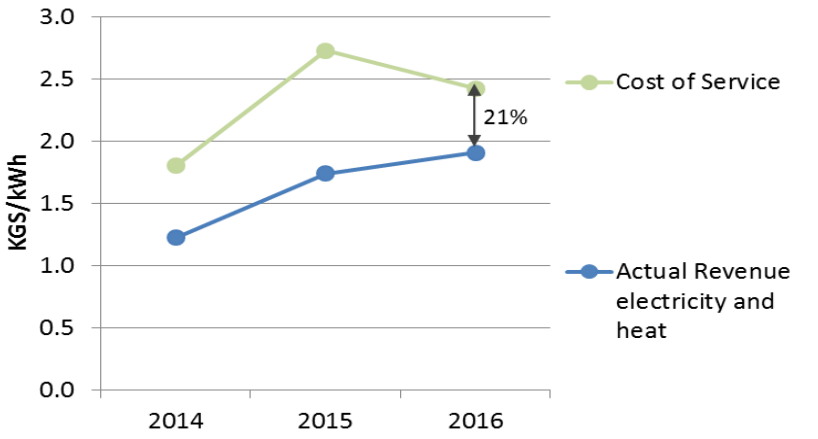
2 Impact of the Reforms

The reforms described in Section 1.1 have resulted in sector improvements, including higher tariff revenues, a lower sector deficit, and lower reported losses. In addition, public opinion of the sector has become more positive in the past few years, partially due to recent reforms. These developments are described in the following subsections.

2.1 Higher Tariff Revenues

On average, tariff revenues are closer to cash requirements today than they were in 2014. Energy sector revenue is still below the cost of service, but by a smaller percent than in 2014 (21 percent in 2016 compared to 32 percent in 2014).

Figure 2.1: Energy Sector Cost of Service vs. Revenue



Source: World Bank calculations using Techno-Economic Indicators[9]

Figure 2.1 shows the gap between cost of service and revenue for 2014 through 2016.[10] The cost of service represents annual cash requirements only; it includes debt service on CAPEX but excludes depreciation and other non-cash items. Therefore, the cost of service may not reflect the needed expenditures on OPEX and CAPEX, especially given that sector entities chronically underspend on maintenance and investments.

2.2 Lower Sector Deficit

Higher cost-recovery levels helped to reduce the overall sector deficit from KGS 9.3 billion in 2015 to KGS 4.9 billion at the end of 2016.[11] In 2016, 49 percent of this deficit was attributable to the electricity sector and 51 percent was attributable to the heating sector.[12]

Table 2.1 shows the energy sector (electricity, heat and hot water) deficit in years 2014-2016 under both actual implemented tariffs and the tariffs outlined in the MTTP 2014. The level of

[9] The Techno-Economic Indicators are a data set compiled by the Regulator, uniformly reported by each energy sector entity.

[10] Revenue is calculated from TEI figures on energy volumes delivered, as complete collections data was not available. Although collections, when reported, were near 100 percent, actual revenues may be slightly lower than the estimates used.

[11] Note that alternative estimates of the 2016 deficit can be found in the media, including a statistic of 9 billion KGS and one of 3 billion KGS respectively. We do not know the methodology for these alternative statistics; the figures reported are based on figures and model results the World Bank team could independently verify.

[12] The sectors do have some shared costs for EPP's CHP plant in Bishkek; assumptions on the allocation of EPP's costs between the two sectors are described in Appendix C.

the low socially oriented tariff fell behind the MTTP, but the increase in tariffs for large and non-residential consumers was enough to offset this difference. Consequently, actual tariff revenues outperformed what had been expected under the MTTP 2014.

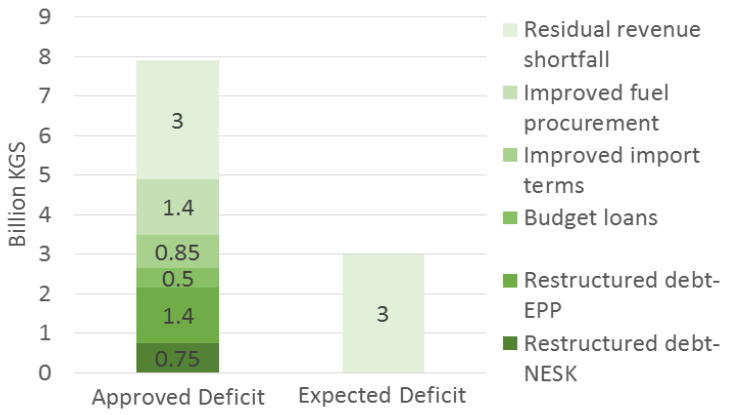
Table 2.1: Energy Sector Deficit, thousand KGS (Difference between Revenue and Actual Cost)

	2014		2015		2016	
	MTTP 2014	**Actual Tariffs**	**MTTP 2014**	**Actual Tariffs**	**MTTP 2014**	**Actual Tariffs**
EPP	(4,172,611)	(4,079,451)	(7,504,815)	(6,358,025)	(3,733,469)	(3,065,811)
NESK	(366,359)	(341,019)	(999,116)	(762,159)	(876,174)	(485,357)
SE	(609,679)	(567,510)	(1,174,499)	(895,948)	(886,660)	(491,166)
VE	(130,480)	(121,456)	(301,281)	(229,828)	(181,479)	(100,530)
OE	(189,487)	(176,381)	(426,127)	(325,064)	(267,632)	(148,255)
JE	(127,777)	(118,939)	(259,729)	(198,130)	(174,183)	(96,489)
BTS	(459,345)	(459,345)	(492,408)	(492,408)	(455,685)	(501,821)
Total	**(6,055,738)**	**(5,864,101)**	**(11,157,975)**	**(9,261,562)**	**(6,575,283)**	**(4,889,429)**
Electricity Sector Deficit Only	(2,770,683)	(2,579,047)	(7,996,136)	(6,099,723)	(4,296,715)	(2,380,166)

Source: World Bank estimation using Techno-Economic Indicators

It is important to highlight that not all deficit reduction is attributable to tariff increases. There have been significant debt reduction efforts, including KGS 2.15 billion in loan restructuring through EPP and NESK. As a result of this and other deficit reduction measures, the NEHC reports that the KGS 7.9 billion energy sector deficit for 2016 was reduced to about 3 billion.[13] Figure 2.2 illustrates the impact of these deficit reduction measures on the sector deficit for 2016.

Figure 2.2: Reduction of the Deficit (2016)



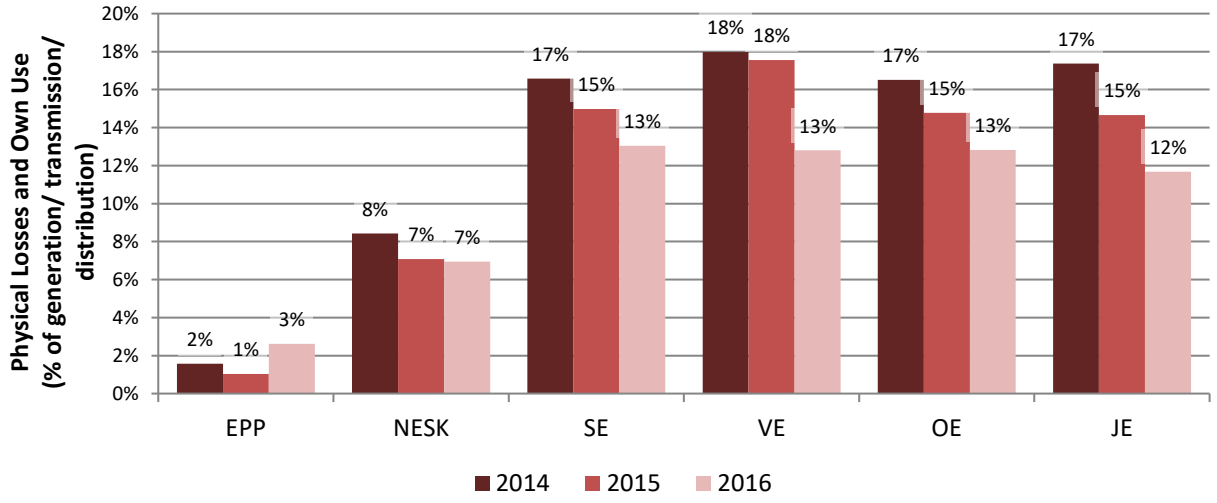
Source: NEHC

[13] Note that these are figures provided by the Energy Holding, and do not entirely align with our calculations. Taking the loan restructuring into consideration, our estimate of the deficit for 2016 is reduced to 2.7.

2.3 Lower Losses

Companies have also reported lower technical and non-technical losses for transmission and distribution. Transmission losses were reported at 7 percent in 2016 (compared to 8 percent in 2014), and distribution losses were reported at 12-13 percent (compared to 17-18 percent in 2014). However, according to the Regulator and sector specialists, actual losses are likely to be higher than reported.[14] Actual distribution losses are more likely in the range of 15-18 percent, with some reductions since 2014 achieved thanks to modernized metering. The change in reported losses is depicted in Figure 2.3.

Figure 2.3: Reduction in Reported Losses



Source: World Bank results, using Techno-Economic Indicators

2.4 Public Opinion of the Sector and Reforms

The public is responding positively to reforms, and public opinion of the sector overall has improved in recent years. A series of energy consumer surveys (carried out in 2014, 2015, and 2016 for the World Bank) documents this increasingly positive public opinion.[15]

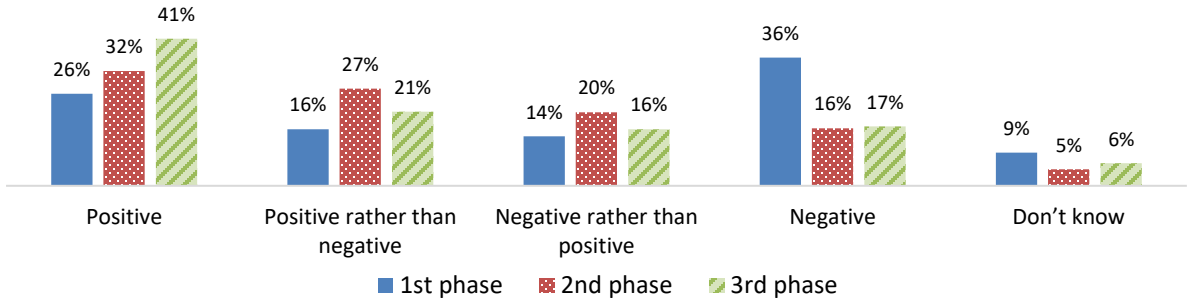
Consumers now have fewer concerns about the quality of supply. In 2014, the energy sector was considered the most important issue for Government by 32 percent of respondents. In 2015, that percentage dropped to 8 percent (although it increased slightly to 11 percent in 2016). In 2014, energy was a top concern because a winter crisis was forecast, with insufficient fuel to provide electricity and heat 24/7 and cutoffs anticipated. However, this situation was averted, which likely played a key role in the improvement of public sentiment.

[14] Utilities in Kyrgyzstan have historically alternated between hiding losses in collections and own use. Donor-sponsored loss reduction programs, using new metering equipment and better management systems are in place in SE and VE but have not yet been rolled out to other distribution companies.

[15] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

Trust in the adequate operation of the sector has also improved. In the 2016 survey, 62 percent of respondents evaluated the work quality and efficiency of the sector as positive (either "positive" or "positive rather than negative"), an increase from 42 percent in 2014. Respondents commented that their ratings were influenced by the Government's efforts to avoid power cutoffs in the winter. Measured in this manner, the level of trust in the sector is highest among pensioners (79.5 percent) and lowest among entrepreneurs (49.5 percent). Figure 2.4 depicts the change in these responses over the last three years.

Figure 2.4: Work Quality and Efficiency of the Energy Sector



Note: Phase 1 was completed in 2014, phase 2 in 2015, and phase 3 in 2016.

Source: M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

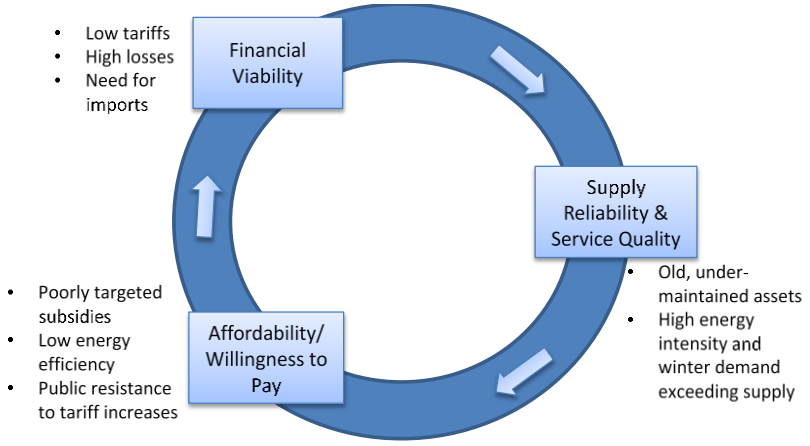
The public is responding well to the reforms described in Section 1.1. Although many people are not knowledgeable about sector reforms (with 56 percent claiming to know nothing), those who have heard about the reforms primarily expressed their approval; 80 percent strongly or somewhat approve. This percentage is double that of the 2015 survey, but the lack of a tariff increase in 2016 may have been a key cause of this increased approval. Despite remaining problems within the sector, 57 percent of respondents did not perceive major technical and financial problems in 2016.

3 Remaining Challenges

The reforms described in Section 2 have had a positive impact, but the sector still faces challenges. Problems with supply reliability and service quality persist, the financial viability of sector companies is tenuous, and efforts to increase tariffs may mean that energy becomes unaffordable for an increasing number of customers.

These problems are interconnected, and, to some extent, self-perpetuating. Figure 3.1 shows the vicious cycle. Energy supply is dependent on old assets that are prone to breakdowns, resulting in unreliable and poor quality supply. Consumers are resistant to tariff increases, in part because of the poor quality and reliability of supply. Decision makers, fearing political backlash or because of concerns about affordability, are consequently hesitant to increase tariffs. Low tariffs, in combination with high losses, limit revenue recovery in the sector. Energy companies are consequently unable to make adequate investments in maintenance and new energy infrastructure, which in turn perpetuates poor supply reliability and service quality.

Figure 3.1: Key Challenges Facing the Energy Sector



Without sufficient revenue recovery, the sector requires transfers from the Ministry of Finance in the form of grants or on-lending of sovereign guaranteed concessional loans. The grants and loans (if the energy companies cannot service the debt) accumulate and become a fiscal burden which reduces the room for government spending in other sectors.

3.1 Service Quality

Service quality is typically described in terms of four characteristics: reliability, quality of supply, access, and customer service. There is room for improvement in these service characteristics in the Kyrgyz energy sector:

- **Reliability.** Reliability refers to the frequency and duration of power outages. The Kyrgyz electricity system offers poor supply reliability, especially in the winter months. In 2009-2012, distribution companies reported around two outages per hour. In 2013, firms experienced an average of 0.9 outages per month, costing about 4 percent of sales value.[16] In December 2012, a breakdown at Toktogul HPP led to country-wide rolling blackouts. A breakdown of Toktogul in the winter of 2015 resulted in electricity consumption limitations in the North and South, which were removed by the following

[16] "Power outages in firms in a typical month (number)", World Bank, Enterprise Surveys (http://www.enterprisesurveys.org/).

day.[17] The breakdown that occurred a year later, in December 2016, resulted in no consumption restrictions, as the capacity of other plants could cover consumption needs, but still demonstrates the poor state of the assets.[18]

- **Quality.** Quality refers to fluctuations in voltage, frequency or harmonics. The Kyrgyz electricity system is prone to regular voltage and frequency fluctuations. In a 2013 survey, more than half of respondents reported problems with voltage (including low voltage and voltage fluctuations), and 18.9 percent of respondents reported damage to electrical appliances because of poor electricity quality.[19]
- **Access.** Access refers to the percentage of the population that has electricity in their home. The Kyrgyz Republic is well connected; nearly 100 percent of the population has access to electricity, as of 2012.[20] However, the connection process for new homes and businesses needs improvement as it is both lengthy and costly compared to that of other countries in the region. A business connection takes 125 days to acquire (compared to 112 on average for the ECA region), and the cost to connect is 858 percent of income per capita (compared to the 376 percent ECA average). [21]
- **Customer Service.** Customer service refers to the quality of the billing service and assistance provided following customer queries (e.g., managing outages and complaints). The Kyrgyz electricity supply system performs poorly on tariff transparency and outage mechanisms. On a scale of 0-8, with 8 indicating total reliability of supply and transparency of the tariff,[22] the Kyrgyz Republic received 0; the ECA average is 5.2.[23]

Problems with reliability and quality are the biggest problem for the Kyrygz electricity sector. These problems are caused by the condition of energy sector assets, the highly seasonal nature of demand, and the country's intensive use of electric energy.

3.1.1 Age and maintenance of assets

Forty-five percent of the Kyrgyz Republic's electric generating capacity is beyond its useful life (see Figure 3.2). More than 700 transmission towers (built in the 60s and 70s) are in critical condition.[24] Distribution lines are also strained. SE (SeverElectro) reported in 2016 that, of the

[17] Kudryavtseva, Tatyana. "Consequences of Toktogul HPP breakdown liquidated, its units put into operation," December 24, 2015. http://www.eng.24.kg/incidents/178634news24.html.

[18] Kostenko, Julia. "Power engineers voice causes of breakdown at Toktogul HPS," December 21, 2016. http://eng.24.kg/incidents/183438-news24.html.

[19] Unison and USAID, "Analysis of Electricity Distribution and Consumption System in Kyrgyzstan," 2013

[20] The World Bank, "World DataBank, World Development Indicators," Washington, D.C.: The World Bank. http://databank.worldbank.org/data/home.aspx.

[21] World Bank, Doing Business project (http://www.doingbusiness.org/).

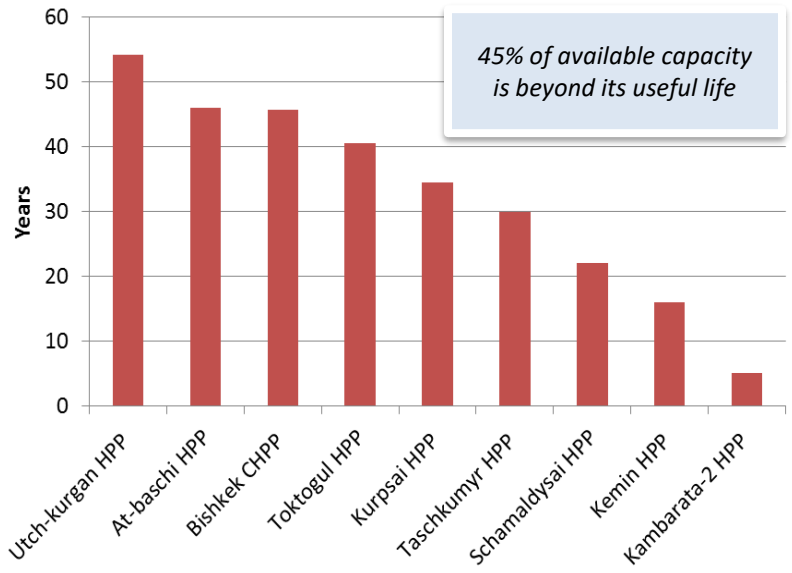
[22] This index includes the duration and frequency of power outages, mechanisms for monitoring and reducing them, and transparency and accessibility of tariffs.

[23] World Bank, Doing Business project (http://www.doingbusiness.org/).

[24] Tazabek, "Aibek Kaliev, Head of National Energy Holding: Tariff is the only source to repay debts," December 22, 2016. http://www.tazabek.kg/news:1353060.

928 kilometers of underground cable lines in Bishkek, roughly 40 percent displayed extreme wear and needed replacing. Only 30 kilometers were planned to be replaced in the year 2016 (costing approximately KGS 30 million). In the previous four years 150 kilometers were rehabilitated.[25]

Figure 3.2: Age of Generation Assets



Source: World Bank estimation using Techno-Economic Indicators

Lack of adequate maintenance and rehabilitation creates risk of breakdowns. Toktogul experienced breakdowns in both the winters of 2015 and 2016 due to cable line breaks. These line breaks were a result of old and under-maintained assets; the hydro units have a service life of 25 years but have been in use for 42 years.[26] In addition to the high risk for equipment collapse, repairs after breakdowns are becoming more difficult, as spare parts for the outdated equipment are no longer manufactured in the Russian Federation.[27]

District heating assets present similar problems. Most DH assets were commissioned 20-50 years ago and are in poor condition due to years of neglect. Generation assets (CHPs and heat-only-boilers) operate at 20-50 percent of their installed capacity and network losses often exceed 25 percent of the generation outputs. Consequently, supply reliability and service quality are deteriorating – the number of network failures in Bishkek, the largest operating DH system in the country, increased from around 50 per heating season in the early 90s to more than 300 per heating season in recent years.

3.1.2 Seasonality and the winter supply-demand gap

Annual electricity consumption has decreased 22 percent from 12.2 GWh in 2011, to 9.5 GWh in 2016. Figure 3.3 depicts the change in consumption over the past three years. However, demand is becoming more seasonal, meaning winter peaks are increasing relative to average load. In 2008, winter consumption was about double that year's summer consumption; as of 2016, winter consumption was three times summer consumption. In 2016 households consumed an average

[25] Severelectro, "Evening Bishkek number 41 (11058). Trenches around the city," June 4, 2016. http://www.severelectro.kg/ru/2009-05-26-10-08-44/3818-vechernij-bishkek-41-11058-transhei-po-vsemu-gorodu.

[26] KirTAG, "Kaliev: Toktogul HPP units have been in operation for 42 years; the service life is 25 years".

[27] ADB, "The Kyrgyz Republic Strategic Assessment of the Economy: Promoting Inclusive Growth," (2014).

of 286 kWh/month in summer and 721 kWh/month in winter (see Figure 3.4). Winter demand now comprises 67 percent of total demand.

Figure 3.3: Total Electricity Consumption

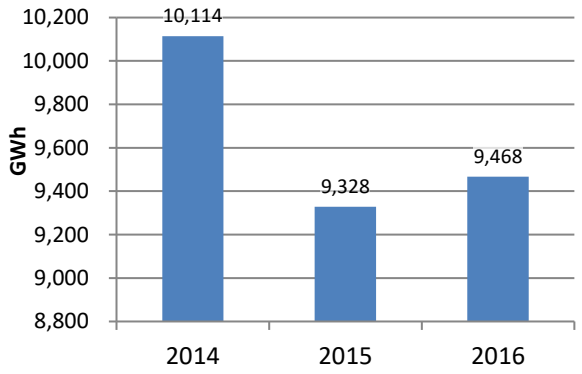
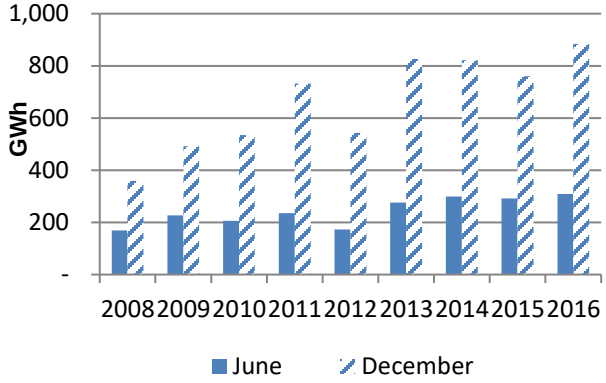


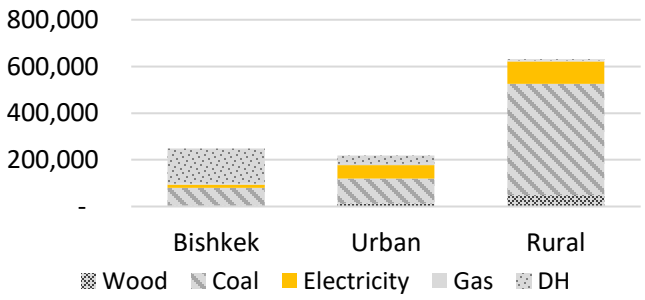
Figure 3.4: Seasonal Residential Consumption



Source: Techno-Economic Indicators

The driving factor behind the seasonality of demand is households' increasing use of electricity as a heating source. In 2016, 49 percent of survey respondents used electricity as a heating source.[28] Access to centralized heating is limited to less than 1/5 of the population. The 907,000 households without access to DH rely on individual solutions to meet their heating needs; 85 percent use individual coal-based systems as their primary heating sources, followed by electricity and gas heaters (see Figure 3.5).

Figure 3.5: Use of Heating Fuel



Source: World Bank (2015) Keeping Warm: Urban Heating Options in the Kyrgyz Republic; and World Bank (2016) Household survey on individual heating solutions.

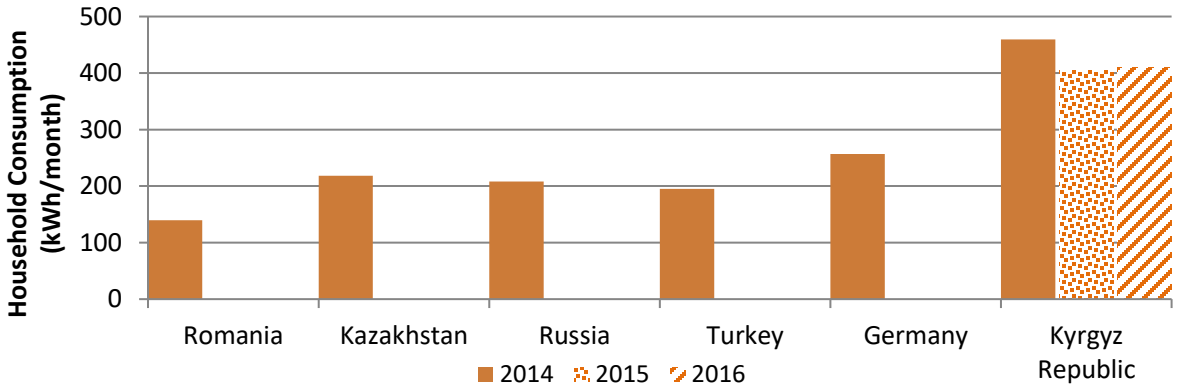
Higher winter peaks relative to average demand result in a lower load factor, which makes the system harder to manage and increases reliability concerns in the winter. Maintaining reliability is important, since reoccurring winter electricity shortages impose both political and economic risks. These risks include tension between countries over the timing of water release, which needs to align with irrigation needs of Kazakhstan and Uzbekistan. Blackouts also disrupt business operations and can impact the entire economy.[29]

[28] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

[29] Institute for War and Peace Reporting, "Energy Fears as Kyrgyz Winter Approaches," (2015). https://iwpr.net/global-voices/energy-fears-kyrgyz-winter-approaches.

Winter supply gaps are primarily driven by residential consumption. Household consumption is much higher than in other countries in the region, and average residential consumption has experienced growth in the last nine years. From 2007-2016, a 12 percent growth in the number of residential consumers was accompanied by 58 percent growth in residential consumption. Figure 3.6 shows recent household electricity consumption trends for the Kyrgyz Republic and comparisons to other countries of the region.

Figure 3.6: Electricity Consumption per Household



Sources: World Energy Council, "Energy Efficiency Indicators," https://www.wec-indicators.enerdata.eu/household-electricity-use.html

Kyrgyzstan Energy Sector Techno-Economic Indicators (2014-2016)

High residential demand, particularly in winter, has caused a supply gap. This gap is expected to grow if no action is taken. Figure 3.7 shows the forecasted winter consumption compared to available winter generation through 2030, and Table 3.1 shows the resulting supply gap. Even with additional capacity expected to come online in 2017 and 2018 from the rehabilitation of the Bishkek CHP plant (+300MW) and Toktogul plant (+200MW), Kyrgyzstan will still need to rely on imports in the winter.

Figure 3.7: Winter Supply Gap (2015-2030)

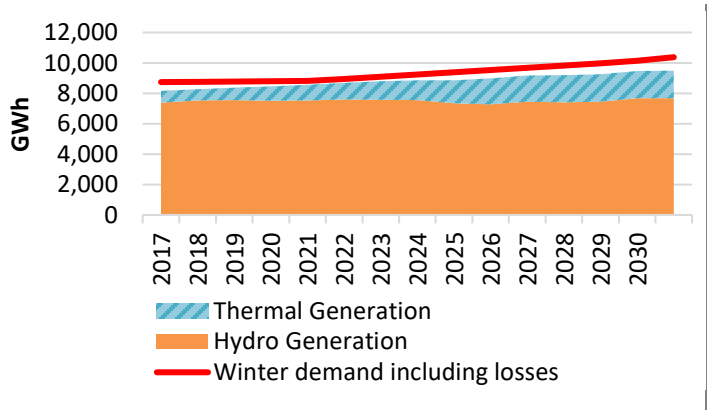


Table 3.1: Unmet Winter Consumption

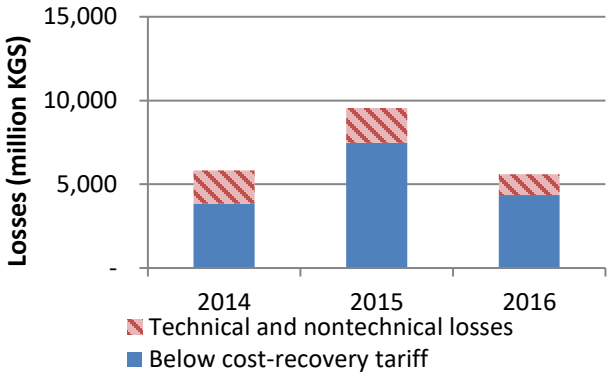
Year	GWh
2015 (actual)	581
2020	244
2025	543
2030	883

Source: World Bank calculation from CASA 1000 Economic and Financial Appraisal and demand forecast

3.2 Financial Viability

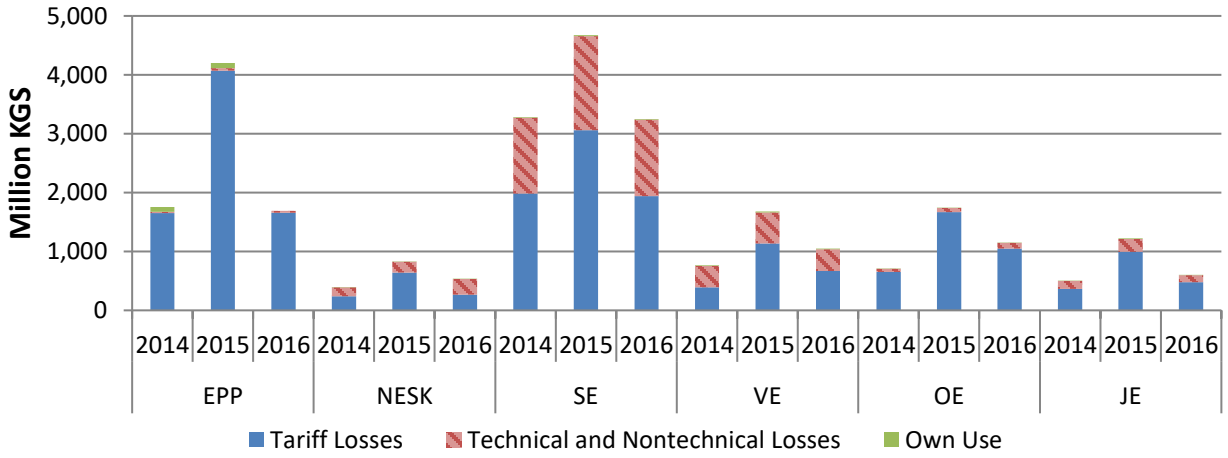
The sector suffers from a substantial revenue shortfall because of tariffs that are below cost-recovery and because of high technical and non-technical losses. In 2016, tariff losses[30] amounted to KGS 4,363.28 million (1 percent of GDP). Technical and non-technical losses were KGS 1,229 million (0.29 percent of GDP). Reducing technical/non-technical losses is important to reducing the shortfall, but tariff reform offers the biggest potential for improvement. Figure 3.8 shows technical and non-technical losses in the electricity sector, and the cost-recovery shortfall attributable to low tariffs. Figure 3.9 shows these figures by company. In 2016, SE was the biggest contributor to losses, followed by EPP, then OE. For all companies, below cost-recovery tariffs are the major contributor to financial losses in each year. The year-to-year fluctuations in tariff losses are dependent on the volume of imports, which spiked in 2015 and were lower than expected in 2016 (see Box 1).

Figure 3.8: Electricity Technical and Non-Technical Losses and Below Cost-Recovery Tariff Losses



Source: World Bank estimation using Techno-Economic Indicators

Figure 3.9: Value of Losses by Type and Company



Source: World Bank estimation using Techno-Economic Indicators

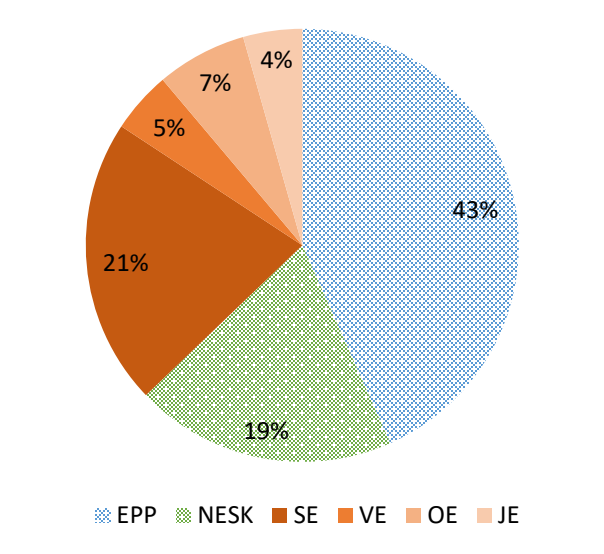
[30] Tariff losses are the difference in revenue from actual and cost-recovery tariffs, assuming 100% collections and no technical or nontechnical losses.

Box 1: Effect of Imports on Cost of Service

In 2014, Kyrgyzstan went from being a net exporter to net importer. The cost of imports has added to the overall cost of service; generation and import costs are the principal drivers of that cost. In 2016, 43 percent of the average end-user cost of service was attributable to generation and import costs (EPP), 19 percent to transmission (NESK), and 37 percent to distribution (SE, VE, OE, and JE). Figure 3.10 shows the breakdown of end-user cost of service.

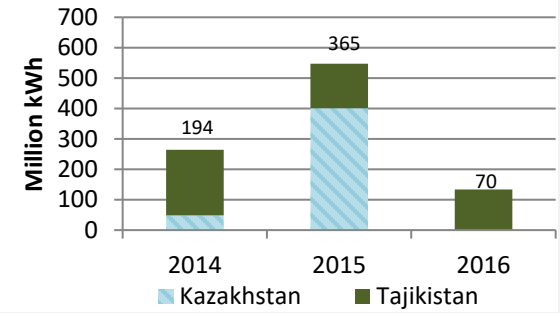
Wetter and warmer weather has kept imports lower than expected in 2016. The reduction of the deficit that year was due in part to the low volume of imports, and an energy tariff which had been set based on expectations that import volumes and import tariffs would be higher than they were. The results in 2016 may well be an exception and not the norm. Another dry year could necessitate more imports, and mean a higher cost of service which would further jeopardize the tenuous financial condition of the sector. Figure 3.11 and Table 3.2 show the volume and cost of imports in 2014-2016.

Figure 3.10: Percent of End-User Cost of Service



Source: World Bank estimation using Techno-Economic Indicators (2016)

Figure 3.11: Imports (Million kWh)



Source: Data provided by the Energy Regulator

Table 3.2: Average Import Costs (KGS/kWh)

Country	2014	2015	2016
Kazakhstan	4.99	4.70	-
Tajikistan	1.06	1.61	1.85

The following subsections detail the major factors contributing to the sector's poor financial condition. The factors include below cost-recovery electricity and heating tariffs, pronounced cross-subsidies between customer categories, high technical and commercial losses, and public sector support through budget transfers and guaranteed loans.

3.2.1 Below cost-recovery tariffs

Average generation, transmission, and distribution tariffs all remain below cost-recovery levels. This report concentrates on end-user tariffs as the primary area for future reform, however the low inter-company generation and transmission tariffs also contribute to the sector's financial instability.

In 2014-2016, the generation company EPP's weighted average tariffs were below cost recovery. These below cost-recovery levels are due to EPP's tariffs for distribution companies, which were all below the cost-recovery tariff in each year. Tariffs for Kumtor, large industrial consumers (LICs), consumer resellers, and wholesale resellers were all above the cost-recovery tariff (except for wholesale reseller tariffs in 2015). Weighted average actual generation tariffs and cost-recovery tariffs are shown in Figure 3.12.

In 2014-2016, the transmission company NESK's weighted average tariffs were below cost recovery. In 2014 NESK's tariffs for distribution companies were all below cost recovery, while tariffs for Kumtor, LICs, consumer resellers, and wholesale resellers were all above cost recovery. In 2015 and 2016, all transmission tariffs were below cost-recovery level, except for Kumtor. Weighted average actual transmission tariffs and cost-recovery tariffs are shown in Figure 3.13.

Figure 3.12: Generation-Actual vs. Cost-Recovery Tariffs (EPP)

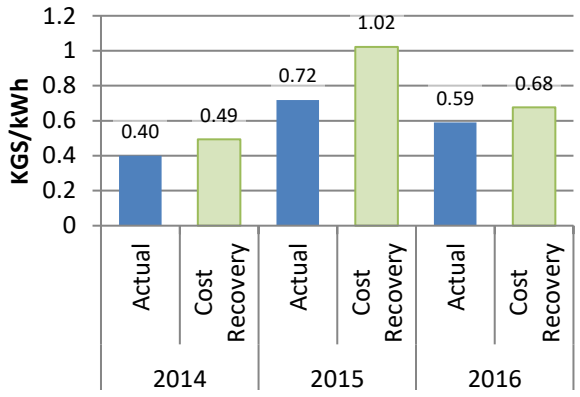
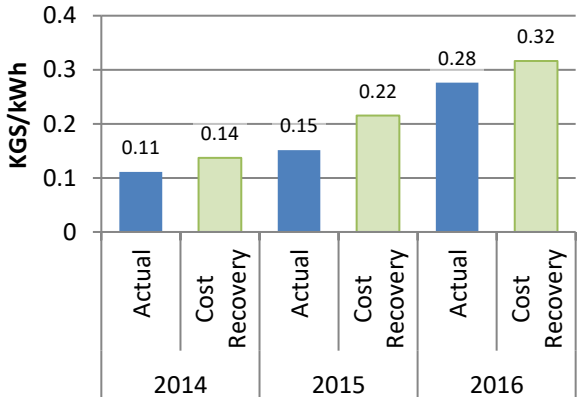


Figure 3.13: Transmission- Actual vs. Cost-Recovery Tariffs (NESK)



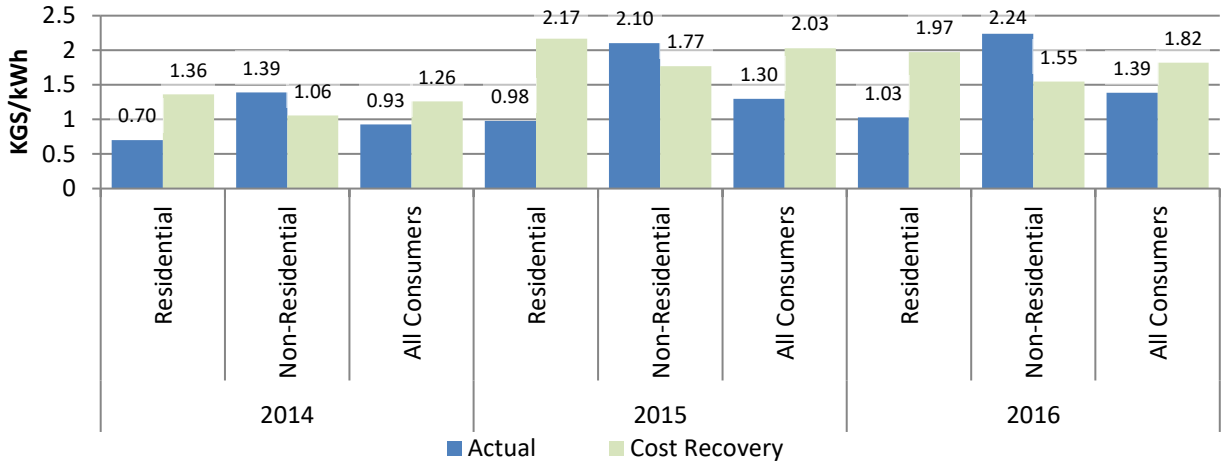
Note: Actual tariffs are a weighted average of tariffs for Kumtor, LIC, consumer resellers, wholesale resellers, and the distribution companies.

Source: World Bank estimation using Techno-Economic Indicators

End-user tariffs (shown in Figure 3.14) were below cost recovery levels, on average, in 2014-2016. Weighted average residential tariffs[31] have been below cost recovery level each year, whereas non-residential tariffs have settled above cost-recovery level.

[31] Actual residential tariffs for 2015 and 2016 are a weighted average of the two rates for consumption above and below 700kWh

Figure 3.14: Actual vs. Cost-Recovery End-User Tariffs

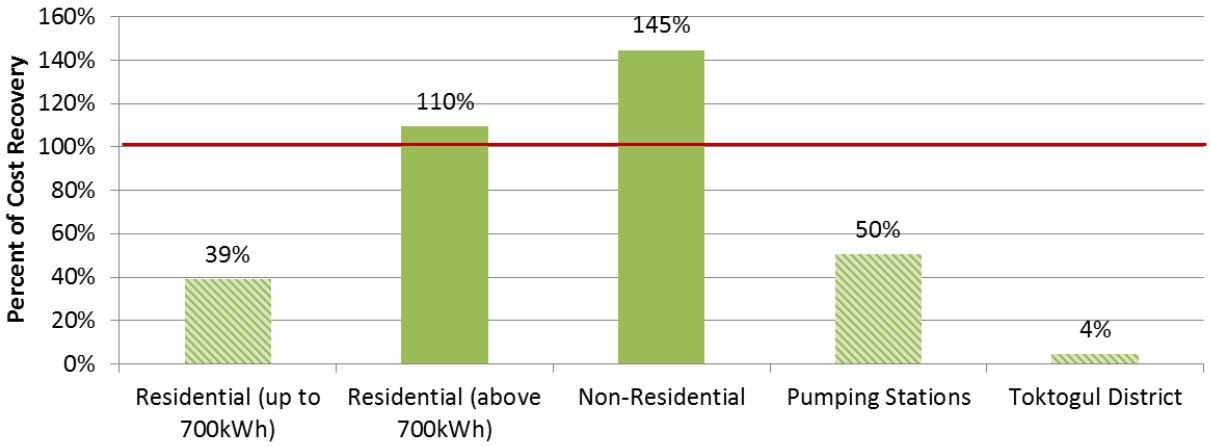


Source: World Bank estimation using Techno-Economic Indicators

Note: Actual residential tariffs for 2015 and 2016 are a weighted average of the two rates for consumption above and below 700kWh

In 2016, residential tariffs for consumption below 700kWh, were only 39 percent of cost-recovery level (as shown in Figure 3.15). This below cost-recovery tariff covers 53 percent of consumption, representing a huge burden on the sector. While pumping station and Toktogul district tariffs are also below cost recovery, these tariffs only cover 4 percent and 0.4 percent of consumption, respectively. Large residential consumers and non-residential consumers are, in part, compensating for these losses with tariffs that are 110 percent and 145 percent of cost recovery, respectively. The cross-subsidization caused by these disparities in cost recovery are discussed in more detail in Section 3.2.2.

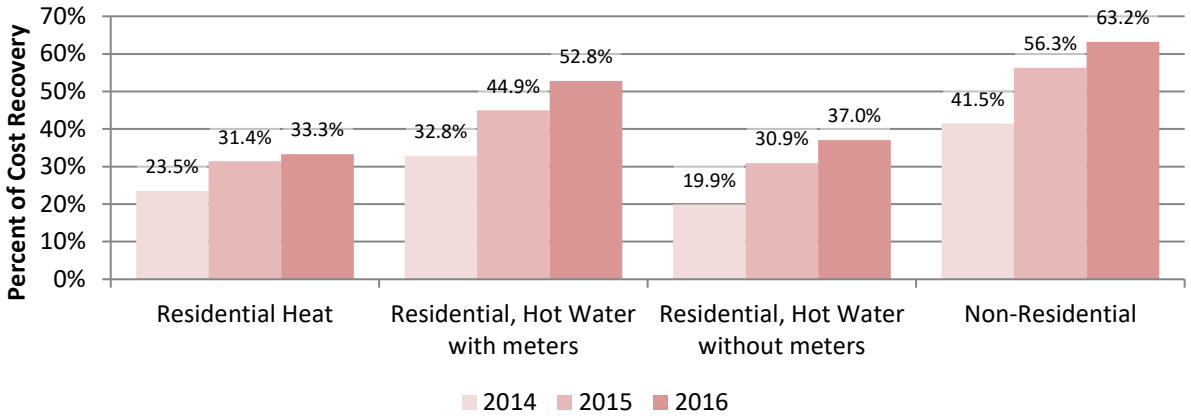
Figure 3.15: Actual Electricity Tariffs as a Percentage of Cost-Recovery Tariffs (2016)



Source: World Bank estimation using Techno-Economic Indicators

Heat and hot water tariffs are far below cost recovery, despite consistent improvement in the past three years. As of 2016, end-user tariffs are between 33 and 63 percent of cost recovery. As with electricity tariffs, residential consumption is much farther below cost recovery than non-residential tariffs. Residential heat tariffs are the furthest from cost recovery and non-residential heat/hot water are the closest to cost recovery (see Figure 3.16).

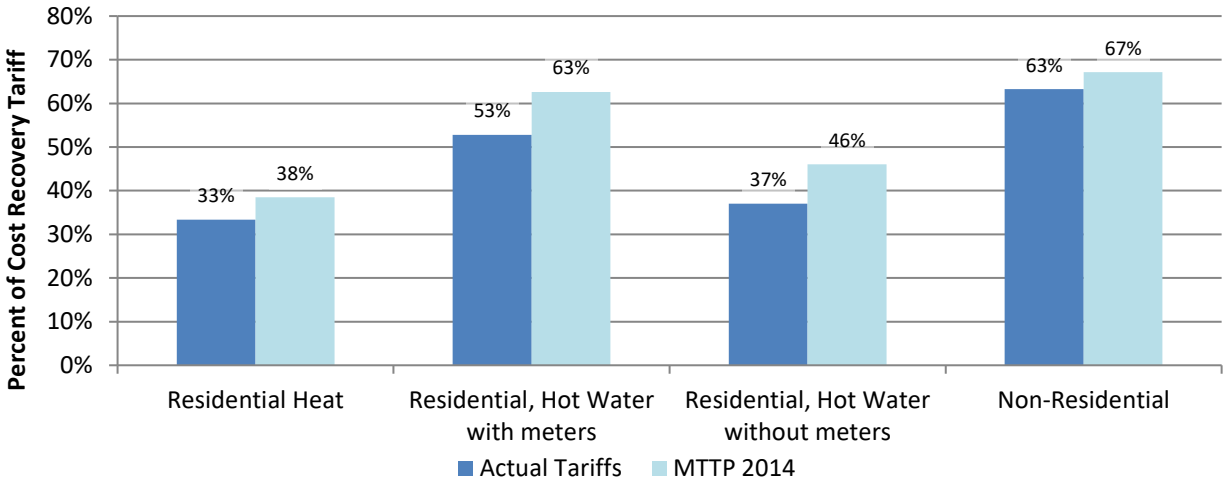
Figure 3.16: Actual Heating and Hot Water Tariffs as a Percentage of Cost-Recovery Tariffs



Source: World Bank estimation using Techno-Economic Indicators

Heat and hot water tariffs would have been closer to cost recovery levels if the MTTP 2014 had been followed, with tariffs between 38 and 67 percent of cost recovery in 2016 (see Figure 3.17).

Figure 3.17: Actual vs. MTTP Tariffs as a Percentage of Cost Recovery (2016)



Source: World Bank estimation using Techno-Economic Indicators

3.2.2 Electricity sector cross-subsidization between customer classes

Large residential consumers and non-residential consumers are paying tariffs that are above cost-recovery levels and are cross-subsidizing residential consumers, which, as shown in Section 3.2.1, are paying tariffs that are below cost-recovery levels.[32]

Non-residential tariffs are providing the bulk of the cross-subsidy. Non-residential tariffs were 0.69 KGS/kWh above cost-recovery level in 2016, resulting in more than 2 billion KGS in revenue above the costs of serving those customers (roughly 45 percent over-recovery). Residential consumption over 700kWh also exceeded cost-recovery by 0.19 KGS/kWh, resulting in 0.2 billion KGS in revenue above the cost of service (roughly 10 percent over-recovery). Large residential customers represented only 19 percent of total residential consumption in 2016, meaning that the excess revenue is relatively small when compared with the tariff losses incurred because of the below cost-recovery socially oriented tariff. The tariff below 700kWh/month applied to 81 percent of residential consumption and 52 percent of total end-user consumption in 2016, and resulted in revenue nearly 6 billion KGS below the costs of serving those customers. This loss (in combination with much smaller losses associated with pumping stations and the Toktogul district) has kept average end-user tariffs below average cost recovery.

Table 3.3 compares the cost of service and revenue for each customer class.

Table 3.3: Cost of Service vs. Revenue by Customer Class (2016)

	Residential (consumption up to 700 kWh)	Residential (consumption over 700 kWh)	Non-residential	Pumping stations	Toktogul district, Karakul, s.Zhazykechuu	Total
Percent of Consumption	52%	12%	31%	4%	0.4%	100%
Tariff (KGS/kWh)	0.77	2.16	2.24	0.779	0.088	
Consumption (billion kWh)	4.98	1.14	2.93	0.420	0.040	
Revenue (billion KGS)	3.84	2.47	6.55	0.330	0.003	13.19
Cost of Service (KGS/kWh)	1.97	1.97	1.55	1.550	1.970	
Consumption (billion kWh)	4.98	1.14	2.93	0.420	0.040	
Full Cost of Service (billion KGS)	9.82	2.25	4.53	0.650	0.070	17.32
Difference between CoS and Revenue (billion KGS)	**(5.98)**	**0.22**	**2.02**	**(0.32)**	**(0.07)**	**(4.13)**

Source: World Bank estimation using Techno-Economic Indicators

The total electricity sector deficit was reduced 2014-2016, but this reduction has been at the expense of large and non-residential consumers who represent the smaller share of

[32] Pumping stations are also being cross-subsidized but represent a much smaller portion of consumption.

consumption. The heavy cross-subsidization of the residential sector can have negative implications for economic growth and development. In addition, the categorical subsidization of residential customers is highly regressive; all households, regardless of income benefit from the tariff structure, making it an inefficient tool in terms of social equity.

3.2.3 High electricity sector losses

Technical and non-technical losses are still high, even after significant reductions. In 2016, losses were reported at 7 percent for transmission and 12-13 percent for generation. Figure 3.18 shows historic network losses, which peaked in 2002 and have been steadily declining in recent years, but not keeping pace with other countries in the ECA region. Figure 3.19 shows the Kyrgyz Republic's transmission and distribution losses in 2013 compared to those of eight other countries in the region. Losses range from 8 to 17 percent of output, compared to the Kyrgyz Republic's 20 percent losses. The figures are several years old, but it is reasonable to assume that Kyrgyz losses are still high compared to the region, on average.

Figure 3.18: Transmission and Distribution Losses in the Kyrgyz Republic

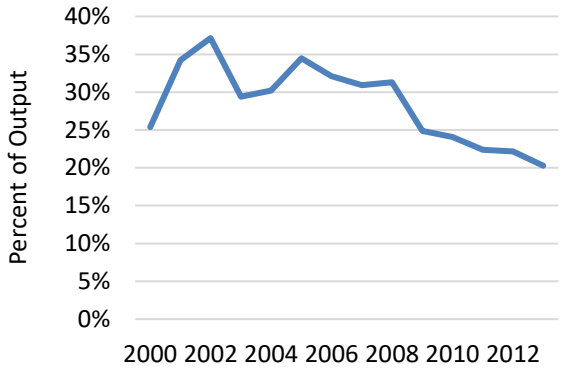
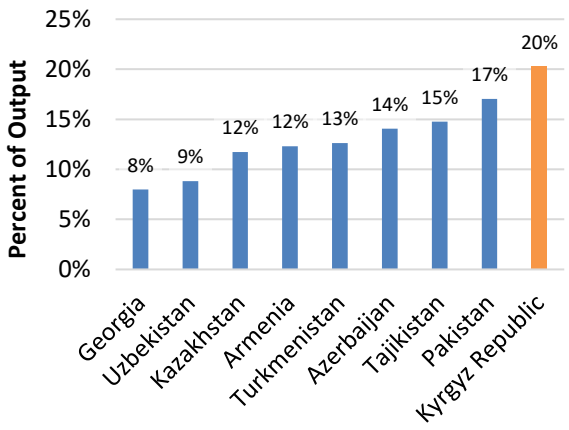


Figure 3.19: Regional Transmission and Distribution Losses (2013)



Source: The World Bank, "World DataBank, World Development Indicators," Washington, D.C.: The World Bank. http://databank.worldbank.org/data/home.aspx.

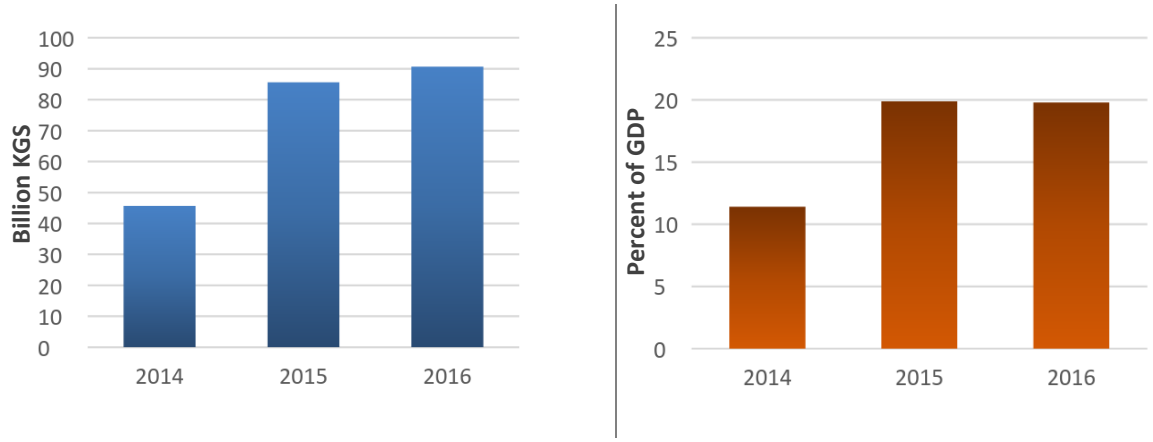
High losses present a major problem for the financial sustainability of the sector. Losses result in higher costs of each kWh sold, since inputs are being used to generate, transmit, or distribute electricity which does not result in a billed service. Moreover, if the electricity tariffs do not recover the costs of these units that are not paid for, then the revenue shortfall is proportionally greater. A dimension of fairness also needs to be considered; while recovering low levels of unavoidable technical losses through tariffs is acceptable and common practice, it is inequitable to make end-users pay for large costs which were not incurred to serve them.

3.2.4 Sector debt

The sector's revenue shortfall is funded by a combination of soft loans (interest free loans) from the GoKR budget, concessional on-lending from international financial institutions (IFIs), and underspending in maintenance and CAPEX.

Energy sector companies' cumulative debt reached KGS 90.7billion in 2016 (19.8 percent of GDP and 32.2 percent of the country's overall stock of public and publicly guaranteed debt).[33] Sector debt has grown quickly (compared to KGS 200 million in 2010), because of large projects, including the Datka-Kemin transmission line and rehabilitation of Toktogul.[34][35] Substantial amounts of soft loans from the budget are required for energy companies to meet their spending needs. In 2015 and 2016, these loans amounted to KGS 42.8 billion and 5.2 billion respectively. Energy companies are unlikely to be able to repay this debt because of the persistent cost-recovery gap. Thus, while energy sector debt currently appears as an asset on Government balance sheets, it may be an asset whose value is ultimately unrecoverable. Energy sector debt for 2014 -2016 is shown in Figure 3.20.

Figure 3.20: Energy Sector Debt (2014-2016)



Source: Ministry of Finance

The sector is also subsidized by implicit means, namely, underspending on maintenance and capital improvements, and accumulation of accounts payable. These indirect means of subsidizing the sector are, in effect, contingent liabilities which will have real consequences in the future as even larger investment will be required to rehabilitate heavily deteriorated assets. However, as discussed in Figure 3.1, these problems are circular and underinvestment is partially the result of low tariff revenues.

3.3 Affordability and Willingness to Pay

Kyrgyzstan's energy tariffs are affordable compared to those of other countries in the region. However, affordability is still a concern for the poorest consumers, especially given that social assistance is currently not well targeted to help the poor afford electricity and heat. Consumer

[33] Ministry of Finance

[34] AKIpress, "Raise of electricity tariffs seen by national energy holding chief as way to resolve energy sector problems, heavy borrowings among them," November 18, 2016. http://akipress.com/news:585300/.

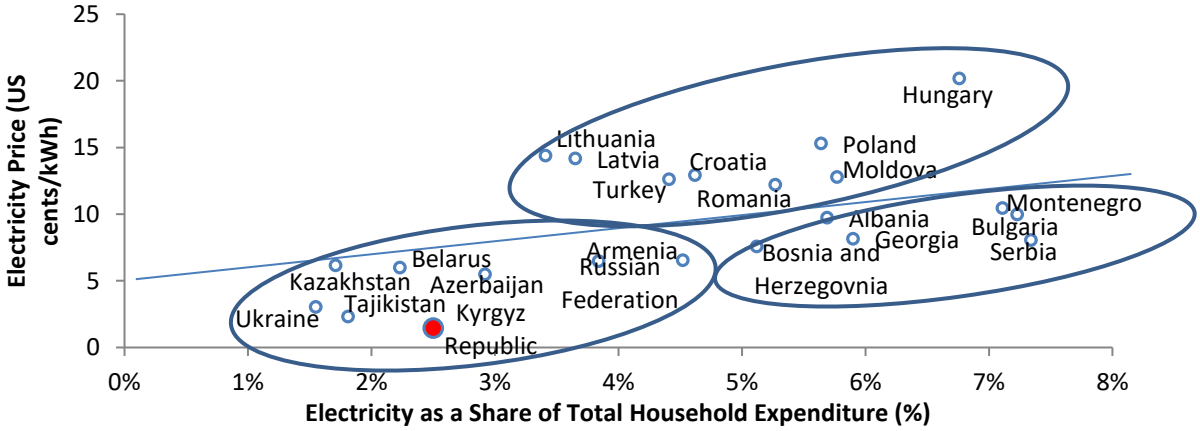
[35] The Datka-Kemin transmission line cost about USD 390 million. The Toktogul rehabilitation is taking place in three parts; the first is financed through a USD 40 million grant and USD 15 million concessional loan from ADB, the second through a USD 44.5 million grant from ADB and USD 165.5 million in loans from ADB and EDB, and the third through a USD 50 million grant from ADB, and USD 100 million in loans from ADB and EDB.

willingness to pay—which is often different than consumer ability to pay—also presents a challenge to sector reform. Opinions of reforms and sector progress appear to be positive, but the public still has conflicting opinions on tariff increases. The following subsections detail the affordability of electricity in comparison to the region, public opinion of reforms, willingness to pay, and the current state of social protection schemes.

3.3.1 Affordability of electricity

Household expenditure on electricity is lower in the Kyrgyz Republic than in most countries in the region (see Figure 3.21). In 2015, households spent between 2.3 and 2.6 percent of their total expenditure on electricity and 6.6 percent on total energy consumption (excluding alternative sources such as firewood).[36] The lowest quintile spent 6.4 percent and the highest spent 7 percent of their total expenditure on energy (see Figure 3.22).

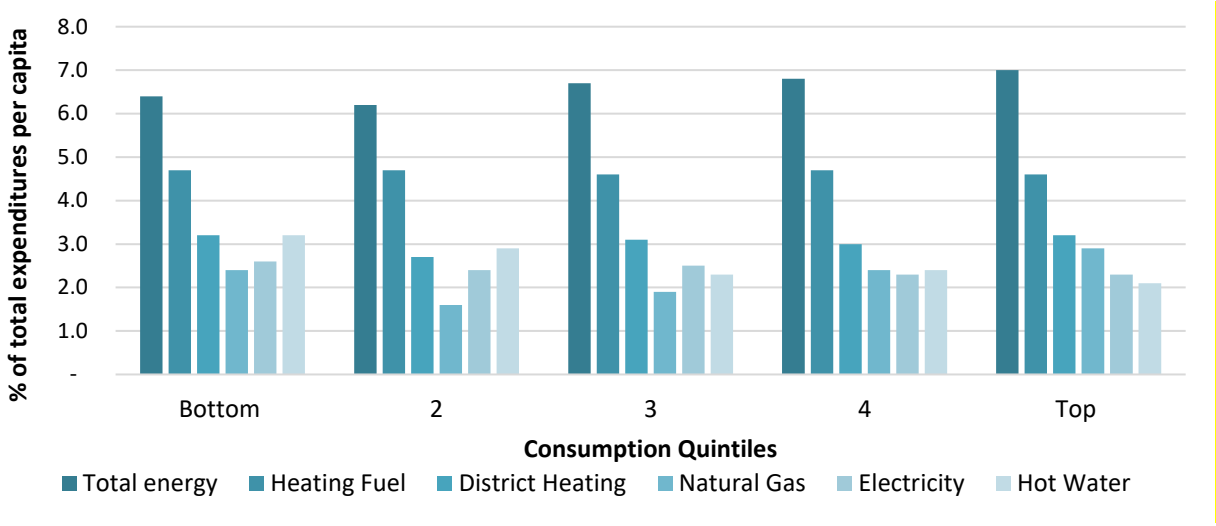
Figure 3.21: Electricity Prices vs. Share of Electricity in Total Household Expenditure



Source: World Bank, "Balancing Act: Cutting Energy Subsidies While Protecting Affordability," 2012. Estimate for Kyrgyz Republic has been updated to reflect 2016 tariff.

[36] World Bank calculations based on Kyrgyz Integrated Household Budget Survey, 2015.

Figure 3.22: Mean Share of Energy Spending in Household Expenditures Per Capita (2015)



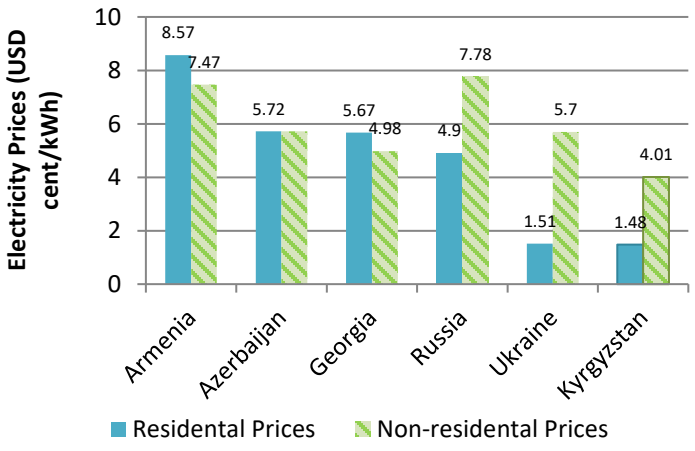
Source: World Bank calculations using Kyrgyz Integrated Household Budget Survey, 2015.

Note: Mean share is for households with a positive expenditure for that energy subcategory. The estimate excludes households with zero spending on a specific energy source. Thus, total mean energy expenditure is not equal to the sum of the individual energy components.

Heating fuel refers mainly to coal but also to other sources such as bottled gas and commercial wood.

The low expenditure on electricity is partially the result of the socially oriented tariff which cross-subsidizes 81 percent of residential consumption (as discussed in Section 3.2.2). Residential tariffs are low relative to the tariffs of other countries in the region and cross-subsidies provided by non-residential consumers are high. Figure 3.23 compares residential and non-residential tariffs for countries in the region. Kyrgyzstan has the second highest percent difference between residential and non-residential prices (residential tariffs are 37 percent of non-residential tariffs), after Ukraine (26 percent). Azerbaijan has identical tariffs for the two groups, and Armenia and Georgia both have residential tariffs that exceed non-residential tariffs.

Figure 3.23: Electricity Tariffs in the Region (2014)



Source: ERRA, "Tariff Database," http://tdb.erranet.org.

Despite the relative affordability of energy in Kyrgyzstan, the poor may still feel impacts from tariff increases. The rural poor population has few sources of cash income, and due to the seasonal incomes of farming, have the lowest income in the winter, when their energy bills are

the highest. The urban poor may face the greatest impacts of increased district heating tariffs, as they face difficulty in substituting electricity for alternative and cheaper sources of fuel, and are subject to pay based on a formula and not on actual consumption (for non-metered consumption), meaning that they may be forced to scale back on other discretionary consumption items (e.g., food, medicines, and other essentials).

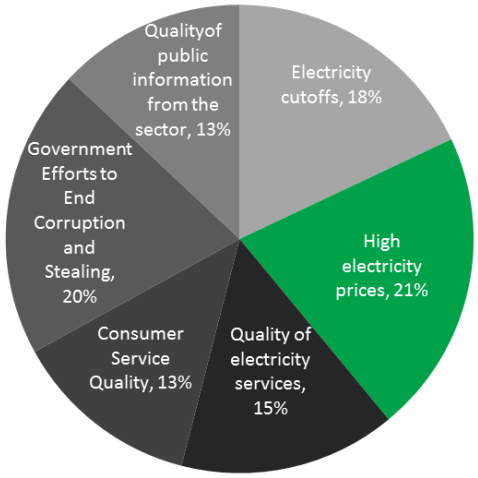
3.3.2 Willingness to pay

There is mixed public opinion on electricity tariff increases, despite the largely positive public opinion on reforms (see Section 2.4). The surveys referenced in Section 2.4, suggest that the public sees the value of reforms, but may not yet be willing to pay more for energy at current service levels. Most respondents to the 2016 public opinion survey (57 percent) felt that tariffs were fair and reasonable. [37] However, when asked how electricity tariffs should be managed, 65 percent said tariffs should be decreased. While the survey did not follow up on why respondents felt that tariffs should be decreased, their answers were likely influenced by one or more of the following factors:

- Poor service quality (as discussed in Section 3.1)
- Concerns about affordability
- The common misconception that hydro generation is cheap so higher tariffs are unnecessary to sustain the sector
- A lack of understanding of why tariffs have been increasing in recent years, when they previously did not increase for long periods of time.

Tariffs are still consumers' top concern for the electricity sector. About 21 percent of survey respondents indicated high electricity prices as a priority area, which the Government should focus on (see Figure 3.24). [38] Tariff concerns were considered a higher priority than corruption, electricity cutoffs, and quality of service (the next highest ranking concerns).

Figure 3.24: Consumers' Opinions on Priority Areas in the Sector



Source: M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

Willingness to pay has been an ongoing challenge for the sector and a key barrier to tariff reforms. In 2009, a unified residential tariff was approved, to be implemented in January 2010. Political unrest followed, and the former Government was removed from power. This precedent has made it politically difficult for subsequent administrations to increase tariffs. In 2016, the President of Kyrgyzstan announced that planned energy sector tariff increases would not occur,

[37] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

[38] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

as it would be wrong to do so in a time of economic crisis. The 2017 Presidential elections may be a deterring factor to further tariff increases in the short-term.

3.3.3 Social protection schemes

The social safety net in the Kyrgyz Republic is extensive, but not well targeted. The country spends an increasingly high proportion of GDP on non-contributory social protection. Expenditures increased from 1.3 percent of GDP in 2008 to 2.2 percent in 2014 (above the ECA regional average of 2 percent).[39] Only one of the social assistance programs—the Monthly Benefit for Poor Families with children (MBPF) —explicitly targets the poor, and it provides inadequate benefits, has leakage problems, and low coverage, with more than 60 percent of children in the poorest quintile not covered. However, the National Social Protection Program 2015-2017 seeks to increase spending on this program.[40]

Other social assistance programs are aimed at certain social categories, such as households with widows or disabled children. Government also implemented a series of measures intended to protect residential customers from a doubling in residential tariffs in December 2009. The tariff increase was rolled back in 2010, but the protection measures remained. The measures include monthly compensation paid to pensioners whose pensions are below 4,000 som. Distributional analysis using 2011 household expenditure data indicates that 50 percent of the benefits were channeled to the richest two quintiles of the population while the remaining 50 percent were roughly evenly spread between the bottom three quintiles. The National Pension System Reform Strategy now in place seeks to improve the program's fiscal stability, coverage, and administrative efficiency.[41] An additional direct subsidy is provided to residents of the settlements around Toktogul reservoir.

Social protections also include a two-tiered electricity tariff for residential consumers, and a higher "socially oriented" cutoff for consumers in mountainous areas, set at 1,000kWh/month (see

Table 3.4). However, as discussed in Section 3.2.2, the social tariff is too extensive, The 700kWh/month threshold exceeds average monthly household consumption (although the average varies by season: 286 kWh/month in the summer and 721kWh/month in the winter of 2016).[42] As a result, this low social tariff disproportionately benefits large consumers, with half of the subsidy accruing to consumers in the top 30 percent of the income distribution. Additionally, the tariff structure is believed to incentivize fraud among small commercial users who reportedly register as residential consumers to receive a lower tariff. The targeting of mountainous areas is also flawed because, despite a higher incidence of poverty in high-altitude

[39] World Bank, "World Bank- Kyrgyz Republic Partnership: Program Snapshot," (April 2016). http://pubdocs.worldbank.org/en/744011461221797191/Kyrgyzrepublic-Snapshot-s2016-en.pdf.

[40] World Bank, "World Bank- Kyrgyz Republic Partnership: Program Snapshot," (April 2016). http://pubdocs.worldbank.org/en/744011461221797191/Kyrgyzrepublic-Snapshot-s2016-en.pdf.

[41] World Bank, "World Bank- Kyrgyz Republic Partnership: Program Snapshot," (April 2016). http://pubdocs.worldbank.org/en/744011461221797191/Kyrgyzrepublic-Snapshot-s2016-en.pdf.

[42] M-Vector, "Survey on Public Awareness of the Energy Sector Reforms in the Kyrgyz Republic," (2017).

areas, most poor and the extremely poor consumers live in densely populated areas in the plains, and therefore do not receive the benefit of the higher threshold.

Table 3.4: Residential Tiered Tariffs (2016)

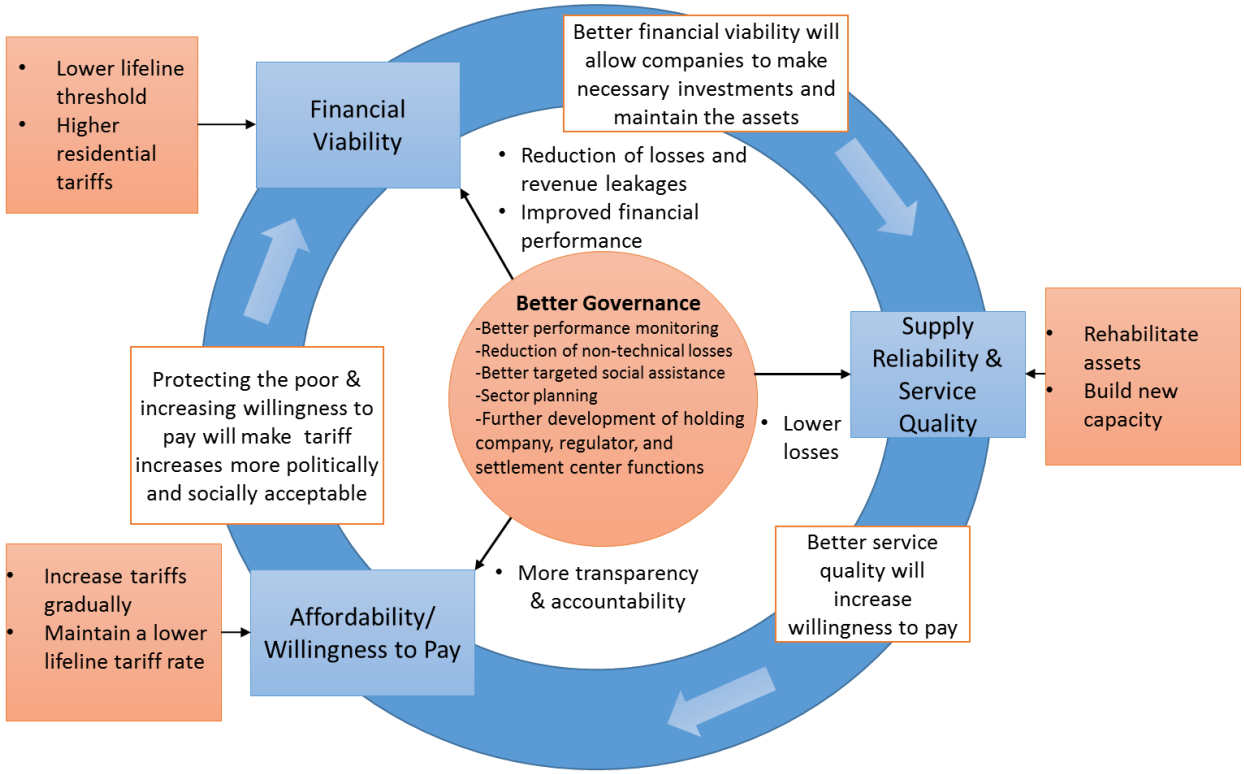
	Residential consumption up to 700 kWh	Residential consumption exceeding 700 kWh	People living at high altitudes and remote inaccessible areas of the Kyrgyz Republic, consumption up to 1,000 kWh	People living at high altitudes and remote inaccessible areas of the Kyrgyz Republic, consumption over 1,000 kWh
Electricity Tariff (KGS/kWh)	0.77	2.16	0.77	2.16

4 Potential Solutions to Sector Challenges

Our recommendations (summarized in

Figure 4.1) focus on addressing the sector's financial, quality of supply, and affordability challenges. Potential solutions to these challenges include continued progress on tariff reforms (described in Section 4.1), prioritization and rehabilitation of new supply (described in Section 4.2), and strengthening of governance and regulation (described in Section 4.3).

Figure 4.1. Impact of Potential Solutions of Sector Challenges



The following section describes potential solutions to each of the principal challenges facing the energy sector. These solutions include continued tariff reform, rehabilitation and prioritization of new supply, and strengthening governance and regulation.

4.1 Solution 1: Continued Progress on Tariff Reforms

Tariff reforms since the adoption of the MTTP 2014 have led to better financial viability of the sector. Revenue is now closer to cost-recovery levels and progress has been made toward reducing the sector deficit. However, to reach cost recovery, additional reforms are necessary. There are two potential tariff reform steps available to address the heavy cross-subsidies to residential consumers: a reduction of the low consumption threshold, and an increase in residential tariffs. These strategies should be combined to achieve the greatest deficit reduction. The following subsections present estimated deficit reductions and the expected affordability impacts of these solutions.

4.1.1 Threshold reduction for socially oriented tariff

The current tariff offers a lower price on residential consumption below 700kWh (as described in

Table 3.4). This socially oriented tariff covers 81 percent of residential consumption (2016), and is therefore excessive to what is necessary for ensuring the affordability of basic needs electricity.[43] In an average month, 86 percent of connections do not exceed this threshold (as of 2014).[44] However, the prevalence of electric heating makes electricity use highly seasonal, resulting in only 66 percent of households consuming at or below the threshold in January, while close to 100 percent consume at or below the threshold in August.

One option for reducing the sector deficit is to lower this high threshold to a level below average consumption, and therefore likely better aligned with the principles of providing affordable access to basic needs while avoiding untargeted over-subsidization. We recommend a threshold of 350kWh (i.e., all residential consumption below 350kWh will be charged at the lowest tariff of 0.77 KGS/kWh). At this threshold, an average of 50 percent of connections consume below the threshold in an average month (vs. 86 percent for 700kWh)[45], and 66 percent of residential consumption would be priced at the social tariff (vs. 81 percent for 700kWh). current and proposed threshold.

Table 4.1 shows the average share of connections with consumption below the current and proposed threshold.

Table 4.1: Share of Connections with Consumption below 350 and 700 kWh (2014 average)

	Below 350 kWh (%)	Below 700 kWh (%)

[43] Basic needs refers to the amount of electricity needed to provide necessities such as light, heating/cooling, and cooking.

[44] World Bank, "Poverty and distributional impact of electricity and heating tariff increases in the Kyrgyz Republic: Analysis based on household survey data," (2016).

[45] World Bank, "Poverty and distributional impact of electricity and heating tariff increases in the Kyrgyz Republic: Analysis based on household survey data," (2016).

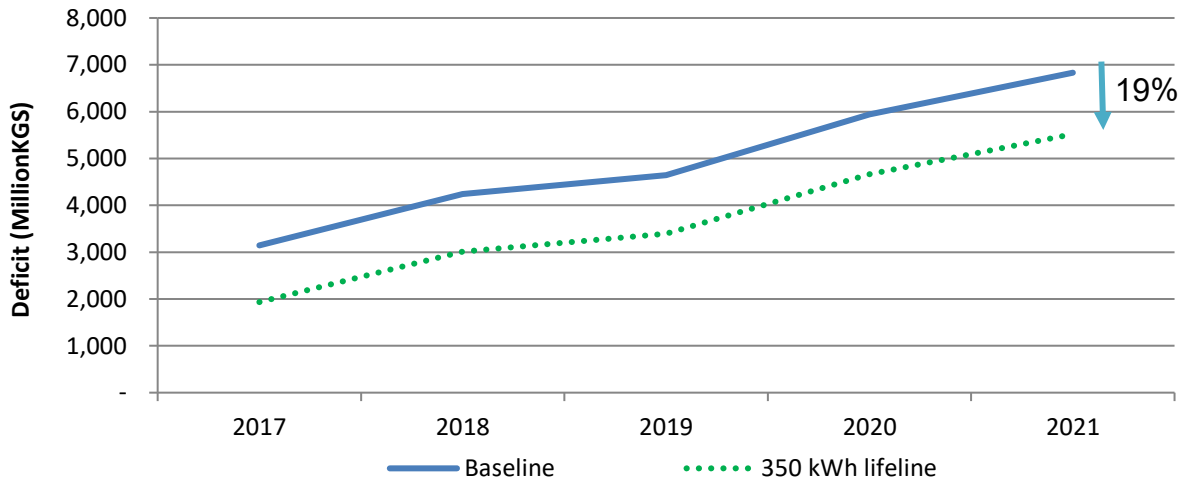
Bishkek	61	85
Other Urban	43	82
Rural	48	87
Total	50	86

World Bank, "Poverty and distributional impact of electricity and heating tariff increases in the Kyrgyz Republic: Analysis based on household survey data," (2016).

This lower threshold option would create an estimated 19 percent deficit reduction, compared to a baseline scenario, leaving a KGS 5.5 billion deficit at the end of 2021, holding all tariffs constant at the 2016 level (see

Figure 4.2).[46]

Figure 4.2: Impact of Social Tariff Threshold Reduction on Electricity Sector Deficit



Source: World Bank estimation using Techno-Economic Indicators

Note: All scenarios assume technical losses gradually reducing to 12% by 2021

The new threshold scenario assumes 34% of residential consumption is over the 350kWh threshold

4.1.2 Residential tariff increase

Combining a reduced social tariff consumption threshold with a tariff increase results in a larger deficit reduction than what can be achieved with the threshold reduction alone. Figure 4.3 shows the impact of decreasing the consumption threshold to 350kWh in 2017, and gradually increasing the residential tariff above the threshold to the forecasted cost-recovery level in 2021 (see Table 4.2 for the tariff path). This option leaves a KGS 5 billion deficit at the end of 2021 (a 27 percent

[46] In the absence of an updated investment plan, all forecasts include assumptions on the timing of generation investments including Bishkek CHP, Uch-Kurgan, and the rehabilitation of Toktogul.

reduction from the baseline scenario).[47] This scenario assumes all other tariffs stay constant at the 2016 level (including those for residential consumption below 350 kWh).

Figure 4.3: Impact of a Tariff Increase and Threshold Reduction on Electricity Sector Deficit

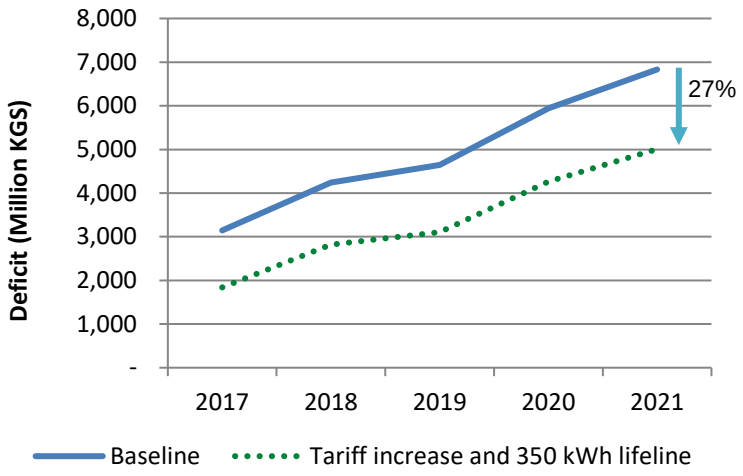


Table 4.2: Tariff Path under Tariff Increase Scenario

Year	Residential Tariff, over 350kWh (KGS/kWh)
2016	2.16
2017	2.21
2018	2.26
2019	2.31
2020	2.36
2021	2.41

Source: World Bank estimation using Techno-Economic Indicators

Note: All scenarios assume technical losses gradually reducing to 12% by 2021

The new threshold scenario assumes 34% of residential consumption is over the 350kWh threshold

In the absence of an updated investment plan, forecasts include assumptions on the timing of generation investments including Bishkek CHP, Uch-Kurgan, and the rehabilitation of Toktogul

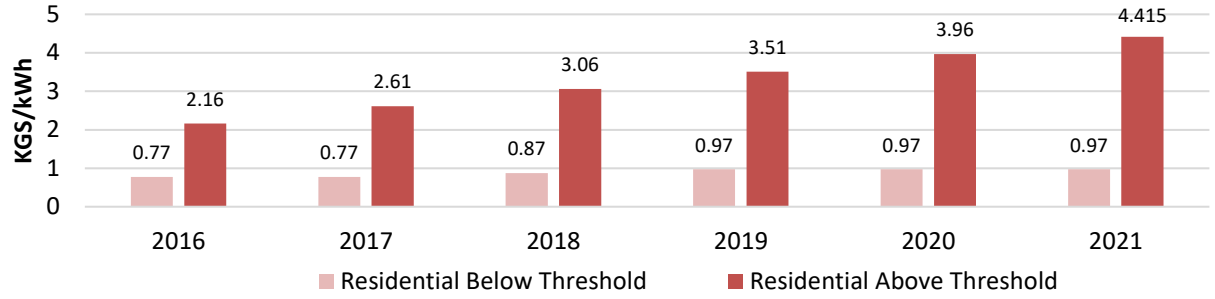
4.1.3 Full cost recovery scenario

If costs are to be fully recovered by 2021 (which should be the goal of the new MTTP), one option is to reduce the social tariff consumption threshold and increase tariffs both above and below that threshold. In this scenario, we propose the same threshold change to 350kWh, along with a gradual increase in the tariff below that threshold to 0.97KGS/kWh. This level was originally proposed in the MTTP2014, was later revised to 0.88, and that revision was never implemented. To ease into this change, we recommend an increase to 0.87 the year after the threshold change, followed by an increase to 0.97 in the next year (and no further increases through 2021). This tariff is still well below the residential cost of service estimated for 2021 (2.41 KGS/kWh). Leaving the non-residential tariffs at the 2016 level, there is still a cross-subsidy provided to residential consumers, given that the 2016 non-residential tariff is above the estimated cost of service for non-residential consumers in 2021. This cross-subsidy covers a portion of the deficit incurred because of the below cost-recovery social tariff. To compensate for the remainder of the deficit

[47] A deficit still exists due to below cost-recovery tariffs for residential consumers below the threshold, pumping stations and the Toktogul district.

caused by the social tariff (along with the much smaller subsidies provided to the Toktogul district and pumping stations), we recommend an increase in the residential tariff above the threshold. Figure 4.4 shows the proposed tariff path. This scenario leaves no estimated deficit in 2021. While we recognize that this scenario may be politically difficult, it is important for the sector to strive for cost recovery. An impact analysis of these and/or other proposed scenarios will help to determine what is possible in terms of a cost recovery timeframe, and how best to get there.

Figure 4.4: Tariff Path for the Full Cost Recovery Scenario



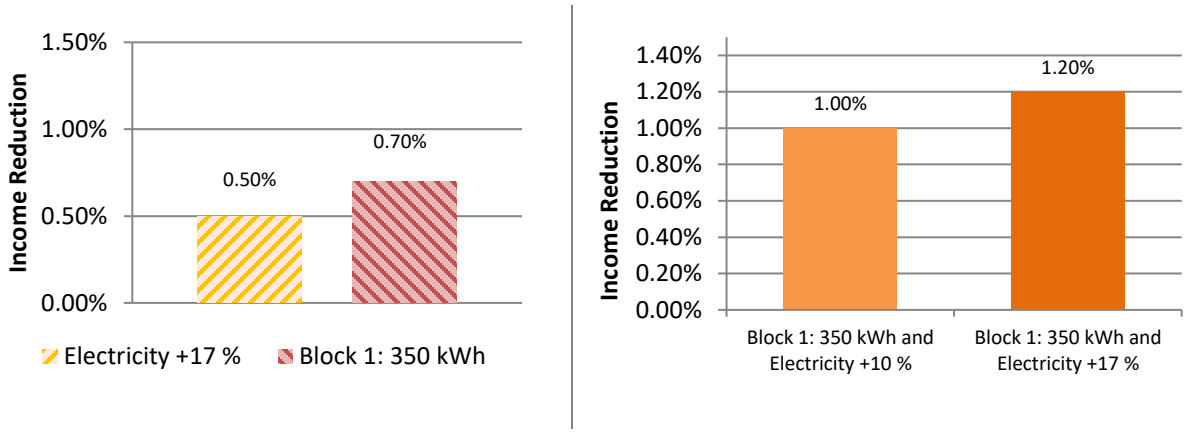
Source: World Bank estimation using Techno-Economic Indicators

4.1.4 Impacts of tariff and threshold adjustments on affordability

Tariff increases and a reduction of the low consumption threshold may not have significant impacts on household income, in part because tariffs are currently very low. A threshold decrease to 350 kWh in combination with a 17 percent tariff increase is estimated to only result in a 1.2 percent income reduction for households on average. Figure 4.5 and Figure 4.6 show the income reduction under separate and combined tariff increase and threshold reduction scenarios.

Figure 4.5: Income Reduction under Residential Tariff Increase or 350 Threshold

Figure 4.6: Income Reduction under Residential Tariff Increase and 350 Threshold



Source: World Bank, "Poverty and distributional impact of electricity and heating tariff increases in the Kyrgyz Republic: Analysis based on household survey data", (2016).

Genuine lifeline tariffs are common and while they provide benefits to all residential consumers, rather than focusing on the poorest and most vulnerable consumers, it is still the best option available in many countries with limited social safety nets and administrative capacity. In the face of the limited coverage of existing social protection programs, a lower lifeline threshold level will allow continued protections for the poor while lessening benefits for the wealthy and the financial burden on the sector.

4.2 Solution 2: Prioritization and Rehabilitation of New Supply

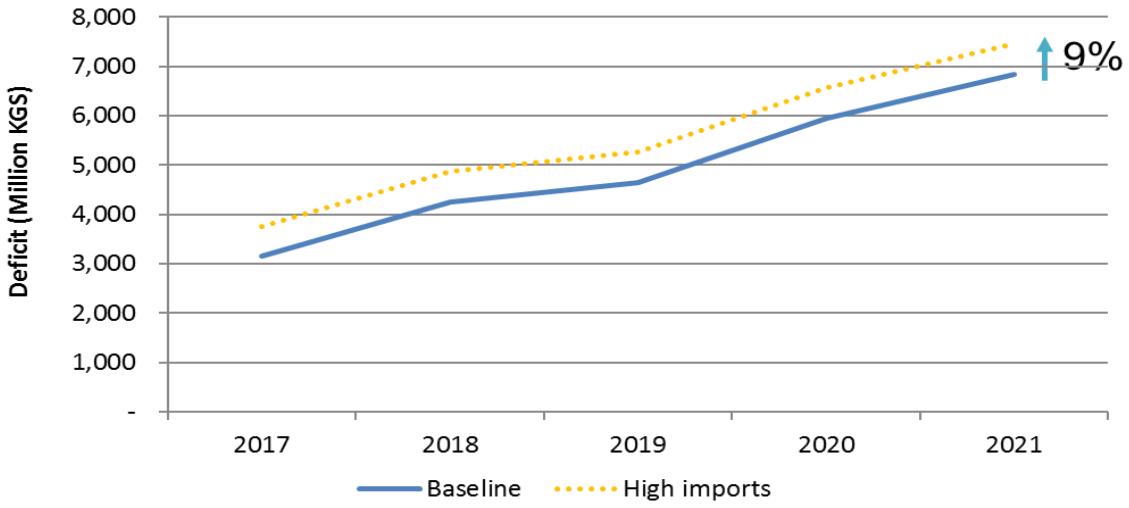
Progress has been made in the rehabilitation of old generation assets (including the Bishkek CHP and Toktogul). However, demand is growing and new supply is needed to avoid costly imports. In addition to continued rehabilitation, we recommend planning for new generation investments, and continuing and expanding upon ongoing loss reduction measures.

4.2.1 Addition of supply to meet the demand gap

It will be important to think about how to meet future demand in a cost-effective manner. The dry year in 2015 resulted in high imports and a spike in the sector financial deficit. If imports return to the level they were at in 2015, the result is an estimated 9 percent increase in the deficit by 2021 over the baseline scenario (see

Figure 4.7).

Figure 4.7: Impact of Imports on the Electricity Sector Deficit



Source: World Bank estimation using Techno-Economic Indicators

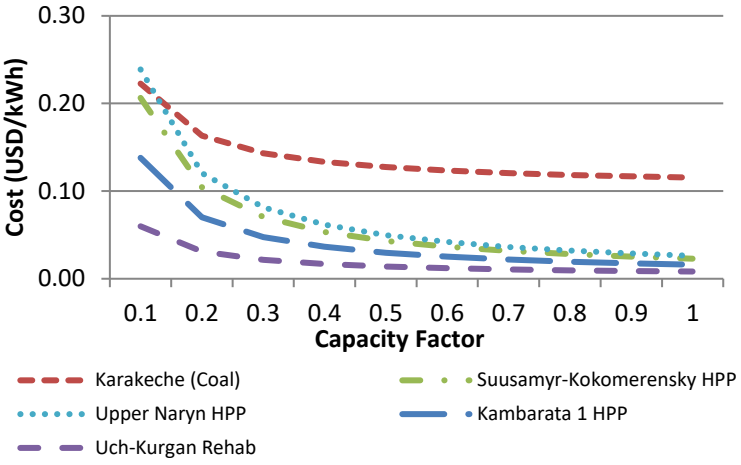
Note: The baseline assumes imports at 2014/2015 average price and level; high imports assume import volumes and prices at 2015 level.

All scenarios assume technical losses gradually reducing to 12% by 2021

In the absence of an updated investment plan, forecasts include assumptions on the timing of generation investments including Bishkek CHP, Uch-Kurgan, and the rehabilitation of Toktogul

To avoid this high import scenario, there are several opportunities to expand supply, including a mix of new plants and rehabilitation of existing ones. Figure 4.8 shows the levelized cost of supply for five prospective sources of new generation.[48] Rehabilitation projects (such as the Uch-Kurgan rehabilitation) are generally lower cost than new plants. Hydropower projects (such as Suusamyr-Kokomerensky, Upper Naryn, and Kambarata 1) are also generally lower cost than thermal plants (such as Karakeche), in economic terms. Other sector challenges also need to be considered in combination with finding least-cost solutions. For example, seasonality of plant operation will impact the winter peaking problems. Hydro plants, although lower cost, may not entirely solve this problem. It is important for Kyrgyzstan to have a current power sector investment plan and financing plan, which outlines the new and rehabilitated sources of supply that will be utilized to meet forecasted demand.

Figure 4.8: Levelized Economic Cost of Supply



Source: World Bank estimation

Note: LECs assume a 5% social opportunity cost of capital and 40 year asset life for each plant. The cost of the coal plant is also assumed to include CO_2 emissions costs of US$0.09/kWh

4.2.2 Loss reduction

It is difficult to know what proportion of losses in Kyrgyzstan's energy system are technical or non-technical, due to a lack of metering. While we assume that the poor condition of assets is the major driver of losses (a reasonable assumption given their age and the inadequate spending on maintenance), it is also possible that a portion of losses are due to corruption and theft from households. Loss reduction strategies, such as improved metering and recordkeeping will help to reduce these kinds of losses.

Some distribution companies have already taken steps to reduce losses through metering. SE and VE (VostokElectro) have installed smart meters. SE is seeing positive results, and has reduced losses at 0.4 kV overhead lines to 5.5 percent and below in areas which received smart meters in 2013. As of 2016, SE had installed 115,000 smart meters, and physical losses were reduced to 11 percent (down from 23 percent in 2012) in the affected areas.[49] VE is in the process of taking on similar loss reduction measures, including the installation of advanced meters and the

[48] See Appendix E for inputs to this LCOE calculation

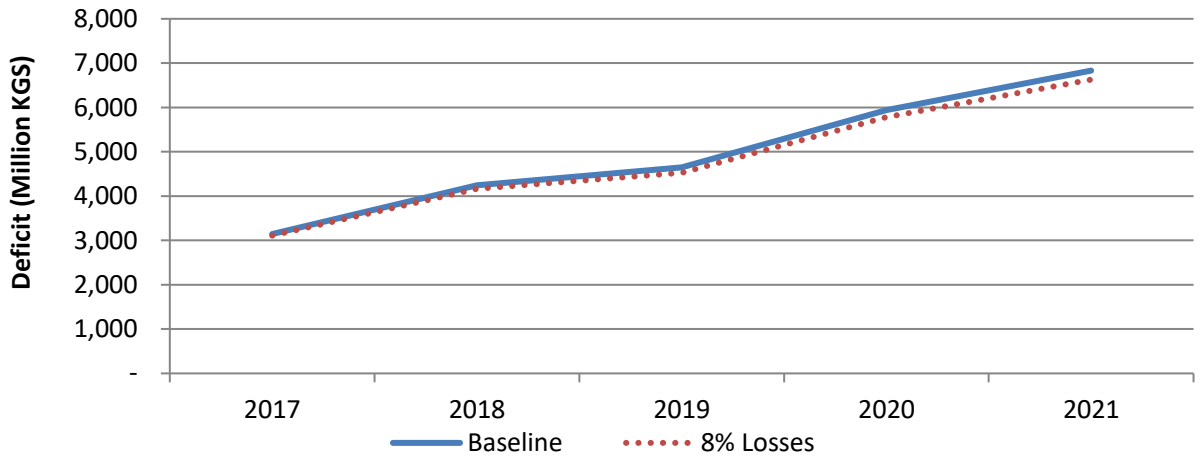
[49] KfW, "Advanced Measures Severelectro Distribution Network Improvement Bishkek (BMZ 2004 66 029) Efficiency Improvement of the Power Distribution Sector (BMZ 2007 65 685)," (2016).

rehabilitation and modernization of low and medium voltage distribution networks.[50] Even after the completion of this project, however, VE's losses may still be high due to the impact of extreme temperature fluctuations on equipment.

Although loss reduction is necessary to reach cost recovery, loss reduction efforts alone are not sufficient to dramatically reduce the deficit. Even if technical losses could be gradually reduced to 8 percent by 2021, there could still be an estimated deficit of KGS 6.6 billion in the electricity sector. This is only a 3 percent reduction compared to 6.8 billion under the baseline scenario with losses reduced to 12 percent by 2021 (see

Figure 4.9). The best method to reduce the deficit would be to combine loss reduction strategies with additional tariff reforms (that is, lowering the threshold and increasing residential tariffs). Substantial loss reduction may even require tariff increases, as this rehabilitation and smart metering is expensive. According to Deputy Ekmat Baybakpaev, automated electricity metering control systems are costly and will take 20-26 years to introduce to Kyrgyzstan; SE alone spent more than USD 6 million on this equipment.[51] The head of the NEHC has stated that an increase in tariffs is the only way to upgrade equipment and reduce losses.[52]

Figure 4.9: Forecasted Deficit under Loss Reduction Scenarios



Source: World Bank estimation using Techno-Economic Indicators

Note: The baseline scenario assumes technical losses gradually reduce to 12% by 2020

In the absence of an updated investment plan, forecasts include assumptions on the timing of generation investments including Bishkek CHP, Uch-Kurgan, and the rehabilitation of Toktogul

[50] Contracts for this work are expected to be tendered through EBRD in the second quarter of 2017.

[51] Kostenko, Julia. "Introduction of smart meters to take 26 years in Kyrgyzstan," January 24, 2017. http://eng.24.kg/vlast/183864-news24.html.

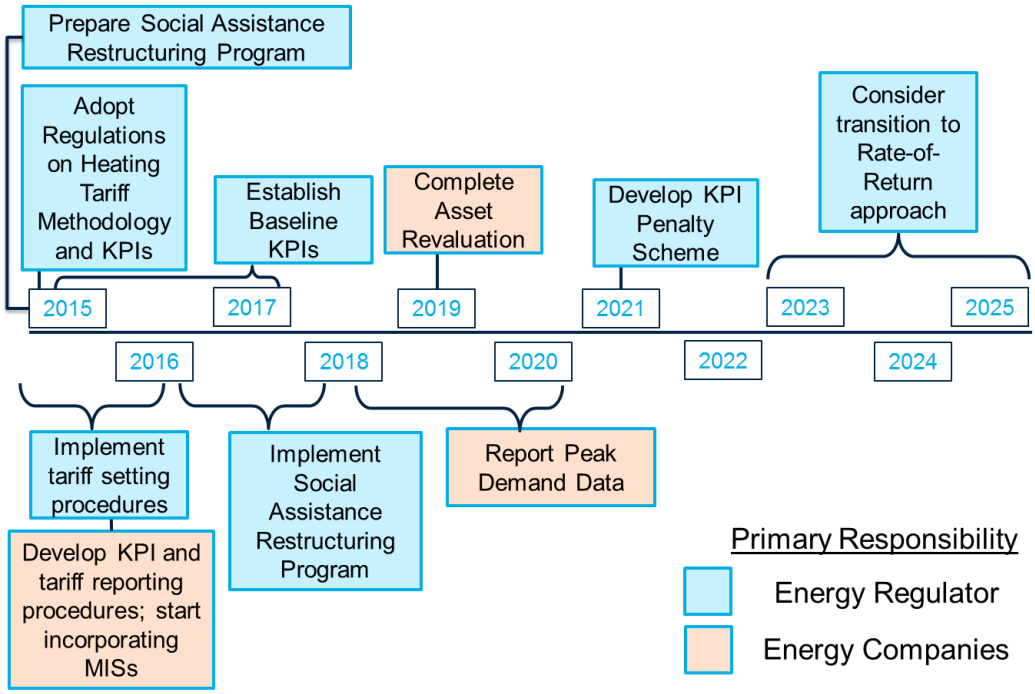
[52] Vesti.Kg

4.3 Solution 3: Strengthening Governance and Regulation

In the World Bank report on the state of the sector in 2015, an action plan for the Regulator and energy companies was recommended (see

Figure 4.10). Some of these recommendations have been adopted, such as the implementation of heating tariff setting procedures, the development of key performance indicators (KPIs) procedures, and the beginning of collecting KPI data. These reforms have had varying degrees of success. Tariff setting procedures and KPI procedures both occurred on schedule. However, KPI implementation has not yet yielded reliable data; compiling the first results may require more time and training of the companies. There have also been some policy updates regarding social assistance. The Program on development of social protection of the population of the Kyrgyz Republic for 2015-2017 (approved 2015 and amended 2016), identifies a need to protect low income groups (pensioners, people with special needs, families who have experienced the loss of the breadwinner, and families with children) from electricity and heating tariff increases, and to improve the housing subsidy mechanism and its dissemination in all regions of the country.[53] However, it is unclear how much progress has been made in improving this mechanism.

Figure 4.10: 2015 Recommendations for the Sector



To further strengthen governance and regulation, we recommend the following actions at the economy, sector and regulatory levels:

[53] Government of Kyrgyz Republic, "Program of development of social protection of population of the Kyrgyz Republic for 2015-2017 years," amended October 14, 2016. http://cbd.minjust.gov.kg/act/view/ru-ru/97348.

Economy level

- Currently the primary means of assistance for the poor in attaining electricity is the socially oriented tariff. While we have suggested a medium-term solution to improve the current threshold for this socially oriented tariff, there is also a need for a more targeted subsidy mechanism for vulnerable households. This sector challenge is part of the broader economy-wide problem of minimal and poorly targeted social assistance (as discussed in Section 3.3.3). Short-term efforts could be devoted to strengthening the MBPF program and rationalizing and scaling-back the categorical benefits. In the short- to medium-term, (in addition to improving the socially oriented tariff) a mechanism could be developed to smooth energy payments annually, and prevent expensive bills in winter months. In the longer term, the social protection system should move away from categorical benefits, and focus on supporting the vulnerable and poor. The social protection system could gain efficiency by simplifying the current system of top-ups and small programs that are costly to administer.

Sector level

- There is a need for in-depth sector planning to address the growing winter demand gap. Medium to long-term planning should include a least-cost generation plan and transmission and distribution plans.
- The NEHC should implement international financial reporting standards and undergo an unbundling of accounts across generation sources/stations.
- The settlement scheme currently provides a disincentive for distribution companies to reduce losses and does not motivate managers to improve financial discipline and duly implement commercial contracts. The implementation of bilateral contracts is almost impossible without administrative pressure/involvement of the Regulator. In the absence of financial discipline, enforceability of commercial contracts in the power sector is problematic. Kyrgyzstan can improve the settlement scheme by drawing on international best practices, and regional success stories. Armenia provides a relevant example of an energy sector with high losses, that were dramatically reduced through a series of changes in sector governance combined with improved metering (See Box 2).
- In the long-term, the sector could work toward the gradual introduction of competition. This competition could first occur in generation then in retail.

Regulatory level

- The development and adoption of the MTTP 2018-2021 is vital for the continuation of cost recovery objectives. The first step in this process is the development of a regulatory impact assessment (planned to be completed May 2017). This will be followed by an MTTP proposal (planned to be completed by the third quarter of 2017). Public outreach will be the next important step, as the Government fears political backlash from raising tariffs, given the public perception of sector mismanagement, and the reality of service that is still unreliable. Outreach efforts must show the linkages between higher tariffs, better sector management and stronger protection of the poor and vulnerable.

- There have not yet been results from the implemented KPIs. The KPIs require continued enforcement and additional training.
- The introduction of an independent Regulator has been a positive step for the sector. In 2014, amendments were made to the Energy Law and Electricity Laws (including the establishment of the Regulator) but not all proposed amendments were approved. The amendments, which would be beneficial to the sector but which have not yet been approved, include an independent source of funding for the Regulator, protection from arbitrary changes in leadership, and authority to enforce decisions. Potential next steps include: the modification of existing laws and regulations to provide clarity, predictability, transparency, autonomy and competency; an entirely new law on electricity that can consider the needs and complexities of a modern state of the power sector; or the addition of a separate law on energy sector regulation.
- The NEHC requires a more clearly defined structure, objectives, and clearly outlined functions and responsibilities.

Box 2: Loss Reduction Case Study: Armenia

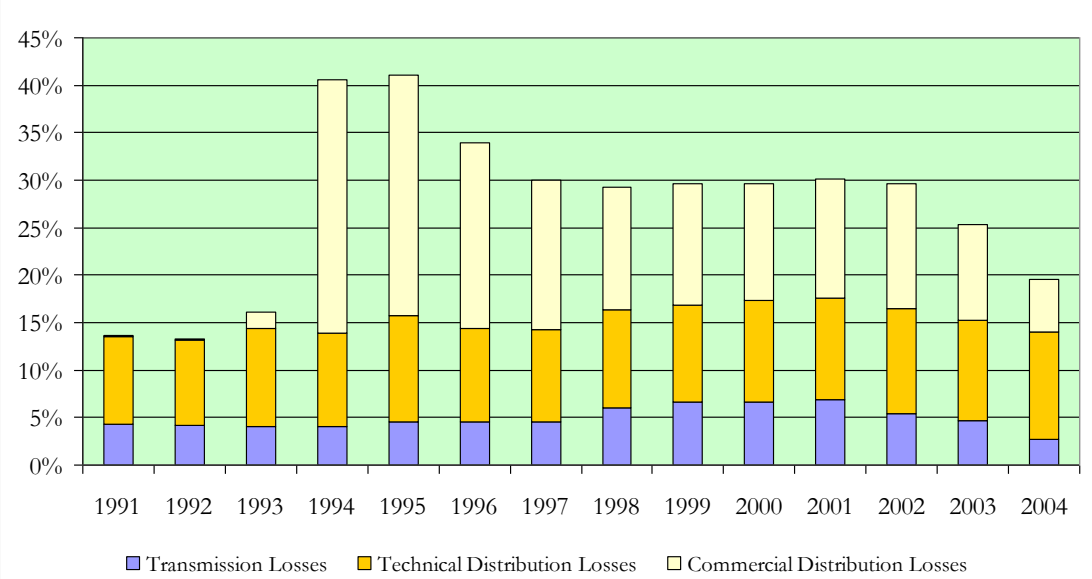
Loss reduction measures have been an effective tool to improve financial stability in Armenia

Electricity Network of Armenia increased collections from 81 percent to nearly 100 percent, and reduce commercial losses from 12percent to 4percent from 2001 to 2004. Loss reduction efforts included:

- Relocation of existing meters from apartments to public areas, and installation of new meters
- Installation of AMDAS and customer information systems
- Variable salaries based on improvements in losses and collections

The sector's annual deficit has been eliminated, and the sector has become one of Armenia's largest sources of tax revenue.

Figure 4.11: Loss Reduction in Armenia



Source: Sargsyan, Gevorg; Balabanyan, Ani; Hankinson, Denzel. 2006. From Crisis to Stability in the Armenian Power Sector : Lessons Learned from Armenia's Energy Reform Experience. World Bank Working Paper No. 74. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/6987 License: CC BY 3.0 IGO.

Appendix A: Functions of Bodies Within the Energy Sector

Body	Functions within the Sector
State Committee on Industry, Energy and Subsoil Use	Sets policies on energy resource use Assists with energy development strategies, interstate programs and agreements Registers sites, holds tenders, and assists in land allocation decisions for small hydro projects
State Regulatory Agency for the Energy Sector	Sets tariffs Licensing Dispute resolution Sets the proportion of cash to be paid out of the RSK transit accounts to power companies
State Inspectorate for Environmental and Technical Safety	Supervises compliance with safety requirements, land legislation requirements, and technical requirements
Kyrgyz Electricity Settlement Center	Data collection and verification Provision of data to the Regulator, for proportional allocation of RSK funds to power companies
National Energy Holding Company	Open joint stock company, which was transferred the state shares of energy companies in 2016 Serves on the Board of Directors of the subsidiary companies, which is responsible for appointing the Managing Director of the Operating Company and members of the Company's Executive Board, approving Subsidiary Company strategies, setting targets and KPIs, and monitoring progress Internal auditing

Appendix B: MTTP Revisions

The MTTP 2014 set out tariffs for 2014-2017 as listed in Appendix Table B.1. This plan then underwent revisions both in the timing and value of tariff changes. The average MTTP 2014 values for each year, along with revision values for subsequent iterations of the policy are described in

Appendix Table B.2.

Appendix Table B.1. MTTP 2014

Consumer groups	Unit	Before Increase	1-Dec-14	1-Apr-15	1-Apr-16	From April 1, 2017
Residential consumption less than 700 kWh/month	KGS/ kWh	0.700	0.700	0.840	1.008	1.210
Increase	%		0%	20%	20%	20%
Residential consumption above 700 kWh/month	KGS/ kWh	0.700	WAT (1.203 + import price)	WAT (1.287 + import price)	WAT (1.377+ import price)	WAT (1.474+ import price)
Increase	%		72%	7%	7%	7%
Budget-funded consumers, agriculture, industry, and other consumers	KGS/ kWh	1.327	WAT (1.380 + import price)	WAT (1.477 + import price)	WAT (1.580+ import price)	WAT (1.691 + import price)
Increase	%		4%	7%	7%	7%
Pumping facilities	KGS/kWh	70	0.728	0.779	0.833	0.892
Increase	%		4%	7%	7%	7%

Source: The Government of the Kyrgyz Republic, "On approval of the Medium-term tariff policy of the Kyrgyz Republic for electric and thermal energy, 2014-2017," November 20, 2014.

Appendix Table B.2. MTTP 2014 and MTTP Revisions

	Residential up to 700 kWh	Residential more than 700 kWh	Non-residential
MTTP 2014*			
2014	0.70	0.75	1.33
2015	0.81	1.37	1.55
2016	0.97	1.36	1.56
Revisions (effective date)			
September 1, 2014	0.70	0.70	1.38
December 11, 2014	0.70	2.05	2.19
January 1, 2015	0.84	2.05	2.19
February 1, 2015	0.84	1.82	1.97
August 1, 2015	0.84	1.28	1.47
August 1, 2016	0.93	1.37	1.58

*Values represent yearly averages where more than one rate was designated within a year (weighted by the number of days the rate would be in effect).

Sources: MTTP 2014 averages are a World Bank calculation. MTTP revised tariff values were provided by the Regulator.

Appendix C: Cost Allocation Assumptions

EPP is a provider of both electricity and heat/hot water. However, techno-economic indicators do not differentiate costs between these functions. Therefore, we have developed the following methodology to allocate EPP costs between electricity and heat.

- First we allocate each expense line item to HPP, CHP, or Admin based on cost allocation proportions in 2013 (the most recent year for which there is data at this level of detail).
- HPP costs were then allocated entirely to electricity.
- CHP variable costs (except fuel) were allocated between heat and electricity based on proportions of total CHP generation. In 2016, 55 percent of these costs were allocated to heat and 45 percent to electricity.
- CHP fuel costs were allocated according to the percent of fuel consumption used for electricity and heat, found in the CHP TEIs. These percentage allocations reflect the two different modes which the CHP can operate in: thermal and condensation. In thermal operation, excess generation and discharge/condensation of heat is avoided. Therefore, thermal energy is the main product of the plant, and electricity is a by-product. This regime would be reflected by a high fuel allocation to heat and a low allocation to electricity. In condensation operation, the plant has a higher than optimal level of power generation, in order to produce more electricity (resulting in wasted heat). In recent years, the CHP has had to run in the condensation regime to make up for a shortfall in the storage level at Toktogul. This regime is reflected by a low fuel allocation to heat and a high allocation to electricity. The fuel allocations to electricity and heat for 2014-2016 (and the forecast for 2017) are shown in Appendix Table C.1.

Appendix Table C.1. Fuel Cost Allocation

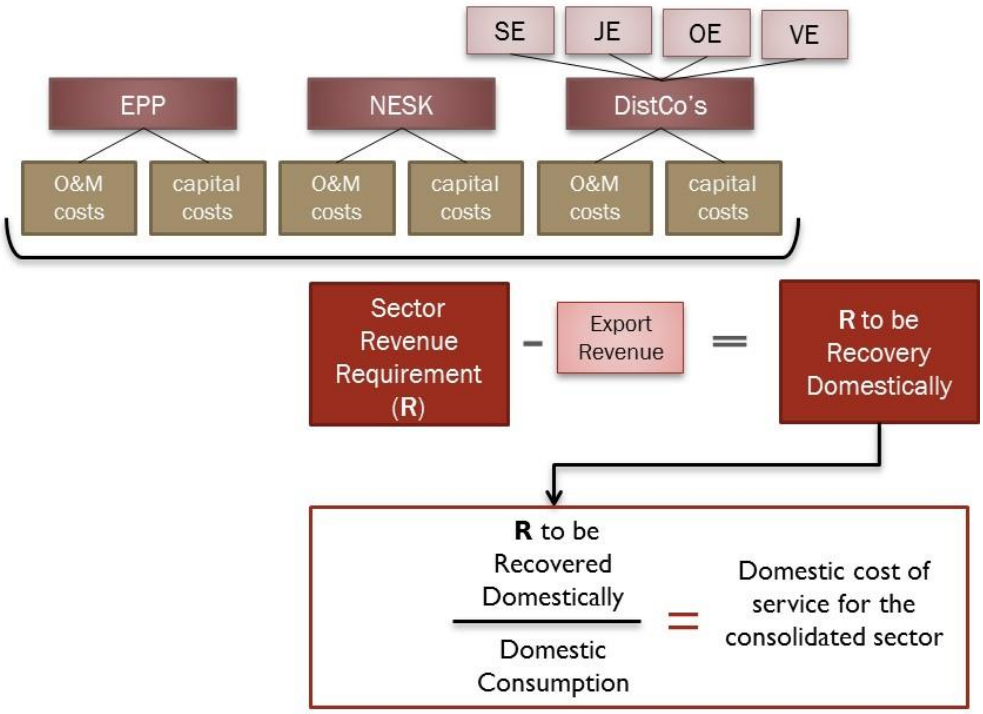
	Electricity	Heat
2014	57%	43%
2015	70%	30%
2016	69%	31%
2017 (Forecasted)	44%	56%

- Fixed CHP costs were allocated based on proportions of total installed CHP capacity for heat and electricity. In 2016, 72 percent of these costs were allocated to heat and 28 percent were allocated to electricity.
- Variable admin costs were allocated between heat and electricity based on proportions of total generation. In 2016, 15 percent of these costs were allocated to heat and 85 percent were allocated to electricity. Fixed admin costs were allocated based on proportions of total installed capacity for heat and electricity. In 2016, 14 percent of these costs were allocated to heat and 86 percent were allocated to electricity.

Appendix D: Cost of Service Analysis

To assess the cost of electricity service in the Kyrgyz Republic, the revenue required to cover all electricity-related costs was calculated, including operating and maintenance (O&M) and capital costs, for each sector entity. Then the total costs for the consolidated sector were calculated by combining the revenue requirements for individual companies. Revenue from exports was then deducted from total sector costs to arrive at the revenue requirement that must be recovered from domestic customers after the cross-subsidy from exports. The revenue requirement to be recovered from domestic customers was then divided by total domestic consumption to calculate the cost of service per kWh for the consolidated sector. Appendix Figure D.1: demonstrates this calculation.

Appendix Figure D.1: Cost of Service Calculation



The following subsections describe the specific sources and methods used to estimate historic and future O&M costs, capital costs, and domestic and export demand.

Operating and Maintenance Costs

For 2014 to 2016, the Note used actual O&M costs by company as reported in the Technical and Economic Indicators provided by the Regulator. To forecast O&M costs and also adjust these costs to reflect an appropriate level of maintenance and repairs required to restore each company's assets to its design specifications and maintain them at that level, the following assessments were completed:

- First, O&M costs for future years were forecasted based on historic values and adjusted for inflation based on IMF projections.[54] For variable costs, such as material costs, an average historic unit cost per kWh was first calculated and these costs were forecasted based on projected inflation growth rates. This ensured that total variable cost would grow based on inflation and demand. For fixed costs, such as salaries, social benefits, and other cost, which do not change significantly with incremental growth in demand, total costs were forecasted using inflation growth rates. Appendix Table D.1 contains the major categories of O&M costs.

Appendix Table D.1. Major Categories of Operating and Maintenance Expenditures

Variable O&M Costs	▪ Material costs, including: – production, maintenance and delivery services – auxiliary materials – fuel for technological purposes – fuels and lubricants – electrical energy – thermal energy
Fixed O&M Costs	▪ Salaries ▪ Contributions to the Social Fund ▪ Other costs ▪ Repairs ▪ Costs of housing and utilities ▪ Transmission expenses

Capital Expenditures

We used the "debt service" and "capital expenditures" categories of the Technical and Economic Indicators for each company as the basis for the capital expenditure (CAPEX) portion of the average cost of service from 2014 to 2016. We projected CAPEX for 2017 to 2020 in two ways:

- **Debt service on existing loans**. Future debt service on existing loans is calculated using the debt repayment schedule provided by the MoE.
- **Debt service on new investments.** Debt service on new investments is calculated based on the financing terms in the investment plans provided by the companies. When financing terms were not available, the Note assumed an interest rate of 2 percent, with a maturity and grace period of 25 years and 5 years, respectively.[55]

The calculation of debt service on future investments includes investments specifically identified by the transmission and distribution companies as well as additional loans for rehabilitation that are known to be needed by the companies in the coming years. Generation

[54] International Monetary Fund (IMF), "World Economic Outlook (WEO) Database," January 2017, http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/download.aspx.

[55] This assumption is based on standard IDA financing terms for the Kyrgyz Republic, effective as of July 1, 2011.

investments include Bishkek CHP, Uch-Kurgan, and Toktogul. It is important to note that capital improvements to rehabilitate existing assets were estimated as the depreciation charge on the revalued asset base (see description in O&M costs) and so were not double counted as CAPEX.

Domestic and Export Demand

Actual consumption as stated in the Technical and Economic Indicators for 2014 to 2016 was used as the basis for historical demand. There are demand forecasts developed for the Kyrgyz Republic- the 2012 CAREC Report by Fichtner, the 2011 CASA 1000 Report by SNC Lavalin, the 2010 CAPS Report by Mercados and forecasts developed by the generation company (EPP) and the transmission company (NESK) in order to project consumption.[56] The 2012 CAREC Report was used as the basis for many of the assumptions about demand growth because of the comprehensive methodology and detailed results of its analysis. Appendix Table D.2 contains key assumptions of the demand forecast for 2017 to 2020 that are based on assumptions used in the 2012 CAREC Report.

Appendix Table D.2. Key Demand Forecast Assumptions

Demand Forecast Component	**Assumptions**	
GDP Growth	2012-2014: 2015: 2016-2030:	6% annually 5% 4% annually
Income elasticity of demand	2012-2015: 2016-2020: 2021-2030:	70% 60% 50%
Price elasticity of demand	2012-2020: 2021-2030:	-15% -20%

[56] Fichtner, "Central Asia Regional Economic Cooperation: Power Sector Regional Master Plan," The Asian Development Bank, October 2012;

SNC Lavalin International Inc, "Central Asia-South Asia Electricity Transmission and Trade (CASA 1000) Project Feasibility Study Update," The World Bank, 2011.

Mercados: Energy Markets International, "Load Dispatch and System Operation Study for Central Asian Power System," The World Bank, 2010;

Appendix E: LCOE Inputs for New and Rehabilitated Generation

Plant name	Technology	Net capacity (MW)	Fuel cost ($/kWh)	Capital cost ($/KW net)	Fixed O&M ($/kW-year)	Years of construction
Karakeche (Coal)	Coal	600.0	0.1	1297	25	3
Upper Naryn HPP	Hydro	237.7	0.0	3058	15	4
Suusamyr-Kokomerensky HPP	Hydro	1305.0	0.0	2605	15	4
Kambarata 1 HPP	Hydro	1860.0	0.0	1570	15	6
Uch-Kurgan Rehab	Hydropower	220.0	0.0	590	15	2