



# Power Sector Policy Note for the Kyrgyz Republic

Final Report

**April 2014**



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## Abbreviations

ADB	Asian Development Bank
BAU	Business-as-usual
CHPP	Combined heat and power plant
ECA	Europe and Central Asia
EPP	Electric Power Plants (generation company)
ERP	Enterprise resource planning
GDP	Gross domestic product
GWh	Gigawatt-hour
HPP	Hydropower plant
IFIs	International financial institutions
JE	Jalalabatelectro (distribution company)
KPI	Key performance indicator
LICs	Large industrial customers
MBPF	Monthly Benefits for Poor Families with Children
MW	Megawatts
NESK	National Electricity System of Kyrgyzstan (transmission company)
O&M	Operating and maintenance
OE	Oshelectro (distribution company)
QFD	Quasi-fiscal deficit
SE	Severelectro (distribution company)
USD	United States Dollar
VE	Vostokelectro (distribution company)



# 1 Introduction

This Power Sector Policy Note analyzes the principal challenges in the power sector of the Kyrgyz Republic and identifies possible solutions for overcoming them. To inform the analysis, the Note describes historical operational and financial performance of the power sector companies between 2007 and 2012, and projects performance until 2030. It also describes the legal, regulatory and institutional arrangements in the sector, and compares the arrangements in the Kyrgyz Republic to those in other countries' power sectors. The Note relies on discussions with, and data provided by key stakeholders, including the power companies, the Ministry of Energy and Industry and the Regulatory Department under the Ministry of Energy and Industry.

The analysis in the Note is targeted to inform, and support for the on-going reform efforts of the Government of the Kyrgyz Republic in the power sector. In 2012, the Government approved the Power Sector Development Strategy outlining key medium-term reform objectives for the sector, and in 2013 it approved the Action Plan for Reforming the Power Sector to operationalize the Strategy. The engagement of the World Bank and other donors in the power sector aims to support the implementation of the Action Plan. The Note substantiates the need for reforms through analysis and proposes solutions consistent with the Strategy and Action Plan.

The Note identifies the following principal challenges in the power sector:

- Power supply reliability and service quality are poor with frequent outages and regular voltage and frequency fluctuations.
- Power sector assets are old and severely under-maintained.
- Per household power consumption has increased substantially in recent years and is comparable to average household consumption in Western Europe.
- There is an emerging gap between available winter generation capacity and winter demand that will continue to grow if investments and reforms do not occur soon.
- The financial condition of the power companies is poor and has led to chronic under-spending on operating and maintenance expenditures and delay of necessary capital expenditures.
- Power tariffs for domestic consumers are exceptionally low; current tariffs do not even cover the actual costs incurred by power companies, which are low because the companies are deferring maintenance and capital expenditure.
- Technical and non-technical losses are high and likely under-reported.
- Power sector receives substantial direct and indirect (quasi-fiscal) subsidies, which are not sustainable and may have serious macroeconomic and fiscal consequences.
- Many of the financial and operational problems in the power sector can be attributed to weak regulation and governance at the sector level as well as within the power companies. More specifically:
  - Responsibilities for regulation and governance in the sector are poorly defined and contractual relationships are excessively complex.

- Within the companies, deficient internal control systems and antiquated information management systems contribute to lack of transparency and accountability.
- Customers are either unwilling to pay higher tariffs due to poor service quality and perceived governance issues of the sector. Affordability will also become a pronounced issue if tariffs increase due to inadequate protection of poor by existing social assistance programs.

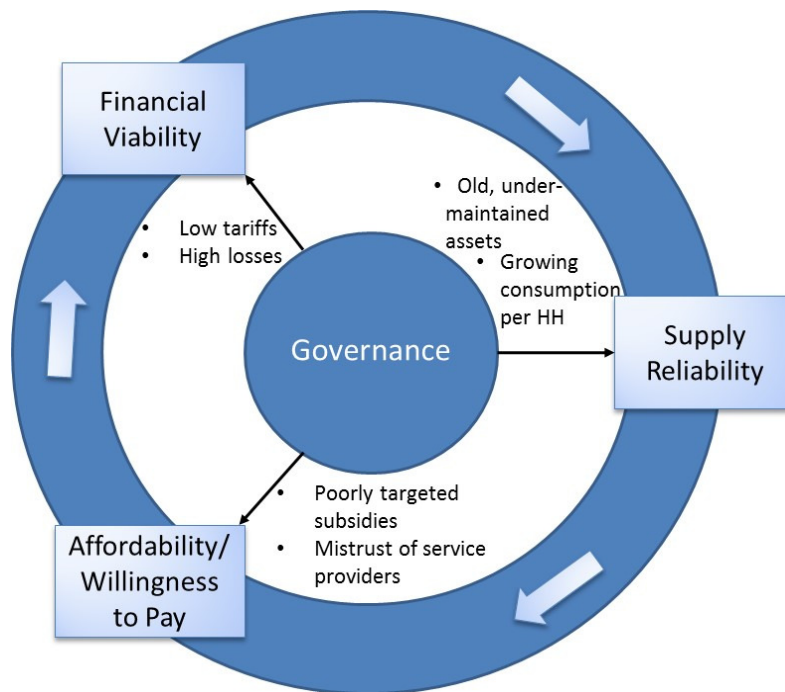
The Note proposes a comprehensive package of reforms to address the looming challenges in the sector. Some reforms should occur immediately while others will need to be implemented over the next three to five years.

- The Note recommends that the following reforms occur **within the next 24 months**:
  - Clarifying the allocation of responsibilities for economic regulation
  - Establishing effective performance monitoring and enforcement framework
  - Implementing a clear and predictable Tariff Setting Methodology
  - Starting tariff increases in line with the Methodology
  - Adopting lifeline tariff to mitigate the impact of tariff increases
  - Beginning to improve governance in power companies by initiating business process re-engineering and starting modernization of management information systems
  - Identifying investment needs for asset rehabilitation and metering
  - Identifying viable heating and energy efficiency investments
  - Identifying investment needs in new assets based on a least cost power system planning.
- The following reforms need to occur **over the next 3 to 5 years**:
  - Applying the performance monitoring and enforcement and improving it as data baseline of companies improves
  - Continuing governance reforms in power companies by completing the modernization of management information systems, establishing internal audit departments, and performance based-contracts
  - Applying the tariff methodology and improving it over time as company reporting improves
  - Increasing tariffs to cost recovery level in a phased manner
  - Redesigning social assistance program to better target poor
  - Reducing losses by making investments in asset rehabilitation and metering
  - Reducing winter power demand by investing in heating and energy efficiency
  - Investing in new assets identified through the least cost planning.

## 2 Principal Challenges in the Power Sector

Figure 2.1 illustrates the principal challenges in the Kyrgyz Republic's Power Sector, and the relationship between them.

**Figure 2.1: Key Challenges Facing the Power Sector of the Kyrgyz Republic**



Financially weak power sector companies are unable to properly maintain, and invest in their assets, which leads to the deterioration of those assets. The deterioration of assets eventually affects power supply reliability and service quality to customers. Customers, as a consequence are unwilling to tolerate the tariff increases necessary to improve the power companies' financial performance. Poorly targeted subsidy schemes also make it difficult to increase tariffs, as some customers are particularly vulnerable to tariff increases.

Poor governance is at the core of the vicious circle shown in Figure 2.1. The regulatory framework for the power sector is characterized by overlapping responsibilities between institutions, and weaknesses in tariff setting and service quality monitoring—two of the three most important functions of economic regulators.

The section below describes each of the principle challenges in the power sector in detail.

### 2.1 Challenge 1: Supply Reliability and Quality

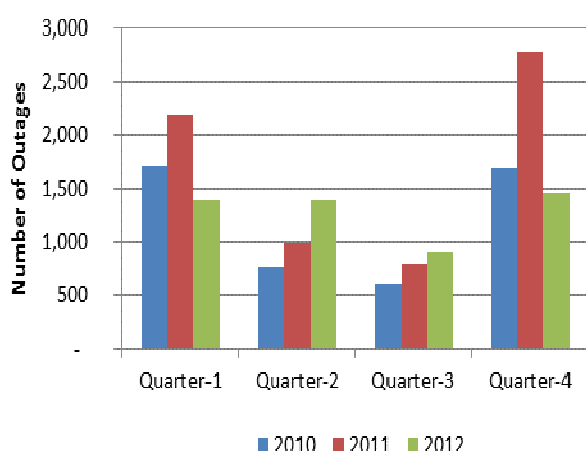
Power supply in the Kyrgyz Republic is unreliable and generally of poor quality. Appendix A discusses the operational performance of the power sector from 2007 to 2012 in detail. Supply reliability, which refers to the frequency and duration of outages, and service quality, which refers to fluctuations in voltage, frequency or harmonics, will worsen in future years if investments and reforms do not occur soon.

**Supply reliability and power quality are poor.**

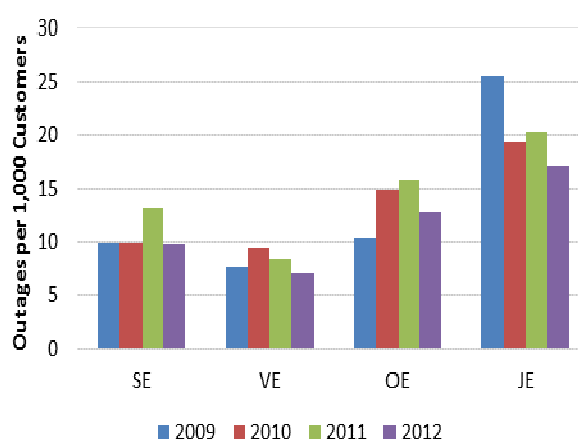
Supply reliability is poor and is characterized by frequent outages and emergency shut-downs of assets, especially during winter months. In December 2012, there was a breakdown at Toktogul HPP which led to country-wide rolling blackouts. The distribution companies reported an average of 43 outages per day between 2009 and 2012. The largest distribution company (SE) reported an average of 20 outages per day during the winters of 2010 to 2012 (see Figure and Figure 2.3).

Service quality is also poor, as demonstrated by regular voltage and frequency fluctuations. The fluctuations affect end-users in a number of ways ranging from poor quality of lighting (from low voltage), to damaged electrical appliances (from fluctuating or excessive voltage). More than half of the respondents in a recent survey about service quality in the Kyrgyz Republic conducted by USAID and Unison reported problems with voltage including low voltage and voltage fluctuations, and 18.9 percent of respondents reported damage to electrical appliance as a result of poor electricity quality.<sup>1</sup>

**Figure 2.2. Number of Outages on SE Distribution Network, 2010-2012**



**Figure 2.3. Outages per 1,000 Customers by Distribution Company, 2009-2012**



Note: In Kyrgyz Republic, the winter months occur during the first and fourth quarters.

**...because power sector assets are old and severely under-maintained**

Poor supply reliability and power quality are a result of the condition of power sector assets. Most generation assets are on average 34 years old, and are near or beyond the end of their projected useful lives. Toktogul HPP, Tash-kumry HPP and Kurpsai HPP are 38, 32 and 27 year old, respectively, and together are responsible for approximately 75 percent of generation.

Transmission and distribution assets are also old and in poor condition. Fifty

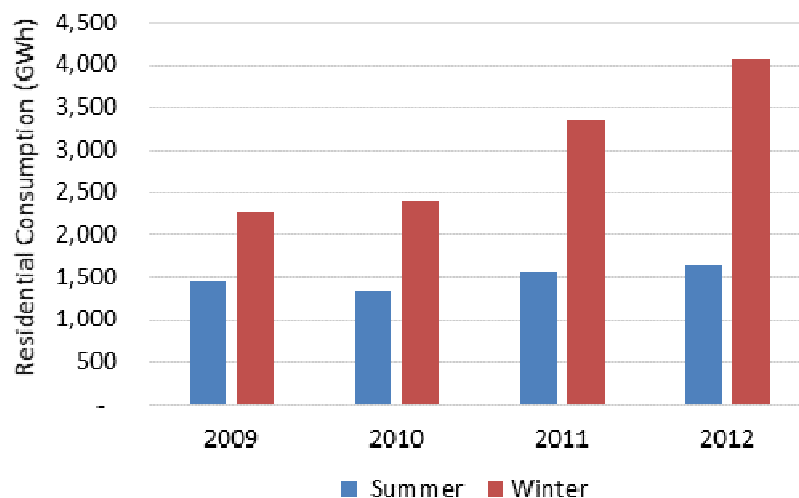
<sup>1</sup> Unison and USAID, "Analysis of Electricity Distribution and Consumption System in Kyrgyzstan," 2013.

percent of the transmission company's (NESK) substations are more than 25 years old, and 18 percent of the lines are more than 40 years old.<sup>2</sup> The four distribution companies reported that 28 percent of their .4-10 kV power lines were in poor condition. The largest distribution company (SE), which serves Bishkek and the surrounding areas, has reported that 85 percent of 0.4 kV distribution lines and electrical equipment are in urgent need of repair.<sup>3</sup>

***Growth in winter consumption has begun to strain the capacity of power sector assets, aggravating problems caused by the condition of assets. .***

Growth in winter consumption has begun to strain the capacity of power sector assets, exacerbating problems of supply reliability and service quality caused by old, under-maintained assets. Power consumption increased steadily from 2009 to 2012, with the largest growth in consumption by residential consumers during winter months. From 2009 to 2012, consumption grew by an average of 10 percent annually. Residential consumption, which accounts for more than half of total domestic consumption, increased by a total of 55 percent during this same period, with 90 percent of this increase occurring during winter months (see Figure 2.4).

**Figure 2.4. Seasonal Residential Consumption, 2009-2012 (GWh)**



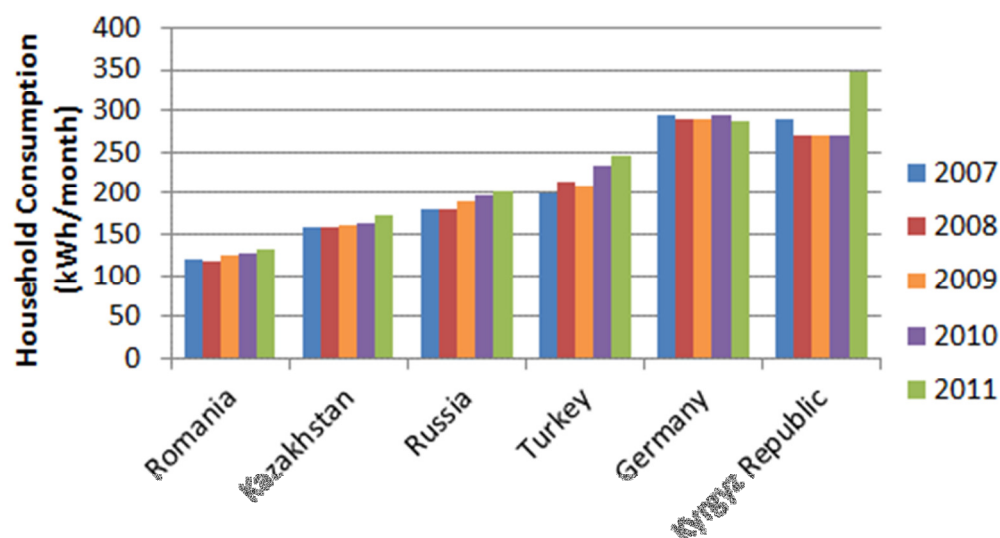
**Growing energy intensity has driven the increase in residential consumption. The number of residential customers grew by 5 percent from 2007 to 2011, while residential consumption grew by 26 percent during the same period (see**

**Figure 2.5).**

<sup>2</sup> Estimates for NESK are for 2009. More recent estimates were requested but were not available.

<sup>3</sup> OJSC Severelectro, "The Development Strategy of Severelectro for 2012-2014," November 1, 2012. [http://www.severelectro.kg/index.php?option=com\\_content&view=article&id=1309&Itemid=78&lang=ru](http://www.severelectro.kg/index.php?option=com_content&view=article&id=1309&Itemid=78&lang=ru)

**Figure 2.5. Electricity Consumption per Household, 2007-2011**



Source: World Energy Council, "Energy Efficiency Indicators," Accessed April 19, 2013. <http://www.wec-indicators.enerdata.eu/>

Most of the growth in consumption occurred in winter months when demand is highest. From 2009 to 2012, winter consumption grew 62 percent, while summer consumption grew 16 percent. In recent years, there have been frequent emergency shut-downs of transmission and distribution facilities equipment because of congestion and overloading, especially in Bishkek. Eleven of the 18 substations in Bishkek are overloaded, and only 5 substations in Bishkek are at less than 85 percent of their maximum load.<sup>4</sup>

***A supply gap is emerging during winter months***

The Kyrgyz Republic does not have enough capacity to meet projected peak winter demand or winter consumption. The winter supply deficit is projected to increase consistently in future years without new investment in generation.

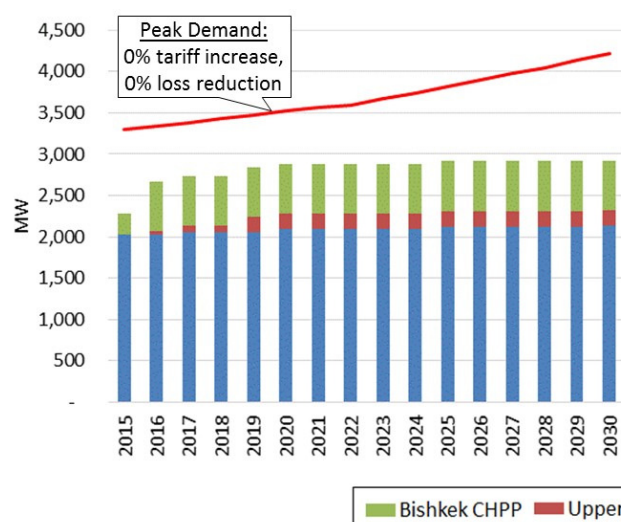
The projected winter supply deficit is based on the assumptions of the business-as-usual (BAU) scenario described in Section 1.

The gap between peak demand and available capacity could increase to nearly 650 MW by 2020, 900 MW by 2025 and 1,300 MW by 2030 (See Figure 2.6) without additional investment in generation or demand-side management measures.

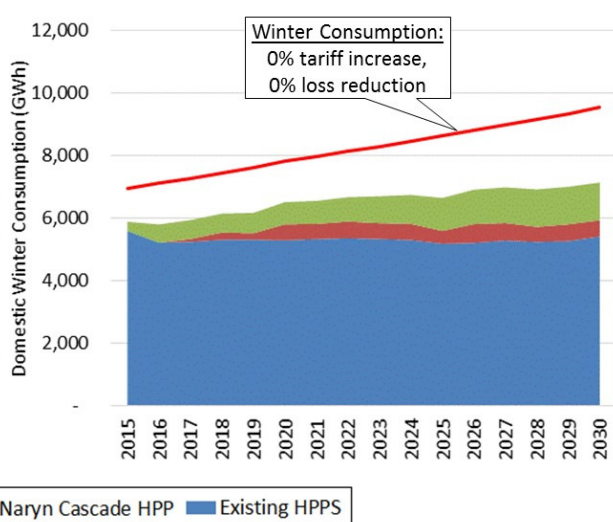
This gap between winter consumption and available generation during winter months could increase from 1,055 GWh in 2015 to 1,300 GWh in 2020 to 2,000 GWh in 2025 and to 2,500 GWh in 2030 (see Figure 2.7).

<sup>4</sup> Brivus Solutions AG, "Electricity Supply Accountability and Reliability Improvement Project (ESARP): Task 2 Report, " November 2013.

**Figure 2.6. Peak Winter Demand vs. Available Capacity, 2015-2030**



**Figure 2.7. Winter Consumption vs. Available Generation (Nov-Feb), 2015-2030**



## 2.2 Challenge 2: Financial Viability

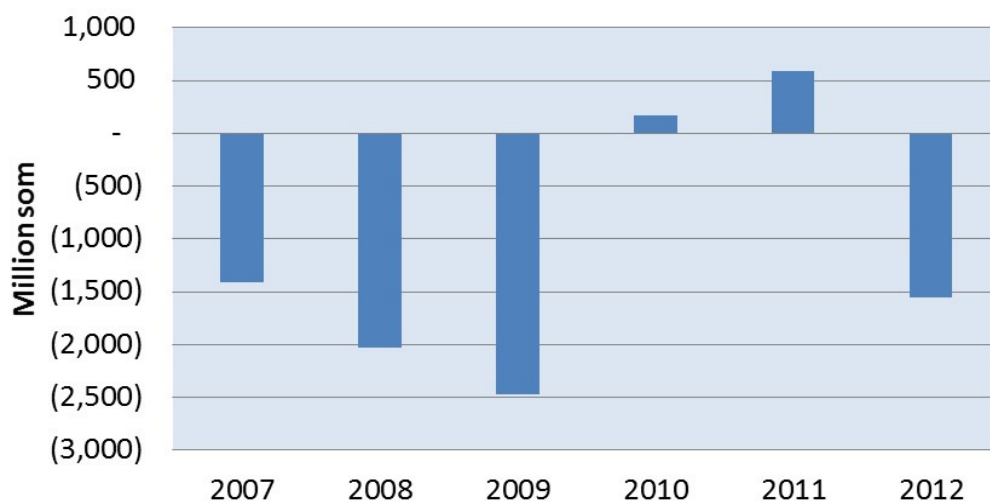
The financial condition of the power sector has improved in recent years, but there is still a large gap between costs and cash collected. The financial and physical condition of the sector will continue to deteriorate if reforms do not occur soon.

### *Historical Financial Performance*

***The financial condition of the power sector has been poor in recent years, but improved from 2009-2011 because of growth in export revenue.***

The financial condition of the power sector has varied greatly in recent years as a result of fluctuations in export revenue. The financial condition of the sector improved from 2009 to 2011 primarily as a result of growth in export revenue. The financial condition of the sector declined in 2012 largely because revenue from exports dropped by nearly 60 percent from the previous year. Figure 2.8 shows the difference between cash inflow and actual costs (recurrent expenses and debt service) incurred by the consolidated sector from 2007 to 2012. As Figure 2.8 demonstrates, there was a financial gap from 2007-2009, and in 2012, and a financial surplus in 2010 and 2011. If the costs for these years were adjusted to reflect an appropriate level of operating and maintenance (O&M) expenditures, the financial gap would be much larger. Appendix B includes further analysis of the historical financial performance of the power sector.

**Figure 2.8: Financial Surplus/Gap of the Consolidated Power Sector, 2007-2012**

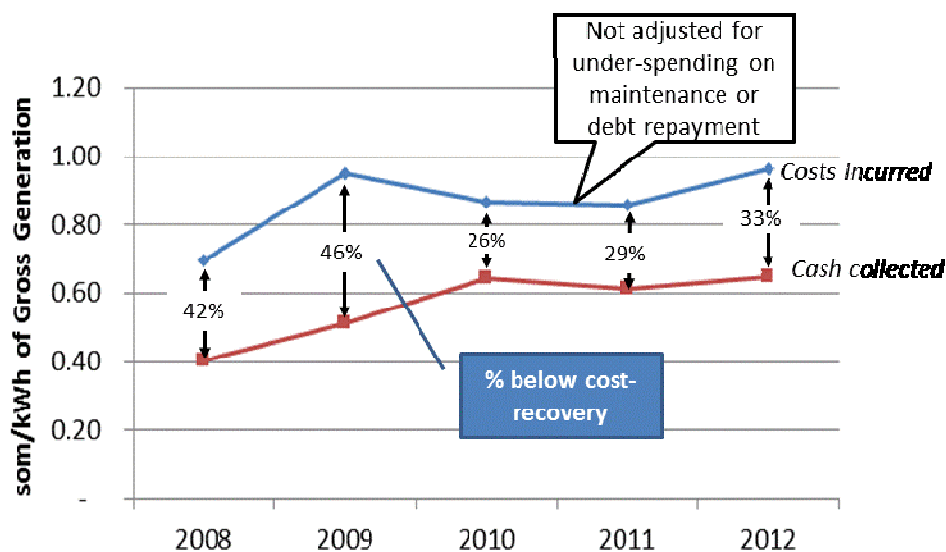


Note: The historical financial gap or surplus is defined as the difference between cash inflow and actual costs (recurrent expenses and debt service) incurred by the consolidated sector. If cash inflow is greater than costs incurred there is a financial surplus. Likewise, if costs incurred are greater than cash inflow, there is a financial gap.

**Costs incurred by companies to serve domestic demand are substantially higher than cash collected from domestic customers.**

Export revenues have helped to mask the poor performance of the sector domestically. The cost of generation has been consistently higher than the cash collected from domestic consumption. From 2007 to 2012, the sector's actual costs incurred per kilowatt hour of domestic consumption were, on average, 35 percent higher than the average cash collected from domestic end-users (see Figure 2.9).

**Figure 2.9: Cash Collected vs Costs Incurred to Serve Domestic Consumers, 2008-2012**



**The gap occurs**

Cash collections from end-users were 98 percent in 2012, suggesting that



***because domestic tariffs are well below actual costs incurred by companies***

the gap between actual costs and cash collections is a result of tariffs which fail to reflect costs incurred per kWh of gross generation, rather than a shortfall in collections.<sup>5</sup> The actual cost of generating, transmitting and distributing one kWh of power in the Kyrgyz Republic was, on average, 36 percent higher than the average end-user tariff from 2007 to 2012. The cost of power supply increased by an average of 15.4 percent annually from 2007 to 2012, with a spike in the costs incurred in 2009 because of large debt service payments by the generation company.<sup>6</sup>

***...and technical and non-technical losses are high***

Some portion of the gap between tariffs and costs incurred by power companies is also attributable to high levels of technical and non-technical losses. Reported losses, which were 28 percent of net generation in 2010, were 16 percent higher than the average level of losses in the Eastern European and Central Asian (ECA) region and actual losses were likely even higher.<sup>7</sup>

***The financial gap has fiscal and quasi-fiscal consequences.***

The Government of the Kyrgyz Republic provides substantial financial support to the power sector. Some types of fiscal support to companies, such as on-lending of loans from international financial institutions (IFIs), are common in countries like the Kyrgyz Republic where assets are state-owned and companies cannot access commercial financing for large investments. Other types of fiscal support, including budgetary loans and grants, are less common and are indicative of a sector in financial distress.

Between 2008 and 2010, Government provided 2 billion som (US\$ 42.2 million) to sector companies in the form of budgetary loans and on-lending of 35.6 billion som (US\$ 751.3 million) from international financial institutions (IFIs). The Government also gave the generation company (EPP) a 4 billion som (US\$ 84.4 million) grant in 2010 for the construction of Kambarata 2. In April 2010, the Government authorized EPP and the transmission company (NESK) to write-off accounts receivable of 2.4 billion som (US\$ 50.6 million) from distribution companies and accounts payable to the Government.<sup>8</sup>

The sector is also subsidized by implicit or “quasi-fiscal” means, namely, under-spending on maintenance and capital improvements, and accumulation of accounts payable. These quasi-fiscal means of subsidizing the sector are, in effect, contingent liabilities which will have real fiscal consequences in the future as even larger investment will be required to

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<sup>5</sup> We use the term “suggesting” because data reported by the power sector companies is of poor quality and often internally contradictory. Several experts familiar with the sector question the accuracy of the cash collection ratios reported by energy companies.

<sup>6</sup> The large increase in debt service payments for EPP in 2009 likely results from a 17 percent currency depreciation of the Kyrgyz Som relative to the US dollar.

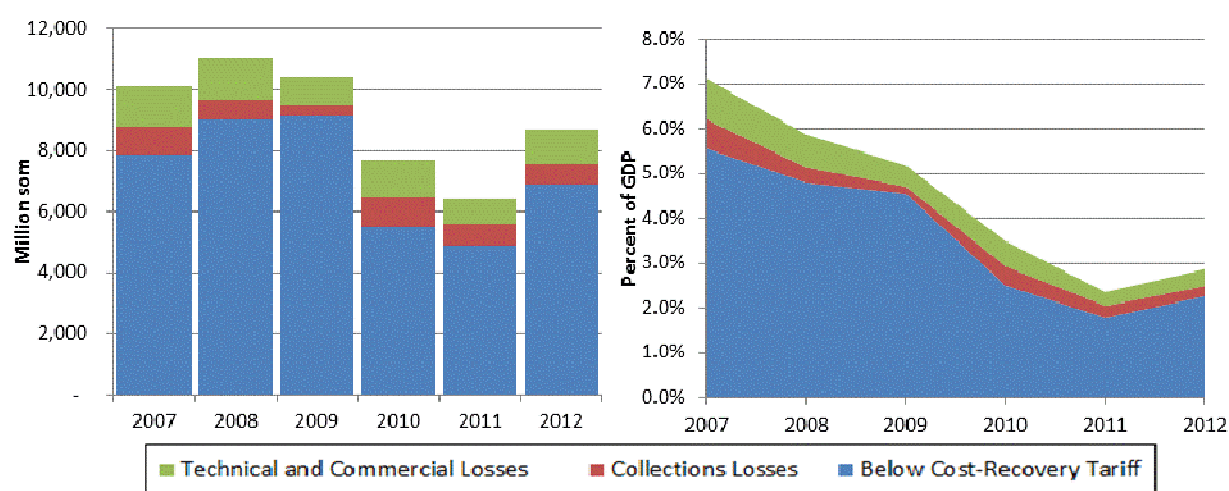
<sup>7</sup> World Bank, “World Development Indicators,” Accessed March 2013.

<sup>8</sup> International Monetary Fund (IMF), “IMF Country Report: Kyrgyz Republic,” May 2012, <http://www.imf.org/external/pubs/ft/scr/2012/cr12111.pdf>.

rehabilitate heavily deteriorated assets. The 2010 write-off of accounts payable from sector companies to the Government is an example of how these contingent liabilities can become direct fiscal burdens.

The sum of fiscal and quasi-fiscal deficits attributable to the power sector has decreased in recent years. The fiscal and quasi-fiscal deficits decreased by 21 percent representing a decline from 5.9 percent of GDP to 2.9 percent from 2008 to 2012. This reduction occurred largely because of higher collections, lower losses and an increase in non-residential end-user tariffs in 2010. Figure 2.10 shows the sum of fiscal and quasi-fiscal deficits attributable to the power sector from 2007 to 2012, in million som (see also Table 2.1) and as a percentage of GDP. Appendix C describes the method used to calculate the fiscal and quasi-fiscal deficit and discusses its impact in further detail.

**Figure 2.10: Fiscal and Quasi-fiscal Deficit of the Power Sector, 2007-2012**



**Table 2.1: Fiscal and Quasi-Fiscal Deficits by Component, 2007-2012**

(Thousand Som)	2007	2008	2009	2010	2011	2012
Technical and Commercial Losses	1,283,651	1,383,548	932,953	1,238,022	825,999	1,143,328
Collections	926,917	629,096	326,144	944,830	729,265	688,124
Below-cost recovery tariff	7,883,940	9,023,022	9,154,416	5,503,365	4,869,475	6,891,389
<b>Total fiscal and quasi-fiscal deficits</b>	<b>10,094,508</b>	<b>11,035,666</b>	<b>10,413,513</b>	<b>7,686,216</b>	<b>6,424,740</b>	<b>8,722,842</b>

***The financial condition of the sector will worsen if tariffs remain at current levels.***

The financial condition of the power sector will continue to deteriorate if tariffs remain at current levels. The annual gap between cash inflow and costs incurred could reach 11.8 billion som (USD 249 million) by 2020 unless tariffs are increased and losses are reduced. On a cumulative basis, this gap would equal 37 billion som (776.4 million USD) by 2020; equal to 12 percent of the Kyrgyz Republic's GDP in 2012 (see Figure 2.11).

These projections are based on the business-as-usual (BAU) scenario described in Box 2.1 and the cost of service methodology described in Appendix D. As described in Appendix D, projected expenses incurred have been increased from historical expenses to reflect appropriate operating and maintenance (O&M) expenditures. Projections of operational and financial performance throughout the Note are based on the assumption described in Box 2.1.

**Box 2.1: Assumptions of 2013-2030 “business-as-usual” (BAU) scenario**

The projections of operational and financial performance used in this Note are based on a 2013-2030 “business-as-usual” (BAU) scenario, which assumes:

- Tariffs remain at 2012 levels for all customer groups
- Technical and non-technical losses remain at 19.6 and 2.7 percent of net generation, respectively, which are the losses reported by the companies in 2012<sup>9</sup>.
- The Upper Naryn Cascade is built in 2016 and Bishkek CHP is rehabilitated the same year. These projects are included in the business-as-usual scenario because they have secured financing.
- The available capacities of existing assets do not decrease in future years, even if there are no current plans to rehabilitate those assets.

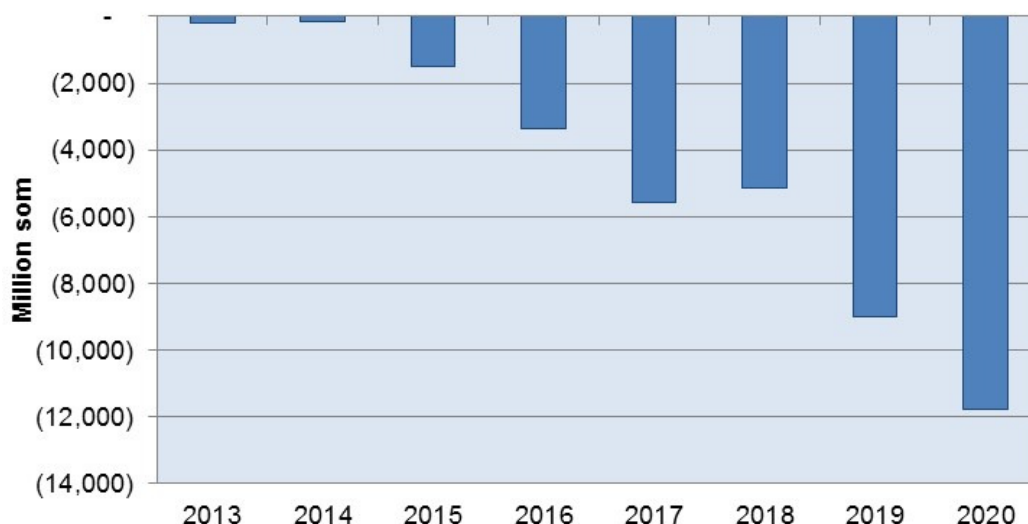
The fourth assumption listed above is optimistic because the available capacities of existing plants will decrease if the maintenance and capital expenditures necessary to maintain the plants' available capacities do not occur. Problems of winter power supply adequacy will be worse than projected in the section below if assets are not properly maintained in future years.

The gap between cash inflow and costs incurred will continue to increase because growth in cash received from tariffs will not keep pace with growth in costs for O&M expenditures and debt service payments. O&M expenditures will naturally increase as a result of inflation and more production to meet growing demand. If tariffs are not increased by at least the inflation rate, growth in cash inflow from tariffs will be less than growth in costs from O&M expenditures. Projected O&M expenditures are also adjusted to reflect an appropriate level of maintenance and repairs required to restore each company's assets to its design specifications and maintain

<sup>9</sup> The actual losses are likely higher than reported losses due to lack of and/or un-reliability of metering as well as other governance issues of the sector discussed in later sections.

them at that level. In addition, the fuel cost component of O&M expenditures will substantially increase if companies do not invest in new assets because there will not be enough generation available from hydropower to supply domestic demand. This will increase production from Bishkek CHP, which, even after rehabilitation, will be expensive to run relative to hydropower plants. Appendix D describes the method used to project O&M costs and future capital expenditures in detail.

**Figure 2.11: Financial Surplus/Gap of the Consolidated Power Sector 2013-2020**



Note: The projected financial gap or surplus is defined as the difference between projected cash inflow and projected costs incurred by the consolidated sector. If cash inflow is greater than expenses incurred there is a financial surplus. Likewise, if expenses incurred are greater than cash inflow, there is a financial deficit.

***There will be severe macroeconomic consequences if the financial condition of the power sector does not improve***

There is a likelihood of severe economic consequences if the financial condition of the power sector does not improve in the near future. In December of 2012, the outstanding balance of sovereign-guaranteed debt to the power sector was 41.7 trillion som, or approximately US\$887 million. This outstanding balance represents 32 percent of total public external debt and 48 percent of 2012 GDP.

Power companies will be unable to service existing debt or any future debt required to rehabilitate or replace assets if reforms to improve the financial condition of the power sector do not occur in the near future. Inability of the power companies to service debt will result in the continued accumulation of accounts payable to the Government and, in all likelihood, Government will eventually have to write-off of these liabilities as it did in 2010.

## **2.3 Challenge 3: Affordability**

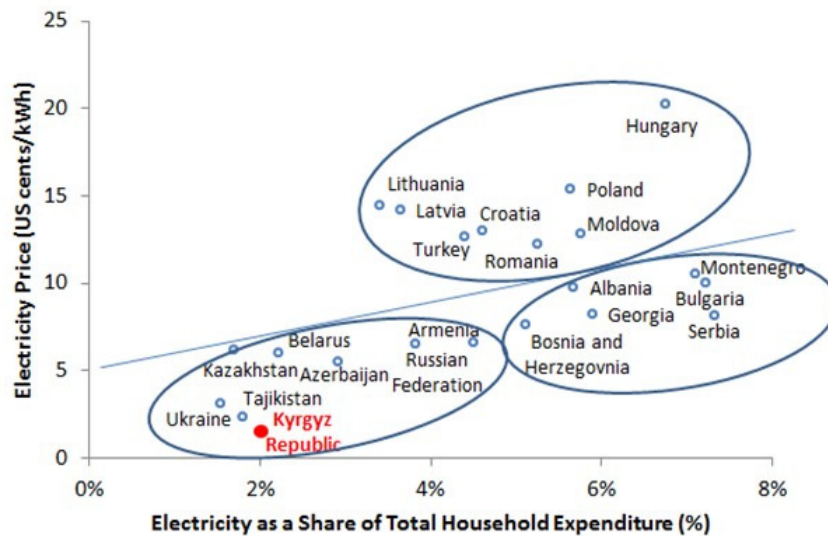
***Household expenditure on***

Household expenditure on electricity is lower in the Kyrgyz Republic than in most countries in the region. Electricity spending accounts for only two

**electricity is lower in the Kyrgyz Republic than in most countries in the region.**

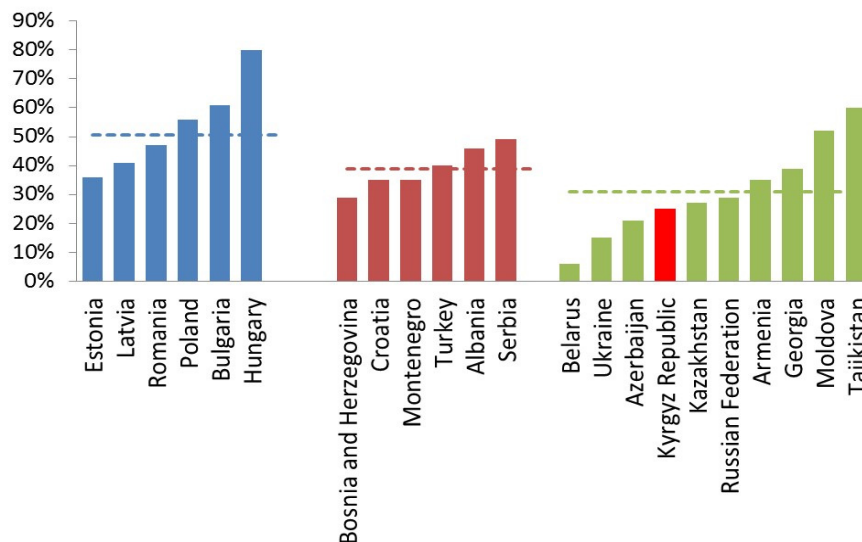
percent of household expenditure in the Kyrgyz Republic, which is significantly lower than in many other countries in the ECA region (see Figure 2.12). As a result, energy poverty, which is measured as the proportion of household spending more than 10 percent or more of their budgets on energy, is below the regional average (see Figure 2.13).

**Figure 2.12: Electricity Prices versus Share of Electricity in Total Household Expenditure (percent)**



Source: World Bank, “Balancing Act: Cutting Energy Subsidies While Protecting Affordability.”

**Figure 2.13. Energy Poverty Rates in the ECA Region**



***Social safety nets are poorly targeted and will not protect the most vulnerable in the case of a tariff increase***

The social safety net in the Kyrgyz Republic is extensive, but not well targeted. The country spends a relatively high proportion of GDP on social assistance—3.34 percent in 2011—above the ECA regional average. Only one of the social assistance programs—the Monthly Benefit for Poor Families with children (MBPF) —explicitly targets the poor, and its coverage is low. The MBPF covers less than one-third of the poorest 20 percent of the population and subsidizes only about 8 percent of their total consumption. Other social assistance programs are aimed at certain social categories such as households with widows or disabled children. These other programs absorbed around 2.8 percent of GDP in 2011. 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. These measures are described in more detail in Box 2.2.

**Box 2.2. Social Protection Schemes for Expenditure on Electricity**

The government implemented a series of measures to compensate vulnerable groups after a December 2009 doubling in residential power tariffs. The measures included top-ups on all main social assistance benefits, an increase in energy compensations to pensioners, reinstatement of a subsidy scheme for population living in mountainous regions, and top-up on wages of government employees earning less than 5,000 som. The tariff increase was fully reversed following the April 2010 events by the interim government; however, the compensation measures were not reversed. The prevailing view among experts is that the compensation measures were poorly designed and targeted, and as a result did not reach their objective. There are currently two schemes that provide compensation for electricity costs:

- Monthly compensations paid to pensioners, whose pensions are below 4,000 som. The size of the compensation varies depending on the size of the pension. In 2011, electricity compensations were paid to more than 516,000 unique beneficiaries (more than 95 percent of all persons receiving old age, disability and survivor pensions) and cost 0.64 percent of GDP. It is a regressive benefit. 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.
- A program providing residential customers in mountainous areas with a 50 percent discount on a certain volume<sup>10</sup> of power consumed (effectively a lifeline tariff system). The list of such areas grew since 1996 from 646 to 794 settlements with estimated population of about 1.3 million. According to 2010 Kyrgyz Integrated Household Survey 41 percent of residents of high altitude areas lived in poverty. Despite a higher incidence of poverty in high-altitude areas, the majority of the poor and the extremely poor are located in densely populated areas in the plains. The fiscal cost of the program is not known.

<sup>10</sup> The discount is provided in accordance with the following parameters: from May 1 to October 1 up to 100 kWh per month; (ii) from October 1 to May 1 up to 220 kWh per month;

## 2.4 Challenge 4: Regulation and Governance

Many of the financial and operational challenges in the power sector can be attributed to problems with regulation and governance at both the sectoral level as well as company levels. These are not the only governance and regulation challenges faced by the sector but they are the challenges which, if not addressed, will limit the effectiveness of other sector reforms. They are also closely aligned with the set of challenges the Government's sector Action Plan seeks to address.

***Responsibilities for sector governance and regulation overlap between Government entities, causing confusion and inefficiency.***

There is substantial overlap between the economic regulatory roles of the Regulatory Department under the Ministry of Energy and Industry and the Anti-Monopoly Agency. The roles typically included in economic regulation are regulation of tariffs, service quality, and licensing. Responsibilities for tariff-setting are unclear. The Anti-Monopoly Agency has had formal responsibility for setting energy companies' tariffs since October 2005, when Presidential Decree number 448 was issued. Until mid-late 2013, the Regulatory Department under the Ministry of Energy and Industry had de-facto responsibility for setting company tariffs. The Anti-Monopoly Agency seems to have taken a more assertive role in tariff-setting since 2013, when it was established as a more autonomous agency, separate from the Ministry of Economy. The future of the Regulatory Department is unclear, but it appears to remain responsible for other aspects of economic regulation, including licensing and service quality. There is overlap, also, between the responsibilities of the State Inspectorate for Environmental and Technical Safety and the responsibilities of the Regulatory Department. By Law, the Inspectorate is responsible for regulating supply reliability, but many of the Key Performance Indicators (KPIs) collected by the Regulatory Department (as part of its role in monitoring performance contracts) are also related to supply reliability.

There is also overlap between regulation and governance in the sector. Governance typically refers to the rules governing the relationships between owners, directors and management of the companies, while regulation refers to rules enforced by government agencies, empowered by law, to restrict or compel certain behaviors.<sup>11</sup> The Regulatory Department's performance agreements include an extensive set of KPIs which relate to financial and operational management.<sup>12</sup> The State Property Fund, which represents Government's ownership in state owned enterprises, also has contracts with the directors of the companies.

Figure 2.14 illustrates the regulatory and governance relationships in the

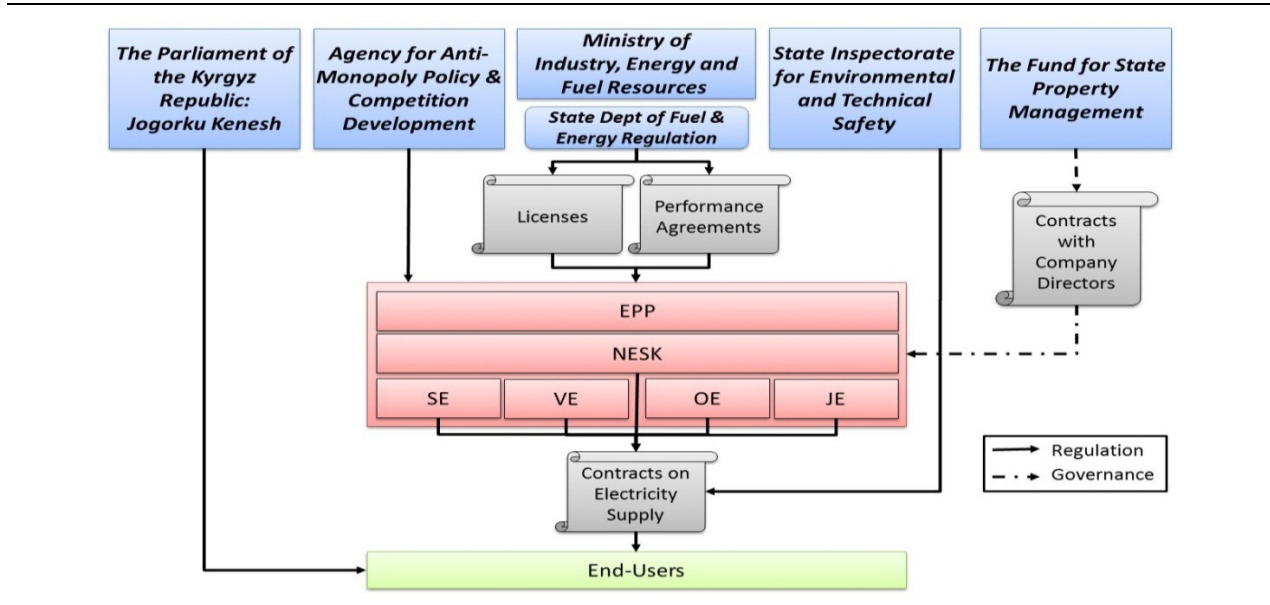
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<sup>11</sup> The line between governance and ownership is often blurry, especially where utilities have government owners. For an excellent discussion of governance versus regulation, refer to: <http://siteresources.worldbank.org/INTWSS/Resources/WSS6-final.pdf>.

<sup>12</sup> As just one example: "Maintain appropriate levels of materials to avoid delays in work flow".

sector.

**Figure 2.14: Regulation and Governance in the Power Sector**



***The result is a patchwork regulatory framework which is ineffective.***

The absence of clear responsibility for regulation has discouraged the development of a robust framework for economic regulation. The Kyrgyz Republic has no clear and consistent framework for setting company tariffs, nor for monitoring performance and ensuring accountability to customers—functions essential to economic regulation. There is, instead (as shown in Figure 2.14) patchwork of contracts and agreements which are not implemented.

The 1996 Energy Law, which along with the 1997 Electricity Law, is supposed to define the legal and regulatory framework of the sector, has tariff principles, but there is no clear and consistently applied tariff methodology.<sup>13</sup> The Anti-Monopoly Agency adopted what it refers to as a “tariff methodology,” but the document bears little resemblance to accepted international practices. It is more about how to estimate specific costs and the procedures for filing documents than about how to aggregate costs, allocate them to customers and determine the tariff structure. The Regulatory Department has a methodology for allocating revenues to the companies but the methodology again bears no resemblance to good international practices. It provides no incentive for reducing technical or non-technical losses—critical problems in the Kyrgyz energy sector, and provides a disincentive for good capital expenditure planning.

The Energy Law also requires performance agreements between the Ministry of Energy and Industry and the power companies. These agreements, which were first established in 2010, are the main documents monitoring and

<sup>13</sup> Resolution of the Government of the Kyrgyz Republic on February 18, 2013 N 83.



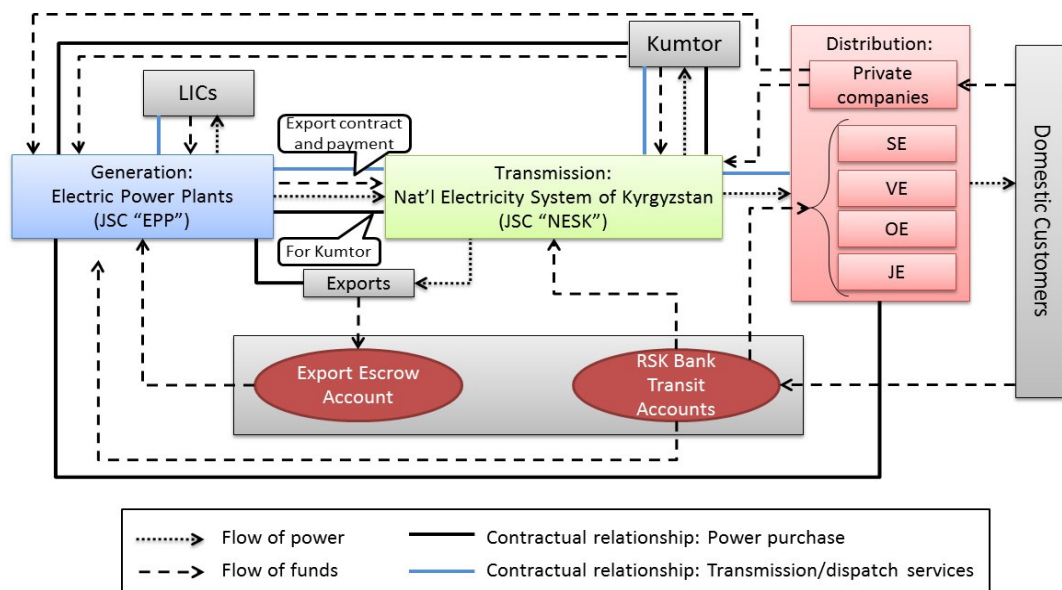
enforcing performance in the power sector. The performance agreements have Key Performance Indicators (KPIs) on financial performance, revenue, financial management, productivity, and customer and technical service, but there are too many indicators for the Regulatory Department to monitor, and the KPIs are poorly defined. The KPIs are consequently collected but not used.

***The institutional structure of the sector is also complex, preventing transparency and accountability***

The contractual arrangements between power companies are as complex as the regulatory framework, making monitoring and enforcement difficult (see Figure 2.15). The problem of complexity can be costly for such a small sector, where regulation is already relatively weak.

In addition to the six public Joint Stock Companies (generation, transmission, and the four regional distribution companies) and private generation companies, there are 21 small private distribution companies responsible for roughly 3 percent of power delivered to end-users. Fifteen of the private distribution companies own and operate distribution networks. Five of them share ownership with one of the four regional distribution companies, and also have responsibility for operations. One private distribution company leases the assets from a regional distribution company, but does not own any assets. All of the private distribution companies have to pay the regional distribution company with whom they share a substation and some must also separately pay the transmission company (NESK) and the generation company (EPP) depending on the voltages of the substations at which they are served. Large industrial customers (LICs) also have power purchase contracts with EPP and the transmission services contracts with NESK.

**Figure 2.15. Structure of the Power Sector of the Kyrgyz Republic**



Note: In addition to payments made to the distribution companies, some end-user consumers pay electricity bills directly to RSK Bank or similar collection centers.

***Governance and internal controls within power companies is also poor, aggravating problems of accountability, transparency & data reliability***

Governance and internal controls within the power companies is also poor. Deficient internal control systems, antiquated information management systems, including corporate resource management, which are largely based on manual entry and are not integrated, aggravate issues related to lack of accountability, transparency and data reliability. Though constituted as Joint Stock companies, the power companies lack autonomy in decision making. The company management is not selected through a well-defined competitive selection process, with clear incentive and disincentive system. The power companies' management often changes without the stability of tenures to show results.

The current organization of functional areas within power companies lacks checks and balances, creating unaccountable business processes. For example, it is common for one senior executive to control both the procurement and the payment process, without any intermediary department monitoring the transactions. This organization of functional areas, which lacks checks and balances, creates obvious opportunities for extortion and other abuses of power. Departmental organizations resulting in unaccountable business processes are common in other functional areas such as finance and accounting, logistics and warehouse management and operations and repairs.

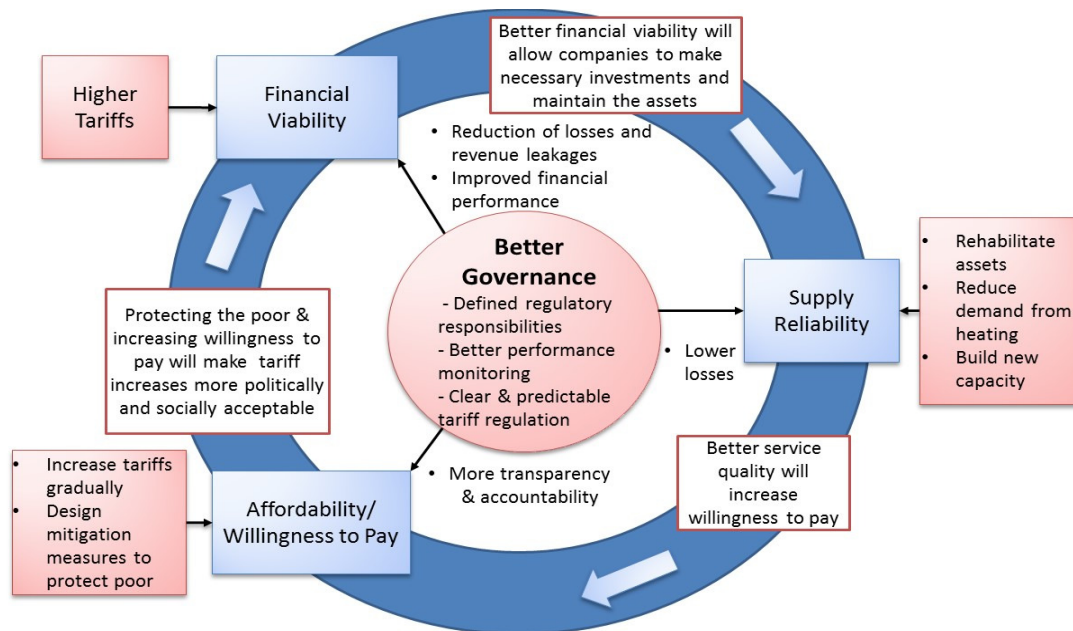
None of the companies, except for the generation company (EPP), have internal audit departments. These departments are responsible for ensuring checks and balances in decision-making procedures and proper control of systems such as resource quality management. They are normally entitled to carry out periodic investigations and inquiries on matters impacting company costs in order to prevent over-pricing or over escalation of the cost of procured goods and services.

Antiquated management information systems used by the companies are inefficient and hinder consistency, traceability, accountability and transparency of business processes. Current systems do not incorporate information from different areas of the business and significant amount of data must be entered manually because programs do not typically integrate with each other. For example, companies use several programs for their general accounting, payroll and billing purposes. The systems are not integrated, and data is manually transferred from sub-systems to the general ledger.

### 3 Potential Solutions to Sector Challenges

Better governance and regulation at the sector level and within the companies are essential to overcoming the challenges discussed in Section 2, but other measures are also needed. The sector must increase tariffs, invest in rehabilitation of assets and construction of new assets, reduce electricity demand for heating, and redesign social assistance programs. Figure 3.1 depicts the relationship between sector challenges and each of the recommended solutions.

**Figure 3.1. Impact of Potential Solutions of Sector Challenges**



The following section describes potential solutions to each of the principal challenges facing the power sector. It starts with discussion of better governance first because of the ability of better governance to address other challenges in the sector.

#### 3.1 Solution 1: Better Governance and Regulation

Government has developed an ambitious Action Plan outlining many of the steps necessary for better governance. There are important plans underway, for example, to establish an independent Settlement Center, to delineate clearly the roles and responsibilities with respect to sector ownership, policy making and regulation, and to strengthen the governance and internal controls of different sector companies. This Note focuses primarily on economic regulation and what is required to establish a clear framework for better regulation and governance at the sector level and the company level. Within the area of economic regulation, the recommendations focus on the regulation of service quality and tariffs.

***Better clarity is needed on responsibility for regulation***

The responsibilities of the Regulatory Department, Anti-Monopoly Agency and Inspectorate need to be clarified, with as fine a line as possible drawn between them. The decisions on how to divide responsibilities are more important than who should have them. A distinction should be made between economic, technical, and competition regulation, and

governance. This is an important step, which needs to be made soon. The donor working group has been supporting the Government in this process.

***Better performance monitoring can help to break the vicious cycle***

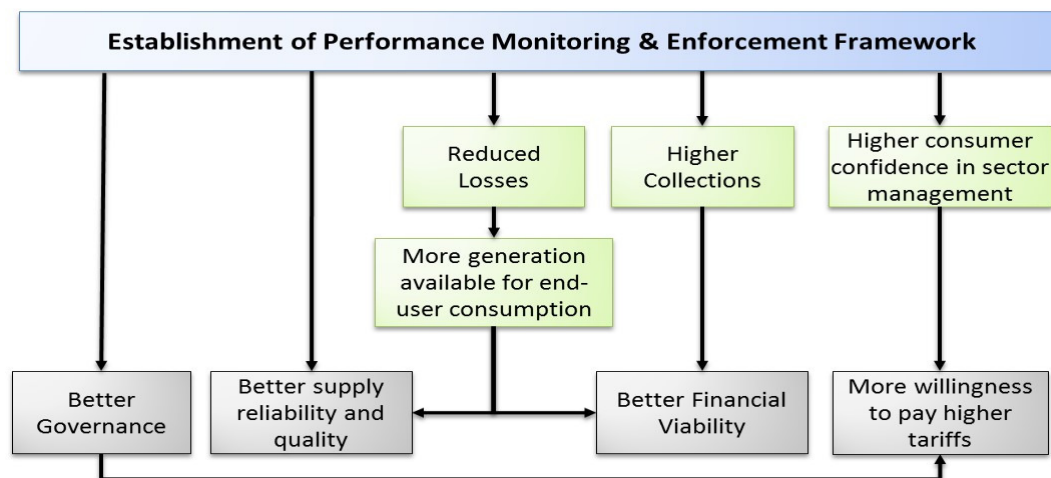
Better performance monitoring can help to break the vicious cycle illustrated in Figure 2.1, by improving customer confidence and reducing opposition to tariff increases.

The economic regulator (either the Regulatory Department or Anti-Monopoly agency, but not both) should develop and monitor a handful of indicators of the biggest operational problems in the Kyrgyz Republic's power sector: reliability, power quality, losses, and collections.<sup>14</sup> The list of indicators must be short, and their method of measurement simple, or it is unlikely (as is the case now) that they will be used effectively. The State Property Fund, as owners' representative, could consider putting in place any financial indicators it considers relevant, but will need to recognize that the companies' success in hitting financial indicators will depend critically on the level of tariff. The World Bank is currently funding technical assistance for the development of a set of key performance indicators (KPIs) and a framework for reporting, monitoring and verifying the KPIs.

Figure 3.2 illustrates how a performance monitoring framework can help to solve many of the challenges in the power sector.

Establishing and enforcing a performance monitoring framework will provide a clear path to better governance. Better governance and accountability for performance by sector companies will increase consumer confidence in the sector, which is a critical component of willingness to pay, especially in the Kyrgyz Republic.

**Figure 3.2. How Better Performance Monitoring can Overcome Sector Challenges**



<sup>14</sup> Collection do not appear to be a problem at the moment but will likely become a problem as the companies attempts take measures to reduce commercial losses and increase tariffs.

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***Better governance and internal controls within power companies can improve accountability, transparency and data reliability.***

Power companies need better governance and internal controls to improve accountability, transparency and data reliability.

Better management information systems are needed to provide real-time and reliable corporate and commercial information and therefore to ensure that business operations are efficient, traceable, and transparent. Information management system needs would be different for power sector companies depending on their functions. A common information management system that all companies should consider incorporating is a fully integrated Enterprise Resource Planning (ERP) system that covers all corporate areas of business (accounting, finance, procurement, human resources management, etc.). The Electricity Supply Accountability and Reliability Improvement Project planned by the World Bank will support strengthening of governance and internal controls for the largest distribution company (SE) through incorporation of management information systems and business process reengineering.

Companies must also reengineer the business processes to increase the accountability of business processes. The Ministry of Energy and Industry together with the State Property Fund should commission a thorough analysis of inefficient and unaccountable business processes across all companies. Upon the findings of those analyses, respective changes in structures, procedures and processes in the companies need to be introduced.

All companies should have internal audit departments to prevent overpricing or over escalation of costs on procured goods and services, ensure the quality of procured goods and services, and ensure adherence to the established internal business processes. Ideally these internal audit departments should be responsible directly to the Board of Directors.

With the improvement of timeliness and reliability of operational and financial data, governance could be improved by putting in place performance contracts, with senior managers of power companies. Such contracts could be used to hire managers competitively, and tie their remuneration to key performance indicators. Terms of dismissal could also be tied more clearly to performance in ways which make it more difficult to replace managers for political reasons.

The performance contracts could be for individuals (such as the “public service contracts” used in many countries), or with private sector management teams. Government is already considering the latter approach, through discussions with donor partners about the possibility of hiring a private management contractor. Box 3.1 describes management contracts, and international experience using management contracts with public service companies.

### **Box 3.1: International Experience with Management Contracts as a form of Private Sector Participation (PSP)**

#### ***Defining management contracts***

A management contract is a form of private sector participation (PSP) in which the government engages a private company (a management contractor) to perform certain management functions within a government-owned utility. The management contractor puts in place a small, senior management team to replace, or work in parallel with existing management. The management contractor's responsibilities, and its exposure to risk are much more limited than under other forms of PSP. The management contractor receives a fixed fee for managing the utility and performing certain specific tasks (for example, installing a new billing system), and may also receive performance bonuses contingent upon hitting targets for a limited range of key performance indicators (for example, the reduction of technical and non-technical losses, or improvements in collections). In some cases, penalties may be assessed for missing the targets. The management contractor's risk is limited because its ability to control the utility's performance is also limited. The management contractor has little or no control over the level of tariffs or capital expenditure, and is therefore principally responsible for management of *inputs*, but only a limited range of *outputs*. It is not directly responsible for achieving the objectives of the utility or customers.

#### ***International experience with management contracts***

Policymakers or public owners often like the idea of management contracts because they avoid changes—staff layoffs, higher tariffs, private ownership—which can be politically difficult. Private operators often like the idea of management contracts because their responsibilities and risks are limited under such contracts, and remuneration is more certain. The principal disadvantages of management contracts are linked to the reasons policymakers and private operators like them: because there is limited transfer to the private sector, the potential effectiveness of such contracts is limited. Where management contracts have been successful, they have proven to be a useful step toward greater PSP. In the Republic of Georgia, for example, the management contract for electricity systems outside of Tbilisi helped set the stage for privatization. In the water and sanitation sector in Armenia's capital of Yerevan, good experience with a management contract prompted Government to move to a lease contract. In other cases, however, management contracts have accomplished little more than a public operator could have accomplished or—worse—were disruptive in ways that weakened utilities' relationships with their customers and countries' reputations with international investors.

#### ***Enabling conditions for better management contracts***

The more successful management contracts have been those which recognize the limitations of such contracts. Management contracts are essentially consulting contracts, with some output risk transferred to the private sector. This means that:

- The capabilities of the individuals on the management team is a critical determinant of success. The qualifications of the individual will be more important than the qualifications of the firm or consortium bidding, and the qualifications should be thoroughly checked (through reference checks against past performance).
- More risk can be transferred to the management contractor if the contractor is given control over those risks. There are some risks that private operators will never accept in a management contract (regulatory risk related to the tariff, for example), but the more successful management contracts have been those in which the management contractor is given broader scope to manage the operations of the utility instead of discrete tasks.

One of the most useful deliverables under a management contract can be a comprehensive business plan aimed at strengthening the utility's staff competencies, management and operational skills in order to achieve and sustain better operational and financial performance. The contents of the Business Plan should be the basis for preparing and tendering the management contract and is the basis for allocating risks and responsibilities between the public and private partners. Key elements of the business plan should be: (i) reform of organizational structures and selection of staff within the structure; (ii) definition of processes (management information systems and IT); (iii) implementation of a training plan; and (iv) implementation of priority investments for meeting service targets.



***Better tariff regulation is essential...***

Better tariff regulation is critically important to breaking the vicious circle shown in Figure 2.1. The power companies need to be able to invest in proper maintenance and system improvements. Such investments—if a proper performance monitoring framework is in place—will improve service and with it, customer willingness-to-pay.

Better tariff regulation starts with a clear methodology for setting cost-reflective tariffs. Predictability and transparency in tariff regulation can be almost as important as the level of the tariff itself because they allow power companies to better plan capital expenditure and maintenance. The World Bank is currently supporting Government in developing a methodology for setting both company and end-user tariffs, based on good international practice.

***...combined with better mitigation measures to protect the poor.***

Because of the high rate of poverty in the Kyrgyz Republic, mitigation mechanisms will be needed to protect the poor from the impact of a gradual tariff increase. However, as described above, existing social assistance mechanisms are poorly targeted and slow to respond to the needs of the poor while the incidence of poverty is high.

A lifeline tariff could be a good option to mitigate tariff increases in the short-term, until better social assistance mechanisms could be developed. It could be particularly helpful in helping middle-class households adapt to higher power prices, thereby increasing the political feasibility of tariff reform.<sup>15</sup> The lifeline tariff should be designed to cover only a “basic” level of consumption in order to protect the most vulnerable customers. This mechanism could be used to replace some of the existing, less effective subsidies described above. The World Bank-funded technical assistance for establishing tariff setting methodology includes an analysis of a range of social impact mitigation options available to Government, including lifeline tariffs, and how to implement them.

In the medium-term, improving the targeting, coverage and delivery mechanisms of existing targeted social assistance programs, such as the Monthly Benefits for the Poor Program, will provide better targeting, and should be implemented. Energy efficiency measures could also be implemented in the medium-to-long term to mitigate the social impact of tariff increases.

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<sup>15</sup> World Bank. 2012. “Europe and Central Asia Balancing Act: Cutting Subsidies, Protecting Affordability, and Investing in the Energy Sector in Eastern Europe and Central Asia Region”. Washington, DC.



## 3.2 Solution 2: Better Financial Viability

***Better governance & regulation can improve the financial condition of the sector***

Better governance and regulation will improve the financial condition of the sector, but alone are not sufficient to put the sector on sound financial ground. Better governance and regulation can increase collections, reduce losses and allow companies to better plan O&M and capital expenditures. Proper expenditure planning will lead to better financial viability by reducing emergency expenditures, which are more costly than routine maintenance and decrease revenue because of outages.

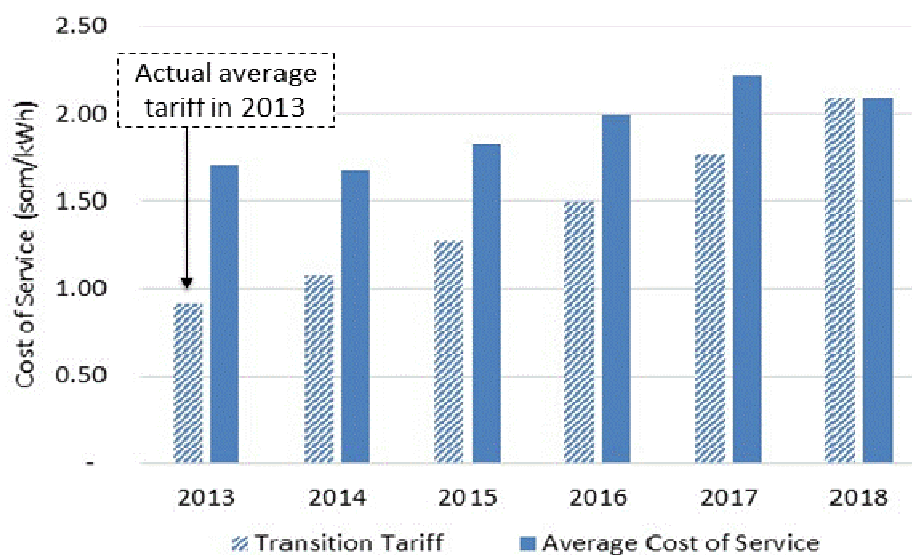
***...but financially viability requires tariff increases***

Establishment of a clear methodology for setting cost-recovery tariffs will only make the companies financially viable if tariffs are increased in line with the recommendations of the methodology. Under the business-as-usual scenario, the average cost of service from 2014 to 2024 will be 2.34 som per kilowatt hour. Raising the nominal weighted average end-user tariff by 17.9 percent annually would allow reaching cost recovery by 2018 (see Figure 3.3).<sup>16</sup> The cost of service can be reduced in future years if important reforms occur. Appendix D presents the results of the cost of service analysis under the “Business-as-Usual” (BAU) Scenario, which is shown below, as well as the cost of service results of the Reform Scenario, which assumes loss reduction, tariff increases and carefully prioritized investment in new generation assets. Under the Reform Scenario, the average cost of service from 2014 to 2024 will be 1.86 som per kilowatt hour, which is 21 percent lower than the average cost of service during this same period under the BAU scenario. The end-user tariffs required to achieve the average cost of service, and the related tariff increase required for each customer class, are currently being refined as part of the on-going World Bank technical assistance to establish a tariff-setting methodology for the power sector.

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<sup>16</sup> These cost of service calculations are projected values. Company costs should be reviewed periodically to determine actual required tariff increases in future years,

**Figure 3.3. Transition to Cost-Recovery Tariffs, 2013-2018**



### 3.3 Solution 3: Better Supply Reliability and Service Quality

As shown in Figure 2.6 and Figure 2.7, the sector needs urgent, and substantial investments to meet winter peak demand and expected future consumption. Such investment must be carefully prioritized, on a least cost basis, and include rehabilitation as well as investment in new generation, transmission and distribution infrastructure. This section describes a package of investments and reforms aimed at closing the emerging winter supply gap and improving service quality. The reforms include a combination of asset rehabilitation, loss reduction, demand-side management, and investments in new generation capacity.

#### ***Rehabilitation should be a priority...***

Rehabilitating existing assets should be a priority since it can improve supply reliability and reduce the power deficit at less than the cost of building new assets. Rehabilitating hydropower plants (Toktogul, Uch-Kurgan, and At-Bashi) will reduce the probability of outages and—for some of the plants—increase available capacity. Rehabilitating transmission and distribution assets will reduce technical losses which will reduce the generation needed to meet demand, thereby improving supply adequacy and reducing probability of outages. The cost of rehabilitating generation, transmission and distribution infrastructure is estimated at roughly US\$870 million. This estimate compares favorably with the estimated cost of building new assets. For example, the cost of rehabilitating existing generation capacity ranges from US\$250 to US\$300 per kW while the cost of building new generation capacity ranges from US\$1,200 to US\$2,000. Table 3.1 shows estimated rehabilitation by asset type. To date, only 22 percent of necessary rehabilitation has secured financing.

**Table 3.1. Estimated Power Sector Rehabilitation Needs<sup>17</sup>**

	Asset	Total Cost of Rehabilitation (mln US\$)
Generation	Toktogul HPP	260
	Uch-Kurgan HPP	130
	At-Bashi HPP	25
Transmission	Line Rehabilitation	160
	Substation and Metering	40
Distribution	Line and Substation Rehabilitation	190
	Metering/Billing	60
	<b>Total Rehabilitation Needs</b>	<b>865</b>

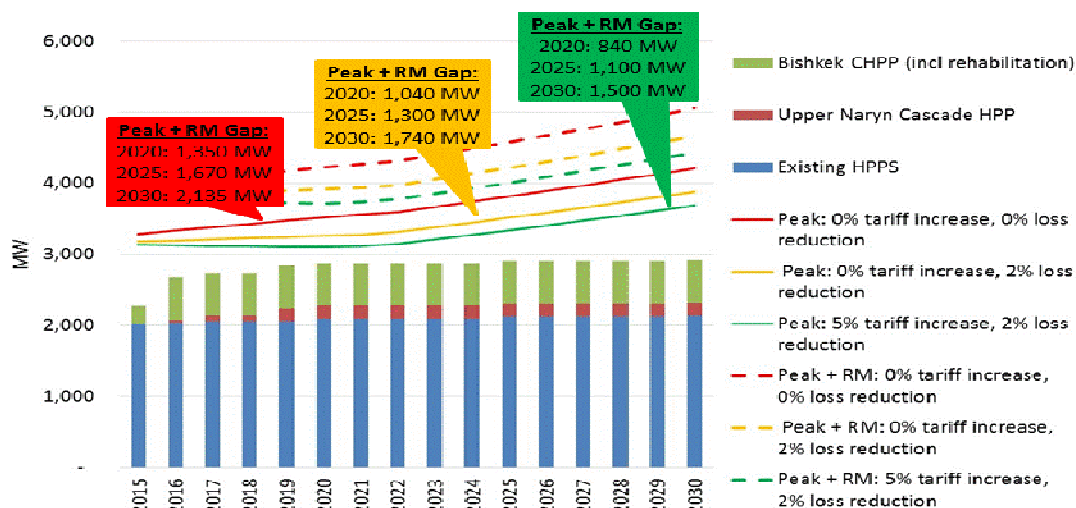
***... as should  
reductions in  
losses and tariff  
increases...***

Investments in rehabilitation and replacement of old transmission and distribution assets, and in metering will lead to lower losses, as will improvements to governance and regulations (e.g. tariff regulation).

Figure 3.4 compares two demand forecasts to the forecast shown in Figure and Figure 2.7 One which assumes companies reduce both technical and non-technical losses by 1 percent every year until 2026 and 2023, respectively, when technical losses are 11 percent and there are no non-technical losses (yellow line); another which makes the same loss reduction assumptions and assumes an annual real tariff increase of 5 percent until 2020 (green line). Loss reduction alone, as shown by the yellow line, can reduce BAU demand by an average of 6 percent annually from 2013 to 2030. Loss reduction combined with a 5 percent real tariff increase, as shown by the green line, can reduce BAU demand by an average of 10 percent annually during the same period.

<sup>17</sup> Estimated rehabilitation needs of transmission lines are based on the assumptions that approximately 20 percent, or 1,340 km, of transmission lines are in poor condition, and the average cost of rehabilitation of transmission lines is US\$ 120,000 per km.

**Figure 3.4: Peak Winter Demand vs. Available Capacity, 2015-2030 with Lower Losses, Higher Tariffs and Investment in Rehabilitation**



Note: Available capacity of hydropower plants shown in this figure reflects historical capacity available during winter months when peak demand occurs in the Kyrgyz Republic.

Note: The reserve margin of 20 percent is used to approximate the relative likelihood that load growth in a particular hour will trigger the need for additional capacity.

**... and other demand-side management measures could reduce load further.**

The need for new generation capacity can also be reduced by decreasing winter electricity load for heating purposes. A substantial share of customers rely on electricity for heating in winter because they are not connected to the district heating network, or district heating alone is insufficient to meet their heat demand. District heating is available only in urban areas of the regions Chuy (including Bishkek), Osh, Jalalabat, Talas, Naryn and Issyk-Kul covering around 24 percent of the residential consumers and 14 percent of the living space.<sup>18</sup> A recent survey conducted by Unison and USAID found that 37.5 percent of respondents rely primarily on electricity for heating and cooking throughout the year, and 34 percent of households use electricity for additional heating during winter months. In Bishkek, nearly half of all respondents use electricity for heating, despite greater availability of district heating in the city than in rural regions of the country.<sup>19</sup>

This dependence on electric heating and the low energy efficiency of buildings aggravates the winter power deficit. Winter power consumption by residential customers is more than twice the level of summer consumption. Alternatives to electric heating and energy efficiency retrofits should be explored as a way of improving supply adequacy and reliability, and reducing the cost of domestic supply. The World Bank is

<sup>18</sup> Fichtner, "Heating Assessment for Urban Building Sector in the Kyrgyz Republic and Tajikistan," The World Bank. 2013.

<sup>19</sup> Unison and USAID, "Analysis of Electricity Distribution and Consumption System in Kyrgyzstan," 2013.

currently conducting a detailed assessment of heating options for the Kyrgyz Republic, which is also assessing the potential benefits of energy efficiency investments. The results of this study will be used to inform future recommendations for reducing electricity load resulting from heat consumption.

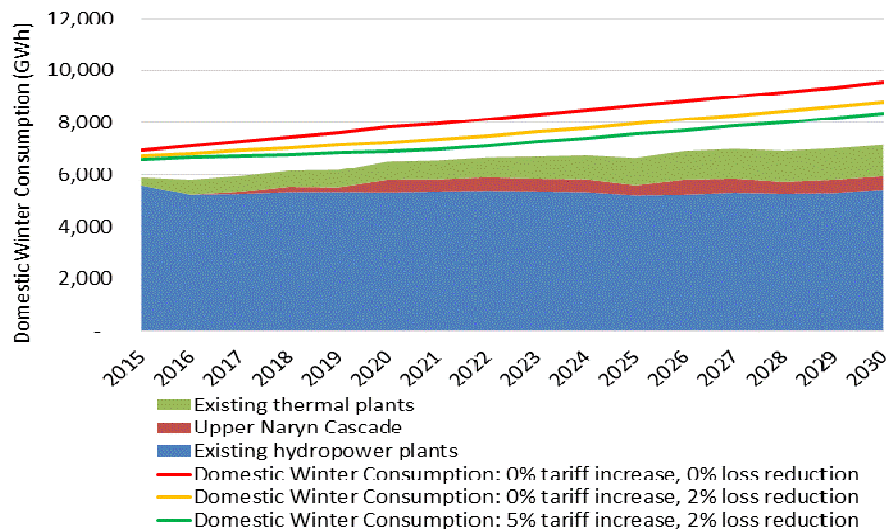
***New generating capacity, however, will still be needed even under the most optimistic scenario***

Investments in rehabilitation, loss reduction and demand side management can substantially reduce the gap between available supply and peak winter demand. New generation capacity will, nevertheless, be required. There is already substantial suppressed winter demand, and—even in the most optimistic scenario shown in

Figure 3.4—a gap between peak and available capacity will likely persist unless new capacity is built. Under the business-as-usual scenario, the gap between peak winter demand and available capacity, including a 20 percent reserve margin, will be 1,350 MW in 2020, 1,670 MW in 2025 and 2,140 MW in 2030.<sup>20</sup> If tariffs increase and losses are reduced, as shown by the green line in Figure 16, the gap will be smaller, but will reach 1,100 MW by 2025 and 1,500 MW by 2030.

There is also insufficient available generation to meet winter consumption in future years (see Figure 3.5). If losses are reduced by two percent annually and there is a real tariff increase of five percent annually until 2020, the gap between available winter generation and winter consumption will be 440 GWh in 2020, 920 GWh in 2025 and 1,270 GWh in 2030.

**Figure 3.5: Available Generation vs. Winter Consumption, 2015-2030 with Lower Losses, Higher Tariffs and Investment in Rehabilitation**



<sup>20</sup> The reserve margin of 20 percent is used to approximate the relative likelihood that load growth in a particular hour will trigger the need for additional capacity.

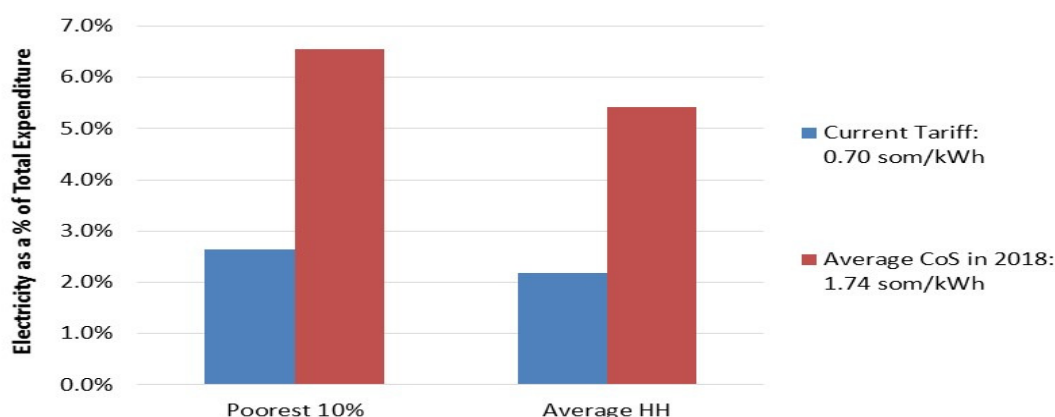
The projected supply gaps between available capacity and peak demand and available winter generation and winter consumption suggest that the sector requires both peaking capacity and firm base load capacity in order to supply future demand. Detailed feasibility studies should be conducted to assess the viability of specific options for the Kyrgyz Republic to meet future demand.

### 3.4 Solution 4: Affordability

***Tariff increases will affect the poor despite efforts to reduce the cost of service.***

A focus on better governance, rehabilitation, loss reduction, and investment in least cost generation capacity can help prevent a large increase in the cost of power supply. Better governance can also help protect the most vulnerable customers from higher tariffs. Tariff increases required to reach the cost of service, nevertheless, will have implications for the affordability of power supply. The average household's expenditure on electricity as a percentage of total household expenditure will more than double if tariffs increase immediately to the average cost of service for 2018. The impact of this increase will be greater on the poorest 10 percent of households, with electricity expenditure increasing to 6.5 percent of total household expenditure (see Figure 3.6).

**Figure 3.6. Electricity Spending as a Percentage of Total Household Expenditures**



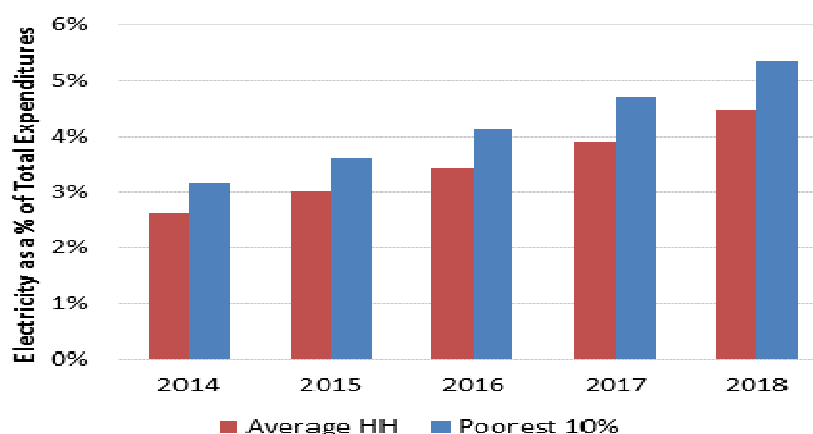
NOTE: The 2018 average cost of service depicted above (1.74 som/kWh) is based on the Reform Scenario, which assumes the following: Losses are reduced by 2 percent annually, tariffs are increased by 5 percent annually and new capacity of 600 MW is constructed to meet peak demand and close the winter supply gap. Appendix D contains the full results of the cost of service analysis under the Reforms Scenario as well as the "Business-as-Usual" Scenario.

***A phased introduction of higher tariffs will help to mitigate the impact on household energy expenditure***

A phased introduction of higher tariffs will help to mitigate the impact on household energy expenditure and will likely require only moderate increases in household expenditures on electricity. A 20 percent nominal tariff increase is required annually for the residential tariff to reach the average cost of service by 2018. This would increase the electricity share in household expenditure by only 2.1 percentage points on average, and 2.6 percentage points for the poorest 10 percent of the population by 2018 (see Figure 3.7). Even with this increase, the electricity expenditure as a proportion of overall household budget would remain significantly below

the ECA average (see Figure 2.13).

**Figure 3.7 Electricity Spending as a Percentage of Total Household Expenditures with Gradual Increase to 2018 Cost-Recovery Tariffs**



## 4 Next Steps

***A comprehensive package of reforms is needed with a clear road-map for implementation.***

As Section 3 highlighted, comprehensive package of reforms is needed to address the looming challenges in the power sector. The Government of the Kyrgyz Republic needs a clear road-map to adequately time, sequence and implement the reforms. Table 4.1 recommends the time frame in which reforms should be implemented and demonstrates which challenges these reforms will help address.

**Table 4.1. Implementation Time Frame for Recommended Reforms**

Objective	Immediate Action (next 24 months)	Next Steps (next 3-5 years)
<b>Better governance at the sectoral and company levels.</b>	<ul style="list-style-type: none"> <li>Clearly define regulatory responsibilities between the Regulatory Department, Anti-Monopoly Agency and Inspectorate</li> <li>Adopt an effective performance monitoring &amp; enforcement framework through clearly defined reporting procedures and templates, more targeted KPIs, and improvements to the existing performance agreements</li> <li>Adopt a clear and predictable tariff setting methodology for determining tariffs for the sector companies and end-users</li> <li>Begin improving governance and internal controls within power</li> </ul>	<ul style="list-style-type: none"> <li>Apply the performance monitoring and enforcement, improving it and setting service quality standards as data baseline of companies improves and analytical ability of the economic regulator improves</li> <li>Continue improving governance and internal controls within power companies by completing the modernization of management information systems, establishing internal audit departments, and performance based-contracts with the senior</li> </ul>

Objective	Immediate Action (next 24 months)	Next Steps (next 3-5 years)
	<p>companies by initiating business process re-engineering and starting modernization of management information systems</p>	<p>management of companies</p> <ul style="list-style-type: none"> <li>▪ Apply the tariff methodology, improving it over time as company reporting improves and capabilities of the economic regulator improve</li> <li>▪ Re-design social assistance program to better target poor</li> </ul>
<p><b>Financially viable power companies, with sustainable revenue and expenditures</b></p>	<ul style="list-style-type: none"> <li>▪ Set company and end-user tariffs in line with the adopted tariff methodology; start increasing tariffs</li> <li>▪ Identify investment needs for asset rehabilitation and metering and begin improving governance and internal controls within companies to reduce technical and commercial losses</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increase tariffs to cost-recovery level in a phased manner</li> <li>▪ Reduce losses by implementing asset rehabilitation and metering investments and strengthening governance and internal controls within companies</li> </ul>
<p><b>Reliable power supply and good service quality characterized by reduced frequency and duration of outages and fewer fluctuations in voltage and frequency</b></p>	<ul style="list-style-type: none"> <li>▪ Identify investment needs for asset rehabilitation and metering and begin improving governance and internal controls within companies to ensure reliable operation of existing assets and reduce losses</li> <li>▪ Adopt performance monitoring &amp; enforcement framework</li> <li>▪ Start increasing tariffs in line with the tariff methodology</li> <li>▪ Identify viable heating and energy efficiency investments</li> <li>▪ Identify investments in new assets based on a least cost power system planning</li> </ul>	<ul style="list-style-type: none"> <li>▪ Implement asset rehabilitation and metering investments and strengthen governance and internal controls within companies</li> <li>▪ Apply the performance monitoring and enforcement, improving it and setting service quality standards as data baseline of companies improves and analytical ability of the economic regulator improves</li> <li>▪ Increase tariffs to cost recovery level in a phased manner</li> <li>▪ Reduce winter power demand through investments in heating and energy efficiency</li> <li>▪ Invest in new assets identified through the least cost planning</li> </ul>
<p><b>Protect the most vulnerable population from tariff increases and increase willingness to pay</b></p>	<ul style="list-style-type: none"> <li>▪ Introduce lifeline tariffs</li> <li>▪ Identify alternatives to electric heating and economically viable energy efficiency investments</li> <li>▪ Start publishing KPIs based on the adopted performance monitoring framework</li> <li>▪ Begin improving governance and internal controls within companies for faster and more effective response to</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provide targeted social assistance</li> <li>▪ Implement heating and energy efficiency investments</li> <li>▪ Continue periodic publication of KPIs and improve them as data baseline of companies improves</li> <li>▪ Improve power supply reliability and service quality</li> </ul>



Objective	Immediate Action (next 24 months)	Next Steps (next 3-5 years)
	customer inquiries and improved service quality	through investment in assets and through strengthening governance and internal controls within companies

***The World Bank and other IFIs have a number of on-going projects to address key challenges in the sector.***

The World Bank and other International financial institutions (IFIs) have a number of on-going projects, which are helping to address the key challenges in the power sector. This work broadly supports the implementation of the Power Sector Development Strategy and Action Plan.

The World Bank is assisting development of a tariff-setting methodology based on international best practice and improving the existing performance monitoring framework. It also funds a heating assessment for the residential and public building sector to help identify alternative heating options and energy efficiency measures which can reduce winter power shortages.

The World Bank's work builds on the work of a number of studies produced by USAID's Regional Energy Security, Efficiency and Trade Program from 2010-2013 which contributed to the body of knowledge about key challenges in the power sector.

The World Bank and KfW are both providing support to the largest distribution company (SE). The World Bank is financing improvements to segments of the distribution infrastructure in Bishkek, incorporation of management information system and technical assistance to improve the company's governance and internal controls. KfW is providing SE with financing for 110,000 smart meters, replacement of conventional (bare) conductors in low voltage networks by aerial bound conductors to prevent illegal connections, and the establishment of a billing system.

The Asian Development Bank (ADB) has been active in financing the rehabilitation and upgrade of critical power sector assets in recent years, including the rehabilitation of Tokotogul hydropower plant, and a transmission metering improvement project which includes the installation of an automatic metering and data acquisition system on all of NESK's commercial borders. ADB has also been funding advisory services. It is funding a public relations campaign to explain tariff setting and raise awareness about the need to increase tariffs, and has plans to support the strengthening of financial management in the sector (including company audits and asset revaluations), and to fund the hiring of a management contractor for the new Settlement Center.

## Appendix A. Analysis of Historical Operational Performance in the Power Sector (2007-2012)

The operational and financial performance of the power sector are closely interrelated. Poor operational performance, including high technical and commercial losses and low efficiency of thermal generation, leads to higher costs per kWh sold. Higher costs for power production draws financial resources away from other important expenditure categories, including maintenance, repairs, and capital expenditure. Under-spending in these areas, particularly in a heavily depreciated power system like that in the Kyrgyz Republic, increases the likelihood of equipment failure leading to reduced service quality and higher frequency of outages. Deterioration in service quality reduces customer's willingness to pay, which further threatens the financial health of the power companies.

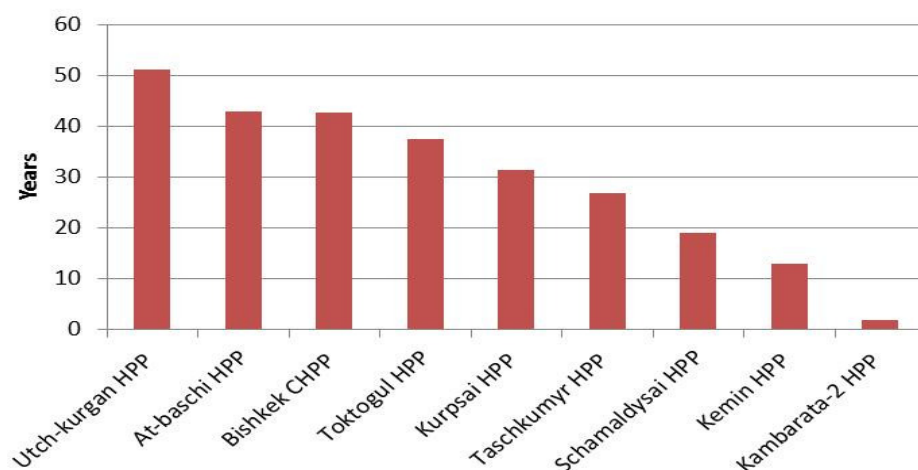
The effects of this cycle are demonstrated in the operational performance of the power system in the Kyrgyz Republic. Generation, transmission and distribution assets in the Kyrgyz Republic have not been properly maintained, and as a result, the country has high losses and poor service quality.

The following subsections discuss the operational performance of the sector. Section A.1 discusses the age and condition of assets. Sections A.2 and A.3, respectively, evaluate service quality and commercial and technical losses in the power sector of the Kyrgyz Republic from 2007 to 2012. Section A.4 analyzes the supply-demand balance from 2007 to 2012.

### A.1 Age and Condition of Assets

Power sector assets are old and have not been sufficiently maintained. The majority of generation assets, which are on average 34 years old, are at or near the end of their useful lives. Kambarata 2, Kemin HPP, and Shamaldy-sai HPP, which together represent 11 percent of total installed generation capacity, are the only existing plants that have been in service for less than 20 years. Appendix Figure A.1 shows the age of generation assets owned by the generation company (EPP).

Appendix Figure A.1: Age of Generation Assets (2013)



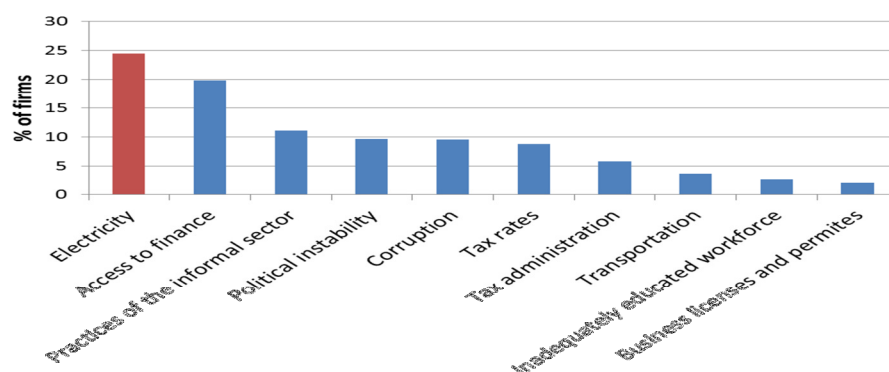
Transmission and distribution assets are also old and in poor condition. In 2012, the distribution company SE, which serves Bishkek and the surrounding areas, stated that 85 percent of 0.4 kV distribution lines and electrical equipment was in urgent need of repair.<sup>21</sup> In 2013, the four distribution companies reported that 28 percent, or 14,550 km, of .4-10 kV power lines were in poor condition. Three distribution companies- SE, VE and JE - together estimate a required investment of 11.8 billion som to rehabilitate distribution assets. In 2009, the transmission company (NESK) reported that 50 percent of transmission substations were more than 25 years old and 18 percent of transmission lines were more than 40 years old.

## A.2 Service Quality

The age of assets combined with under-spending on maintenance and rehabilitation has led to a deterioration of service quality. During winter months, service quality is particularly poor because demand exceeds supply and transmission capacity. From 2009 to 2012, the consolidated distribution companies reported an average of 43 outages per day on an annual basis, and SE alone reported an average of 20 outages per day during the winter from 2010 to 2012. As recently as December of 2012, there was a breakdown at Toktogul HPP which led to country-wide rolling blackouts. There are also frequent emergency shut-downs of transmission and distribution facilities because equipment has insufficient capacity to meet high winter demand, especially in Bishkek.

Poor service quality has significant consequences for economic development. The business environment in the Kyrgyz Republic compared to other countries in the region has suffered as a result of poor service quality, with almost 25 percent of businesses surveyed in 2009 ranking electricity service quality as the single largest obstacle to their business (see Appendix Figure A.2). As shown in Appendix Figure A.3, the Kyrgyz Republic ranks third worst in countries in the Eastern Europe and Central Asia (ECA) region, and among the worst 10 countries worldwide in terms of the ease of getting electricity in International Finance Corporation's Doing Business Index.

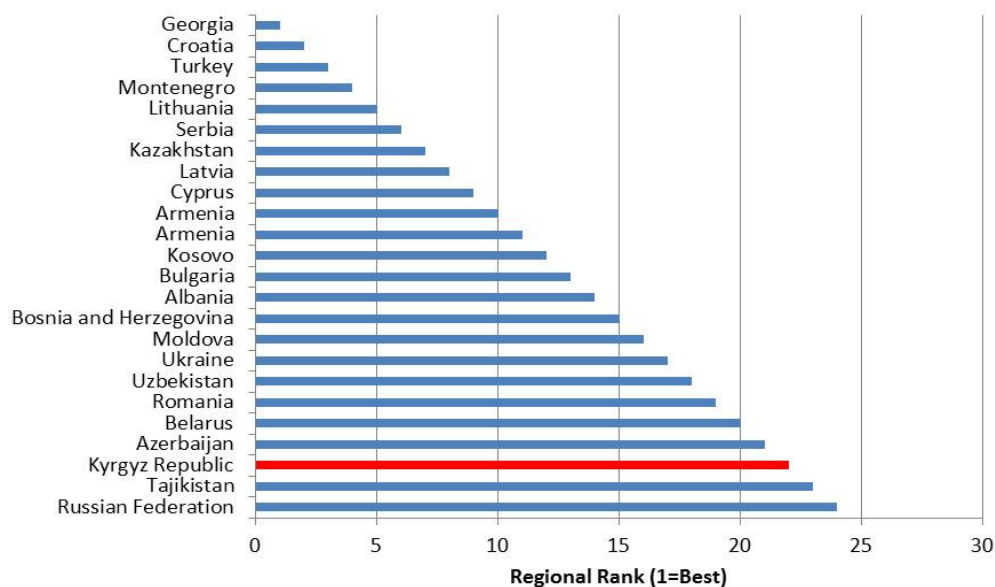
**Appendix Figure A.2: Top 10 Constraints to the Business Environment, Kyrgyz Republic (2009)**



Source: The World Bank, "Enterprise Survey: Kyrgyz Republic," 2009.

<sup>21</sup>OJSC Severelectro, "The Development Strategy of Severelectro for 2012-2014," November 1, 2012. [http://www.severelectro.kg/index.php?option=com\\_content&view=article&id=1309&Itemid=78&lang=ru](http://www.severelectro.kg/index.php?option=com_content&view=article&id=1309&Itemid=78&lang=ru)

**Appendix Figure A.3: Ease of Getting Electricity, Doing Business Regional Ranking (2012)**

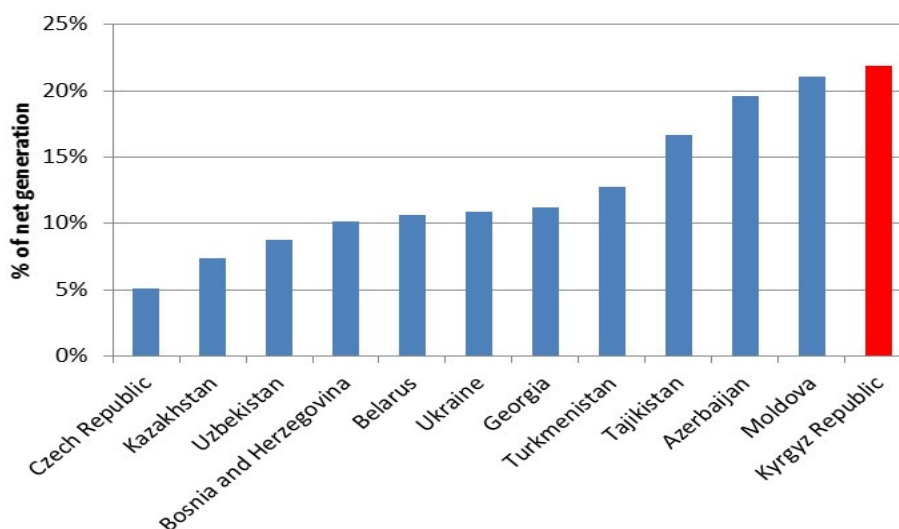


Source: International Finance Corporation (IFC), "Doing Business Index," 2012.

### A.3 Technical and Commercial Losses

The Kyrgyz Republic's power system has the highest technical and commercial losses in the ECA region, despite a steady reduction in losses since 2007. Reported losses, which were 22 percent of net generation in 2011, were 9 percent higher than the average level of losses in the region and actual losses were likely even higher. Appendix Figure A.4 compares transmission and distribution losses in the Kyrgyz Republic to other countries in the ECA region.

**Appendix Figure A.4: Transmission and Distribution Losses in the ECA Region, 2011**

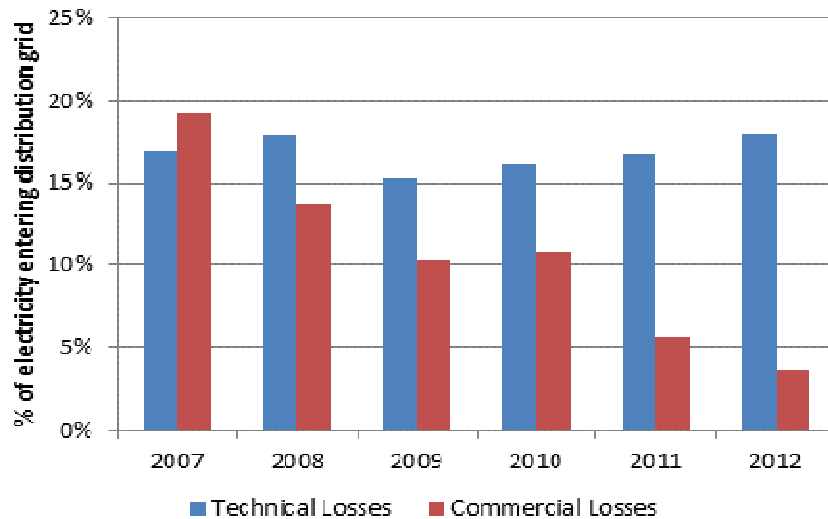


Source: World Bank, "World Development Indicators," Accessed January 2014.

Losses decreased steadily from 2007 to 2012 driven primarily by a decrease in reported commercial losses. Technical losses decreased slightly from 25 percent of net generation in

2007 to 23 percent in 2009 and 2010, but increased back to 25 percent in 2012. Over the same period, commercial losses decreased from 19 percent of electricity entering the distribution grid to 4 percent. Commercial losses decreased by an average of 3 percent annually even though companies have not made any significant investments or changes in management practices. Appendix Figure A.5 shows the commercial and technical losses for all distribution companies from 2007 to 2012.

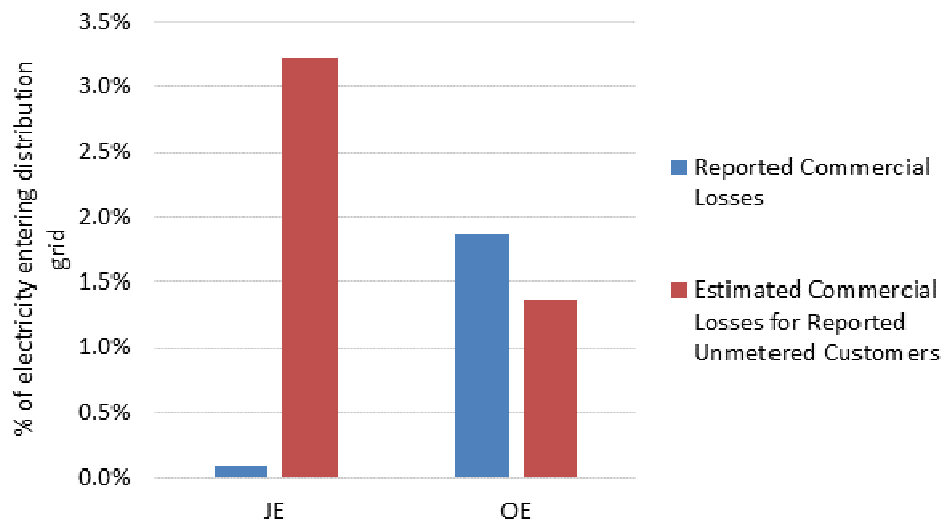
**Appendix Figure A.5: Distribution-Level Technical and Commercial Losses, 2007-2012**



Commercial losses may be underreported given the number of unmetered customers. In 2012 Jalalabatelectro (JE) and Oshelectro (OE) reported less than 2 percent commercial losses despite the fact that these companies together report over 7,000 unmetered customers.<sup>22</sup> As demonstrated in Appendix Figure A.6, estimated commercial losses from these unmetered customers alone would surpass JE's reported commercial losses, and would represent more than 60 percent of OE's officially reported commercial losses.

<sup>22</sup> Estimate of commercial losses for unmetered customers based on assumption that unmetered customers consume double the electricity of metered customers (Tetra Tech/USAID, "Management Diagnostic of the Electricity Distribution Companies of the Kyrgyz Republic" March 31, 2011).

**Appendix Figure A.6: Reported vs. Estimated Commercial Losses for JE and OE, 2012**



## **A.4 Supply and Demand Balance**

Electricity generation decreased significantly from 2007 to 2009 as a result of an energy crisis that caused widespread outages across Kyrgyz Republic and curtailed opportunities for export. Domestic and export demand have increased steadily since the crisis ended, with the majority of domestic demand growth occurring during winter months. Section A.4.1 provides an overview of power supply from 2007 to 2012, and Section A.4.2 discusses historical domestic and export demand.

### **A.4.1 Historical Supply**

The Kyrgyz Republic has a total installed capacity of 3,786 MW. The installed capacity of hydropower plants (HPPs) is 3070 MW and the installed capacity of combined heat and power plants (CHPs) is 716 MW. From 2007 to 2012, HPPs produced an average of 93 percent of gross generation. The majority of HPP production comes from the Naryn cascade, which has five large HPPs: Toktogul, Kurpsai, Tash-Kumyr, Shamaldy-sai and Utch-Kurgan. The remaining 7 percent of generation comes from Bishkek CHP and Osh CHP. Bishkek and Osh CHPs operate primarily to meet winter heating demand, producing electricity as a byproduct. Accordingly, the majority of annual production from these plants occurs from November to March.

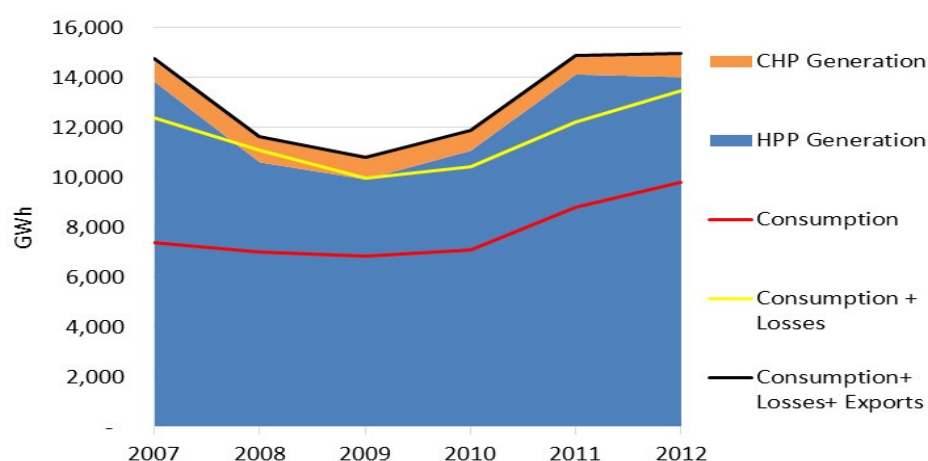
Appendix Table A.1: shows the installed and available capacity of the plants of the Toktogul Cascade and Bishkek CHP.

**Appendix Table A.1: Installed vs. Available Capacity of Toktogul Cascade and Bishkek CHP, 2012**

Plant Name	Installed Capacity (MW)	Available Capacity (MW)	Available Generation (GWh)
Toktogul HPP	1,200	1,192	6,079
Kurpsai HPP	800	796	2,769
Tash-Kumyr HPP	450	447	1,746
Shamaldy-sai HPP	240	237	820
Utch-Kurgan HPP	180	180	992
Bishkek CHP	666	384.8	828

Appendix Figure A.7: shows total generation by technology from 2007 to 2012. As the figure shows, there was a significant decrease in generation from 2007 to 2009. Low water levels at Toktogul Reservoir and an unusually cold winter caused an energy crisis in the Kyrgyz Republic during the winter months from 2007 to 2009. As a result, there was not enough generation to meet domestic and export demand. Exports dramatically declined and there were power cuts in the Kyrgyz Republic during the winter months.

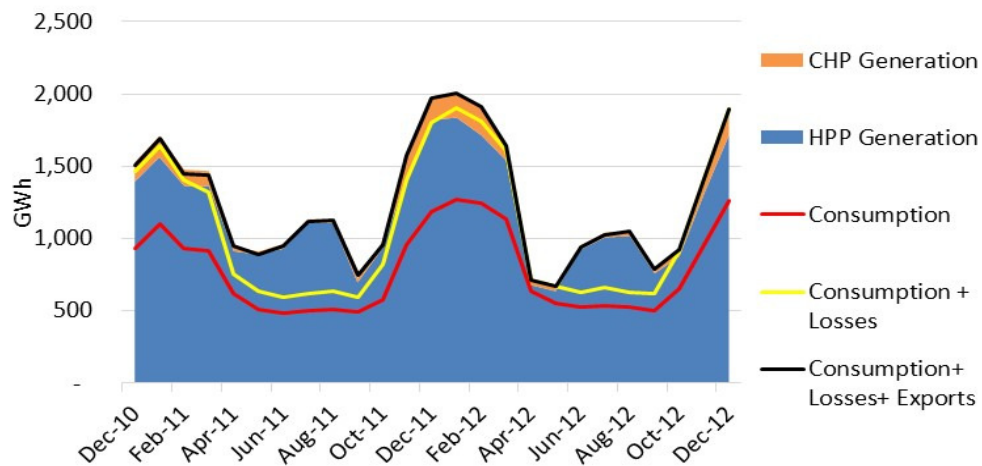
**Appendix Figure A.7: Historic Generation in the Kyrgyz Republic (2007-2012)**



The share of generation from HPPs is greatest during the summer months because there is very little demand for heat and sufficient hydropower capacity to meet demand. In addition, the Toktogul Cascade produces energy during summer months when water must be released from the Toktogul Reservoir to fulfill irrigation agreements with neighboring countries. Appendix Figure A.8 depicts monthly generation, consumption and exports from December of 2010 to December of 2012, which are reflective of typical seasonal trends from 2007 to 2012.



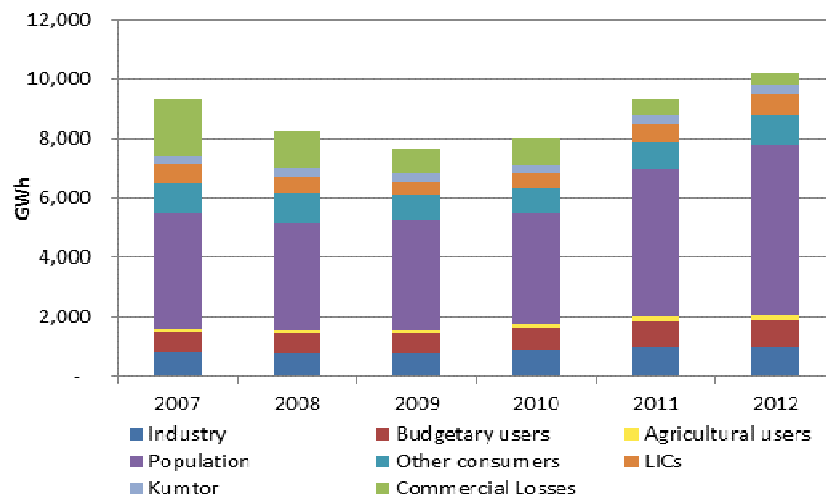
**Appendix Figure A.8. Monthly Generation Profile (December 2010-December 2012)**



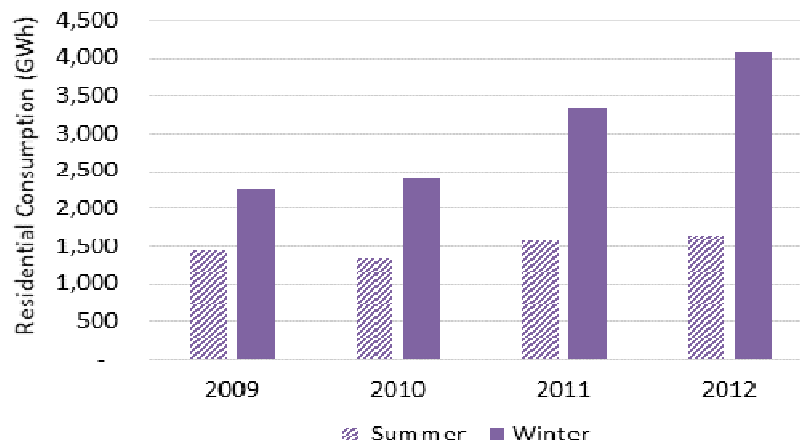
#### A.4.2 Historical Demand

Domestic consumption decreased in 2007 and 2008 as a result of the energy crisis, but began to recover in 2009, driven by growth in winter demand from residential customers. Residential customers are the largest consumer class, and grew from representing 53 percent of total domestic consumption in 2007 to representing 59 percent in 2012. From 2009 to 2012, residential demand grew by 54 percent, with 90 percent of this growth occurring during winter months. Appendix Figure A.9 shows annual domestic consumption by customer class from 2007 to 2012, including commercial losses. Appendix Figure A.9 depicts seasonal demand growth among residential customers from 2009 to 2012.

**Appendix Figure A.9: Domestic Consumption by Customer Class, 2007-2012**

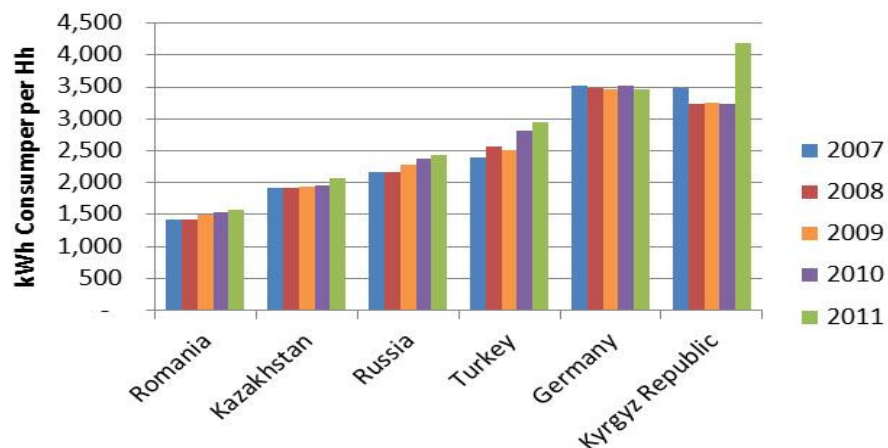


**Appendix Figure A.10 Seasonal Residential Consumption, 2009-2012**



Growing energy intensity has driven the increase in residential consumption. The number of residential customers grew by 7 percent from 2007 to 2012, while residential consumption grew by 47 percent during the same period. Appendix Figure A.11 demonstrates average household consumption in the Kyrgyz Republic compared to select countries with similar climates from 2007 to 2011.

**Appendix Figure A.11: Electricity Consumption per Household, 2007-2011**

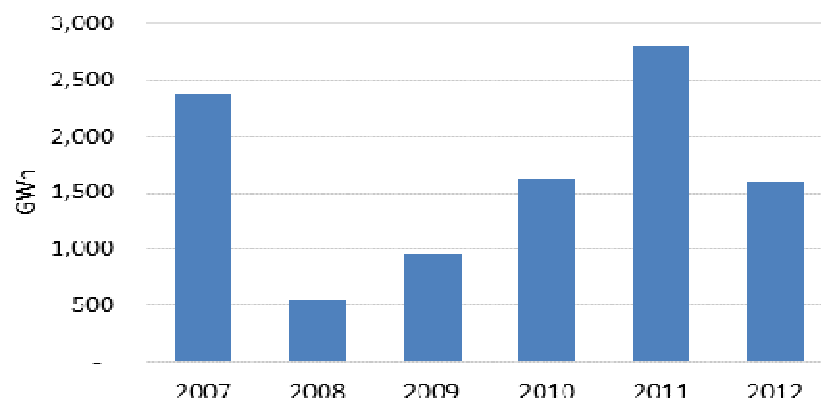


Source: World Energy Council, "Energy Efficiency Indicators," Accessed April 19, 2013. <http://www.wec-indicators.enerdata.eu/>

Exports nearly tripled from 2008 to 2012, following a sharp decline from 2007 to 2008 as a result of the energy crisis. In 2008, there was not enough generation to meet export demand and, as a result, the share of exports dropped from 24 percent of combined domestic and export consumption in 2007 to 7 percent in 2008. Exports increased consistently after 2008, and in 2012, exports represented 14 percent of combined domestic and export consumption. Exports in 2011 were abnormally high due to a number of factors including a particularly high water season and the negotiation of favorable export contracts. Appendix Figure A.12 shows exports from the Kyrgyz Republic from 2007 to 2012.

**Appendix Figure A.12: Total Exports, 2007-2012**

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Export demand is projected to continue to grow, especially if the CASA-1000 transmission line connecting the power grids of Tajikistan, the Kyrgyz Republic, Pakistan and Afghanistan comes online. If completed as scheduled, the line would increase export potential from the Kyrgyz Republic to 1,600 GWh by 2020.<sup>23</sup>

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<sup>23</sup> This estimation of export growth was provided by the CASA-1000 project team.

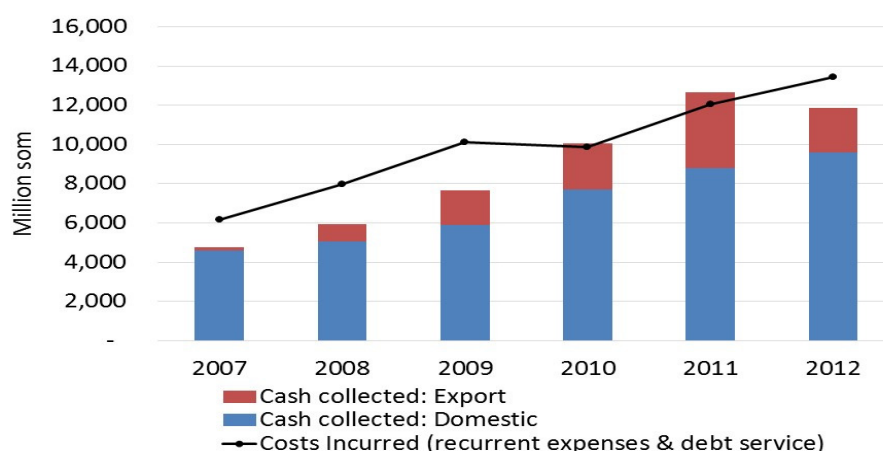
## Appendix B. Analysis of Financial Performance in the Power Sector

The financial performance of the power sector in the Kyrgyz Republic has improved in recent years, but performance is still poor and is highly reliant on export revenue. The financial condition of the sector improved from a financial deficit of 2.5 billion som (approximately US\$ 52.8 million) in 2009 to a financial surplus of 600 million som (US\$ 12.7 million) in 2011.<sup>24</sup> This improvement occurred in part because of improved collections and reduction in losses, but the main driver of better financial performance was a 130 percent increase in export revenue during this period. In 2012, the financial condition of the sector deteriorated when export revenue decreased by 60 percent from the previous year. Appendix Table B.1 provides key statistics about the financial performance of the power sector from 2007 to 2012. Appendix Figure B.1 compares cash collected to costs (recurrent expenses and debt service) incurred by the consolidated sector.

**Appendix Table B.1 Financial Performance of Consolidated Power Sector, 2008-2012**

<i>Million som</i>	2007	2008	2009	2010	2011	2012
<b>Financial gains/losses (Billed Revenue vs Costs)</b>	<b>533</b>	<b>(1,588)</b>	<b>(2,393)</b>	<b>789</b>	<b>1,035</b>	<b>(1,123)</b>
<b>Financial gains/losses (Collections vs Costs)</b>	<b>(1,410)</b>	<b>(2,029)</b>	<b>(2,472)</b>	<b>173</b>	<b>594</b>	<b>(1,554)</b>
Collection Rate (%)	71%	93%	99%	94%	97%	96%
Domestic	86%	92%	97%	91%	95%	96%
Exports	13%	101%	106%	105%	100%	99%

**Appendix Figure B.1 Cash collected versus Actual Costs Incurred (2007-2012)**



<sup>24</sup> The financial gap or surplus is defined as the difference between cash inflow and actual costs incurred (recurrent expenses and debt service) by the consolidated sector. If cash inflow is greater than costs incurred there is a financial surplus. Likewise, if costs incurred are greater than cash inflow, there is a financial deficit.

Despite improvements in recent years, financial problems of the sector are masked by under-spending on operating and maintenance costs, delayed capital expenditures and an accumulation of accounts payable. These activities allow companies to avoid necessary expenditure in the short-term by pushing off spending into future years. The economic and financial impact of these activities is discussed in Appendix C.

The following subsections evaluate the financial performance of the power sector in the Kyrgyz Republic since 2007. Section B.1 provides a detailed discussion of sector revenue, evaluating tariffs, export revenue, collections and accounts receivable. Section B.2 discusses power sector costs in terms of operating and maintenance (O&M) costs, capital expenditures and accounts payable.

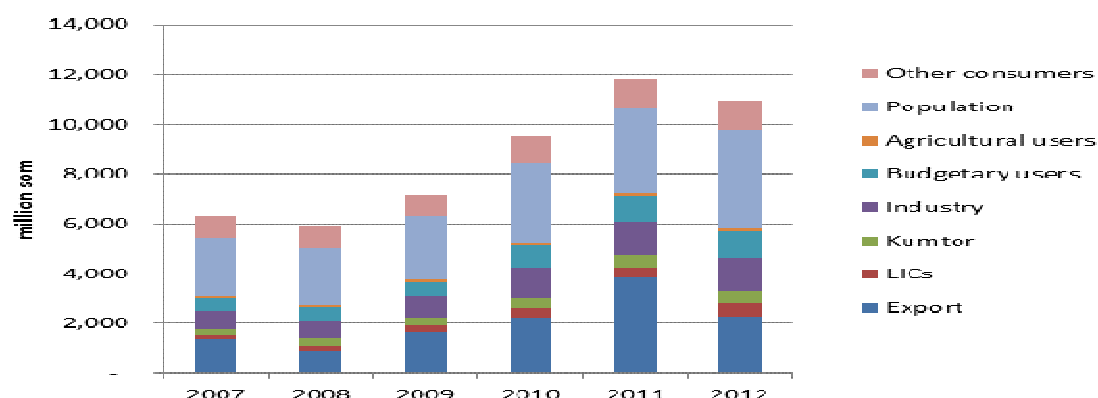
## B.1 Cash Inflow

From 2007 to 2012, power sector revenue nearly doubled on an accrual basis, and in 2012 revenue for the consolidated sector was nearly 11 billion som, or US\$ 231 million. Revenue growth was driven by:

- Domestic tariffs, which increased by 32 percent from 2007 to 2012 as a result of a 66 percent increase for non-residential customers from 2008 to 2010 and a 13 percent increase in residential tariffs in 2008.<sup>25</sup> The weighted average tariff for domestic customers was 92 tyin/kWh (0.019 USD/kWh) in 2012. Domestic tariffs have not increased since 2010, and tariffs for residential customers have not increased since 2008.
- Export revenue, which more than doubled from 2008 to 2012 as a result of a 175 percent increase in the volume of power exported. In 2012 the Kyrgyz Republic exported 1,500 GWh of power at a tariff of 152 tyin/kWh (USD 0.032/kWh).

Revenue also increased on a cash basis from 2007 to 2012 because of improvements in collection rates, which increased from 71 percent in 2007 to 96 percent in 2012. Appendix Figure B.2 shows sector revenue by customer category from 2007 to 2012.

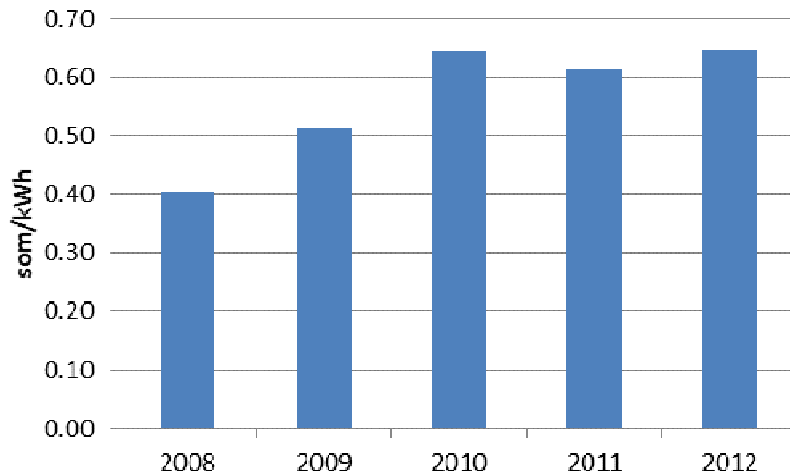
**Appendix Figure B.2: Power Sector Revenue, 2007-2012**



<sup>25</sup> The 32 percent tariff increase from 2007 to 2012 refers to the increase in the weighted average domestic tariff.

Data accuracy, particularly the validity of reported numbers pertaining to technical and non-technical losses and collections, is a major concern in the Kyrgyz Republic. Therefore the financial performance of the sector is assessed based on cash collected per kWh of gross generation, which after factors in collection rates and technical and commercial losses while not depending on the reported level of these three performance indicators. As Appendix Figure B.3 shows, cash collected per kWh of gross generation has increased by 60 percent from 2008 to 2012.

**Appendix Figure B.3: Cash Collected per kWh of Gross Generation, 2008-2012**



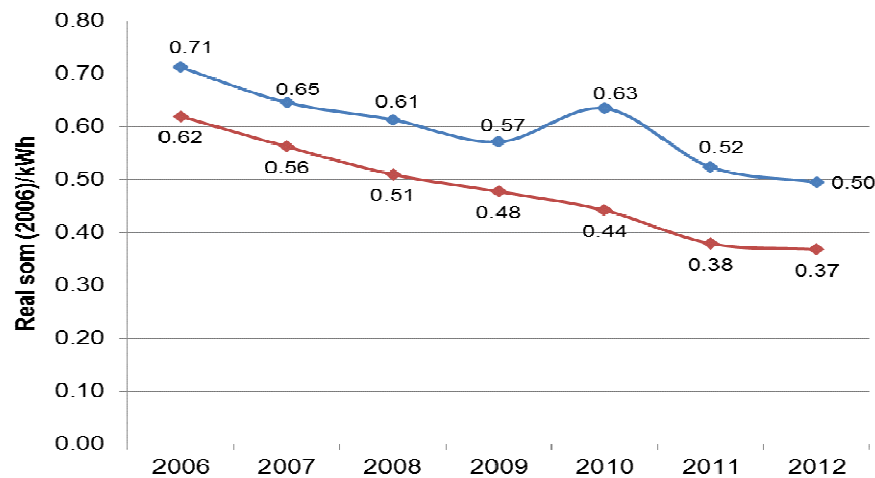
The following subsections discuss components of the power sector's revenue from 2007 to 2012 in further detail. Section B.1.1 discusses end-user tariffs. Section B.1.2 evaluates export revenue in the context of overall sector revenue. Section B.1.3 assesses collection rates. Section B.1.4 analyzes accounts receivable of the power sector.

### **B.1.1 Tariffs**

Revenue increases in 2010 can be partially attributed to non-residential tariffs, which increased from 80 tyin per kWh in 2008 to 132.7 tyin per kWh in 2010. However, residential tariffs have not increased since 2008 and increases in non-residential tariffs have not kept pace with inflation.<sup>26</sup> As a result, the weighted average end-user tariff decreased by 31 percent from 2006 to 2012 in real terms, and the residential real tariff decreased by 41 percent. Appendix Figure B.4 shows the real weighted average end-user tariff and the real residential tariff from 2006 to 2012.

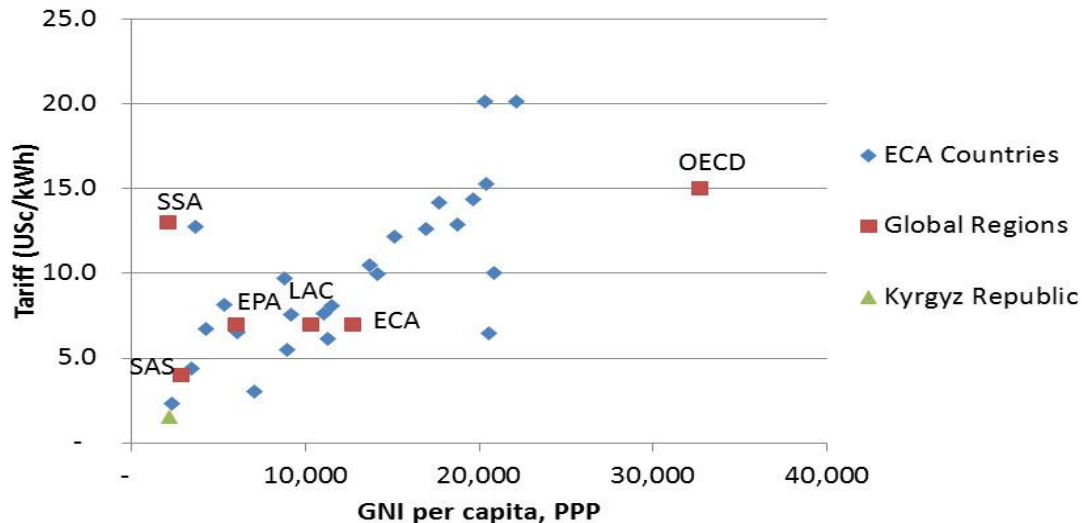
<sup>26</sup> Residential tariffs increased for a brief period from January to April 2010, but were then returned to their previous level.

#### Appendix Figure B.4: Weighted Average and Household Real Tariffs, 2006-2012



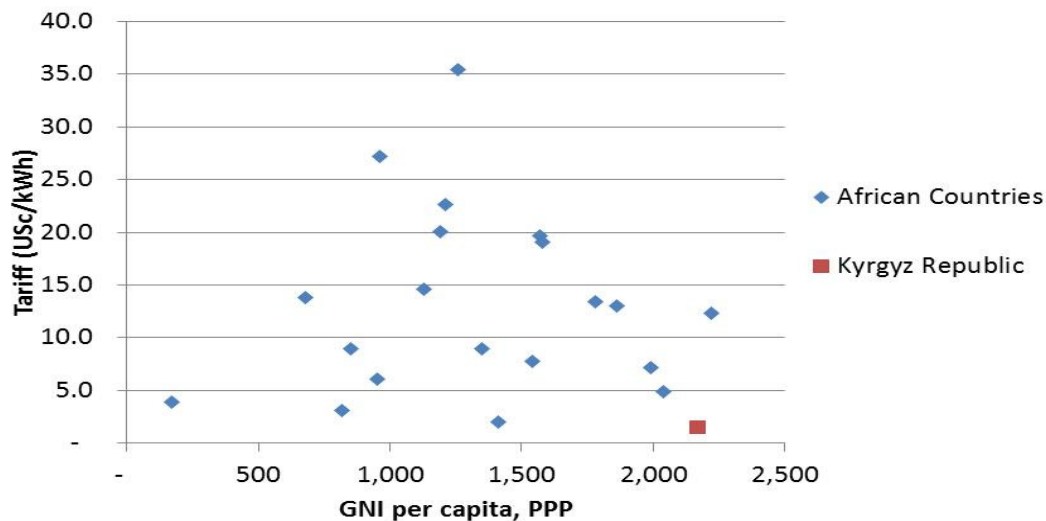
The Kyrgyz Republic has one of the lowest residential tariffs in the world, even compared to countries with much lower income per capita. The residential tariff in the Kyrgyz Republic is currently 70 tyin per kWh (USc 1.5 per kWh), which is lower than the average tariff for every region of the world, and all Sub-Saharan African nations surveyed in a 2009 study by the World Bank.<sup>27</sup> Appendix Figure B.5 compares the tariff and GNI per capita in the Kyrgyz Republic to other countries in the ECA region as well as the average in other regions globally. Appendix Figure B.6 shows the tariff and GNI per capita in the Kyrgyz Republic compared to countries with lower GNI per capita in Sub-Saharan Africa.

#### Appendix Figure B.5 Electricity Tariffs in the Kyrgyz Republic vs. Global Regions



<sup>27</sup>The Sub-Saharan African Countries included in the study are: Benin, Burkina Faso, Cameroon, Chad, Democratic Republic of Congo, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, Sudan, Namibia, South Africa and Cape Verde. Source: Foster, V. and Cecilia Briceno-Garmendia, eds. *Africa's Infrastructure: A time for transformation*, Africa Infrastructure Country Diagnostic, World Bank, Washington DC, 2009

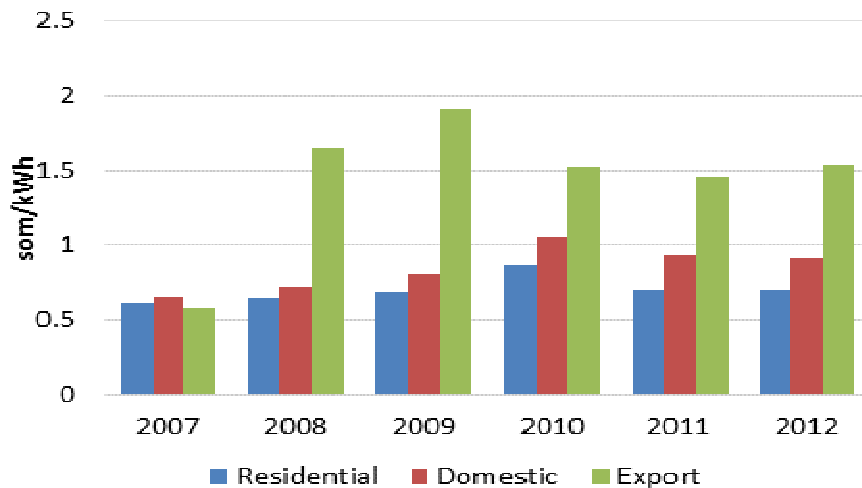
**Appendix Figure B.6 Electricity Tariff in the Kyrgyz Republic vs. Sub-Saharan Africa**



### B.1.2 Export Revenue

The Government of the Kyrgyz Republic negotiates power export agreements with neighboring countries at prices that help to subsidize domestic consumption.<sup>28</sup> This is demonstrated by how much higher the average billed export tariff is compared to the average billed domestic tariff. In 2012, the average billed tariff for exports was 69 percent larger than the average billed tariff for domestic consumers, and 121 percent larger than the average billed tariff for residential customers (see Appendix Figure B.7).

**Appendix Figure B.7 Average Billed Tariffs, 2007-2012**



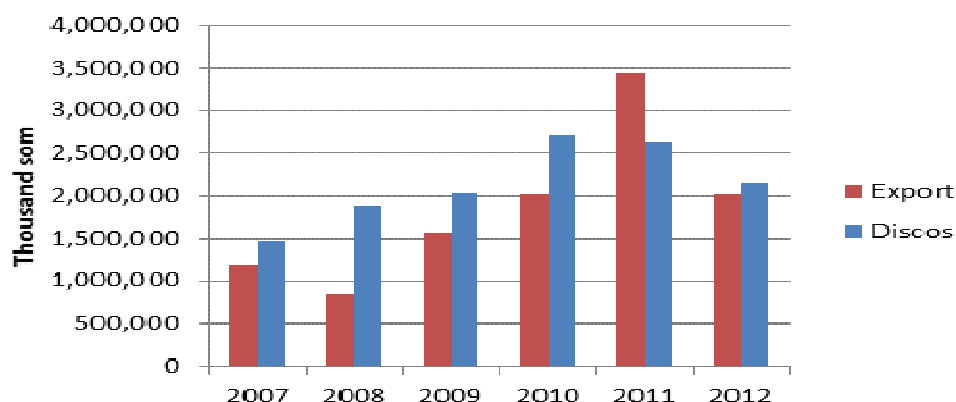
Export revenue has been a primary driver of revenue growth for the generation company (EPP). Appendix Figure B.8 demonstrates the increasing reliance on exports for generation revenue,

<sup>28</sup> In recent years, the Kyrgyz Republic has exported almost exclusively to Kazakhstan, with minimal exports to China. In 2007, the Kyrgyz Republic also exported power to Tajikistan.



showing how revenue from exports for EPP surpassed revenue from distribution companies in 2011. The subsidy of domestic consumption with export revenue is also demonstrated by the breakdown of costs compared to revenue for the sector. From 2008 to 2012, costs of the generation company made up 57 percent of total sector costs. However, the generation company (EPP) only received 44 percent of revenue disbursed from RSK Bank, which disburses domestic revenue collected from domestic customers of distribution companies.

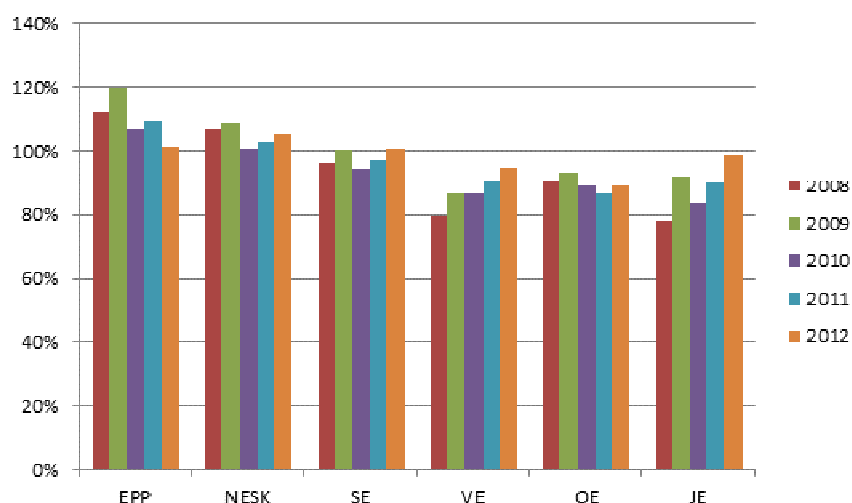
**Appendix Figure B.8: EPP Revenue from Distribution Companies and Exports, 2007-2012**



### B.1.3 Collections

The overall collection rate for the sector increased from 71 percent in 2007 to 96 percent in 2012. However, there is still room to improve collections for residential and industrial customers, whose collections were 96 and 77 percent, respectively, in 2012. Residential customers are the largest domestic source of revenue for the power sector, representing 52 percent of revenue at the distribution level and 36 percent of total sector revenue in 2012. Appendix Figure B.9 shows the collection rate by company for 2008 through 2012.

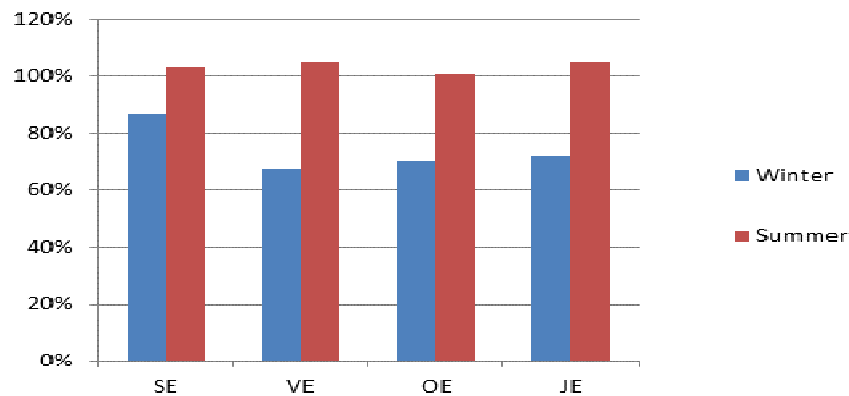
**Appendix Figure B.9. Tariff Collection Rate by Company, 2008-2012**



Collections are significantly lower in winter than in summer for all customer classes. From 2007 to 2012, collections from end-users were on average 29 percent higher during summer than

during winter, indicating difficulty paying higher winter bills. Appendix Figure B.10 demonstrates summer collections versus winter collections from 2007 to 2012.<sup>29</sup>

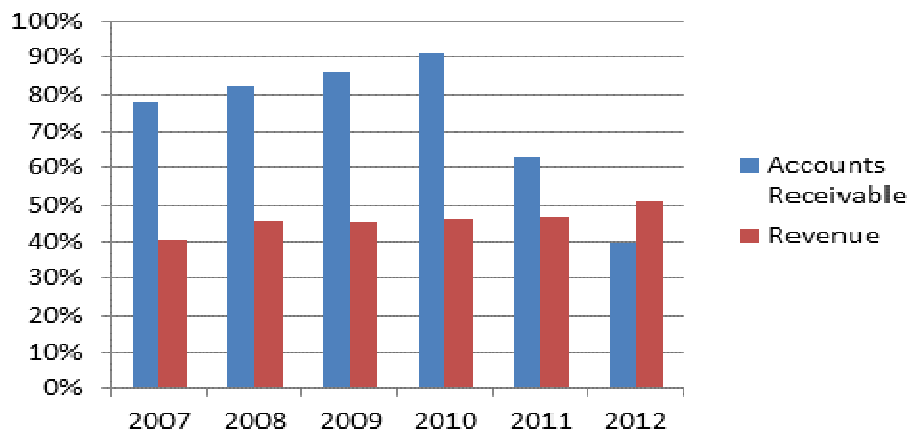
**Appendix Figure B.10: Average Seasonal Collections by Distribution Company, 2007-2012**



#### B.1.4 Accounts Receivable

Residential customers represent the largest share of accounts receivable of any consumer class. The residential share of accounts receivable is consistently larger than the residential share of revenue. Revenue from residential customers was 46 percent on average from 2007 to 2012 and accounts receivable from residential customers were on average 73 percent of total accounts receivable to distribution companies during this time period. Appendix Figure B.11 shows the share of accounts receivable from residential customers compared to the percent of revenue by residential customers from 2007 to 2012.

**Appendix Figure B.11 Share of Total Revenue vs. Share of Total Accounts Receivable, Residential Customers (2007-2012)**

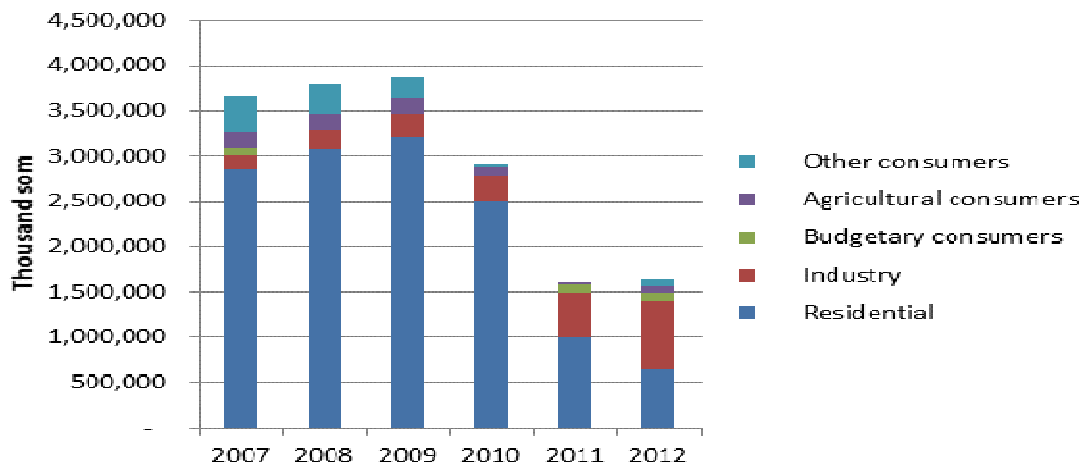


Total accounts receivable fluctuated slightly from 2007 to 2009, but greatly decreased in 2010 and 2011 as a result of a government-approved write-off of accounts receivable for all power companies. Accounts receivable increased by 1 percent from 2007 to 2009, and dropped by 56

<sup>29</sup> This analysis assumes summer months to be April to October and winter months to be November to March.

percent from 2009 to 2012. Appendix Figure B.12 shows accounts receivable by customer class from 2007 to 2012.

**Appendix Figure B.12. Accounts Receivable by Customer Class, 2007-2012**



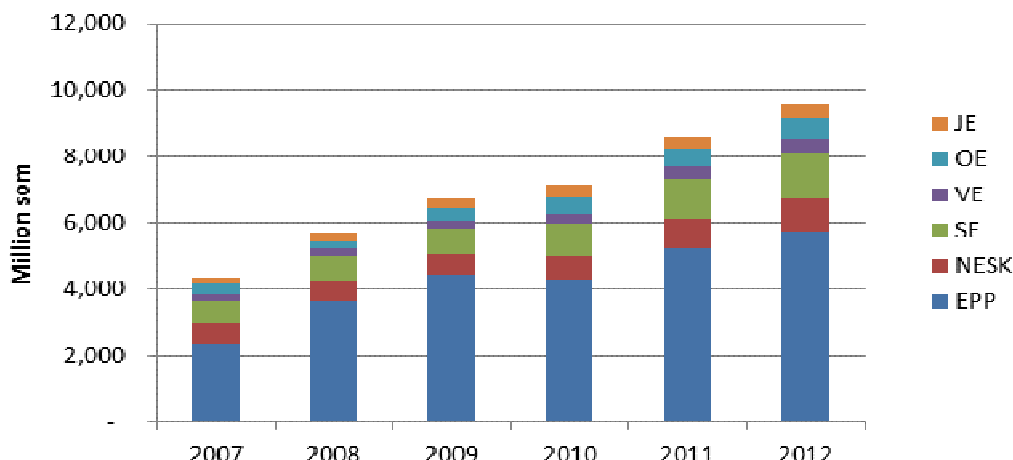
## B.2 Costs

Total power sector costs, including operating and maintenance (O&M) and capital expenditures (CAPEX), increased steadily from 2007 to 2012. The following section discusses specific trends in power sector costs from 2007 to 2012. Section B.2.1 discusses O&M expenses from 2007 to 2012. Section B.2.2 discusses historic CAPEX as well as future CAPEX that the companies could incur as a result of growing debt service payments on existing and planned investment. Section B.2.3 analyzes accounts payable in the power sector and the ways in which account payable have changed in recent years.

### B.2.1 Operating and Maintenance (O&M) Costs

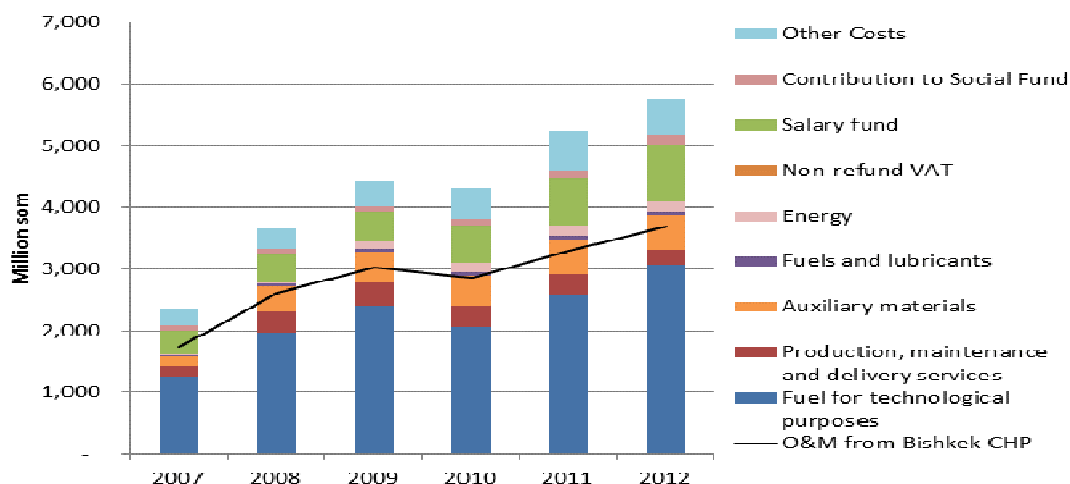
O&M costs for the power sector steadily increased from 2007 to 2012, with the largest increases in spending resulting from fuel expenditures by the generation company (EPP) and salary payments by the distribution companies. The consolidated distribution companies more than doubled O&M spending and EPP increased O&M spending by nearly 150 percent from 2007 to 2012. EPP had the highest O&M costs on average from 2007 to 2012, with 61 percent of sector O&M expenditures, followed by the distribution companies (28 percent) and then the transmission company (NESK) (11 percent). Appendix Figure B.13 shows O&M expenditures by company from 2007 to 2012.

**Appendix Figure B.13. O&M Costs for the Consolidated Power Sector, 2007-2012**



Approximately two-thirds of the generation company's (EPP) O&M expenditures are related to Bishkek CHP, particularly fuel expenditures, which alone represent half of all of EPP's O&M costs and have more than doubled since 2007. Salary payments are EPP's second largest expenditure, representing an average of 14 percent of O&M costs from 2007 to 2012. Appendix Figure B.14 shows the breakdown of EPP's O&M expenditures from 2007 to 2012, and demonstrates how much of the costs were associated with Bishkek CHP for each year.

**Appendix Figure B.14. O&M Expenditures for EPP, 2007-2012<sup>30</sup>**

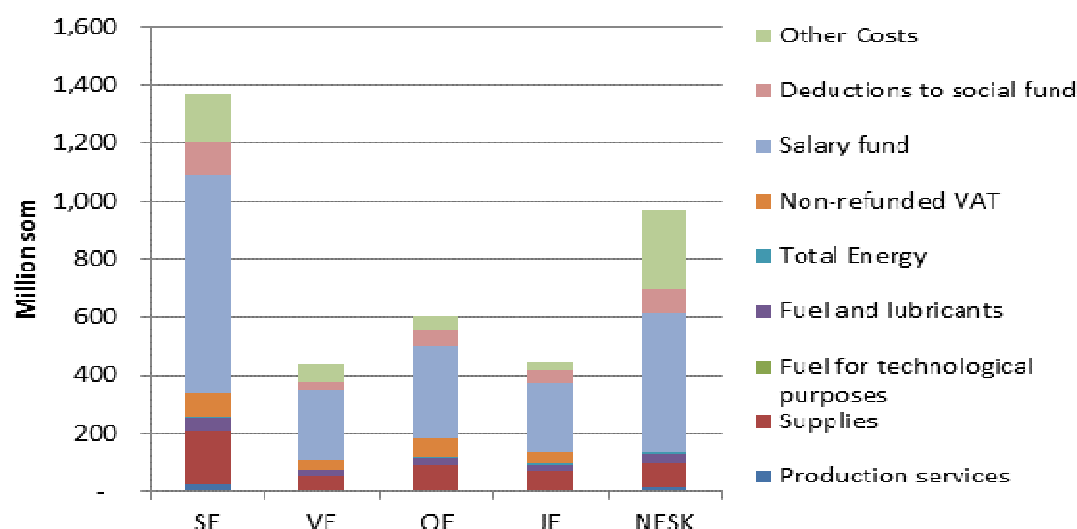


Salary is the largest portion of O&M for the transmission and distribution companies and has grown consistently in recent years. Contributions to the salary fund by the consolidated distribution companies increased from 42 percent of total O&M costs in 2007 to 55 percent in

<sup>30</sup> Data on 2012 O&M expenditures from Bishkek CHP were only available for the first 9 months of the year. Therefore, 2012 O&M costs from Bishkek CHP have been adjusted to approximate annual O&M expenditures based on actual costs from January-September.

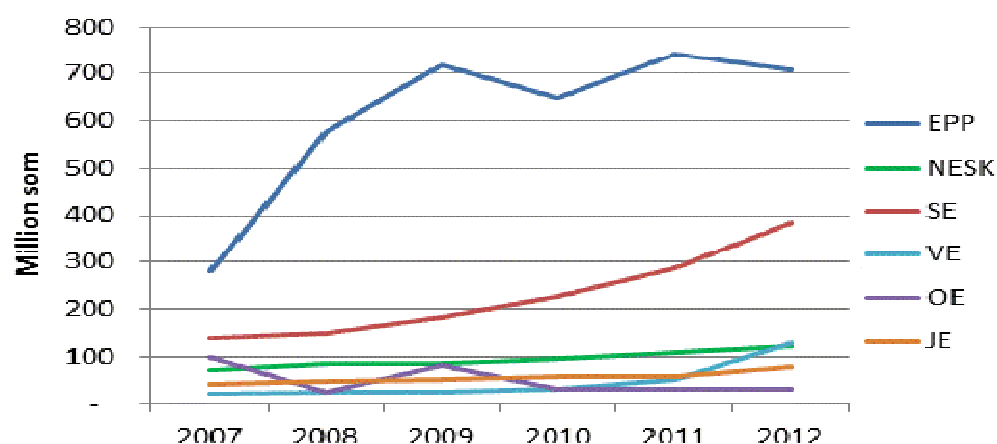
2012. The transmission company's (NESK) contribution to the salary fund was 40 percent of the company's total O&M costs in 2007, and increased to 50 percent in 2012. Appendix Figure B.15 shows the breakdown of 2012 O&M expenses for the NESK and the distribution companies.

**Appendix Figure B.15. Transmission and Distribution O&M Expenses, 2012**



Power sector expenditures associated with repairs consistently represent around 15 percent of O&M expenditures for the sector. However, approximately 80 percent of these expenditures are made by the generation company (EPP) and the largest distribution company (SE), and EPP and SE are the only companies that have substantially increased spending on repairs since 2007. Appendix Figure B.16 demonstrates repairs by company from 2007 to 2012. Appendix C evaluates the level of spending on maintenance and repairs in the power sector and discusses the long-term implications of under-spending in these critical areas.

**Appendix Figure B.16 Repairs by Company, 2007-2012**



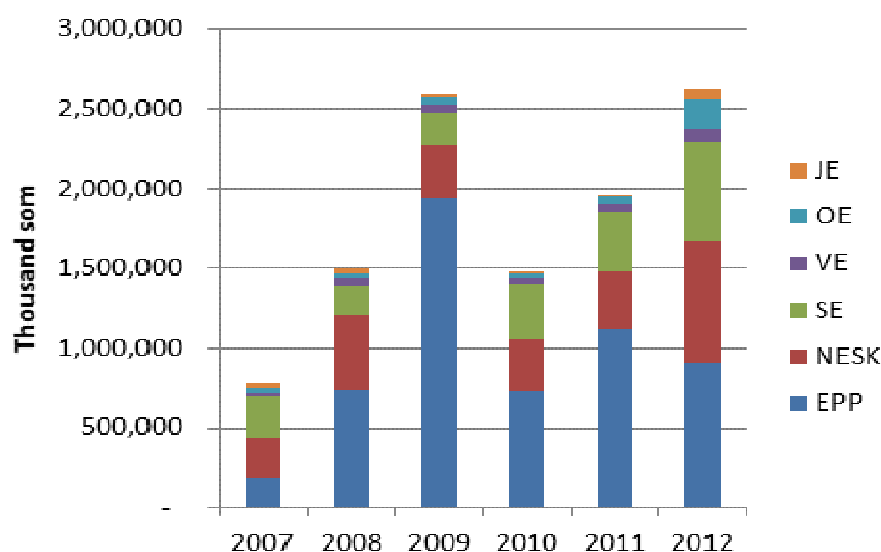
## B.2.2 Capital Expenditure from Own Funds and Debt Service for Capital Expenditure

Annual capital expenditure (CAPEX) from own funds and debt service for capital expenditure for the consolidated power sector increased steadily from 2007 to 2012, with a large increase in

2009 as a result of high debt service payments by the generation company (EPP). CAPEX from own funds and debt service for capital expenditure for the consolidated sector more than tripled from 2007 to 2012. Appendix Figure B.17 shows CAPEX from own funds and debt service for CAPEX by company from 2007 to 2012.

This section describes CAPEX from own funds and debt service for CAPEX because investment from own funds and repayment of principal and interest on loans have a direct impact on the cash standing of the power companies. Capital expenditure, which refers to the funds used by a company to acquire or upgrade a physical asset, is important from an accounting perspective; however, if CAPEX is financed with loans, the cash standing of the power companies is not impacted until debt service begins.

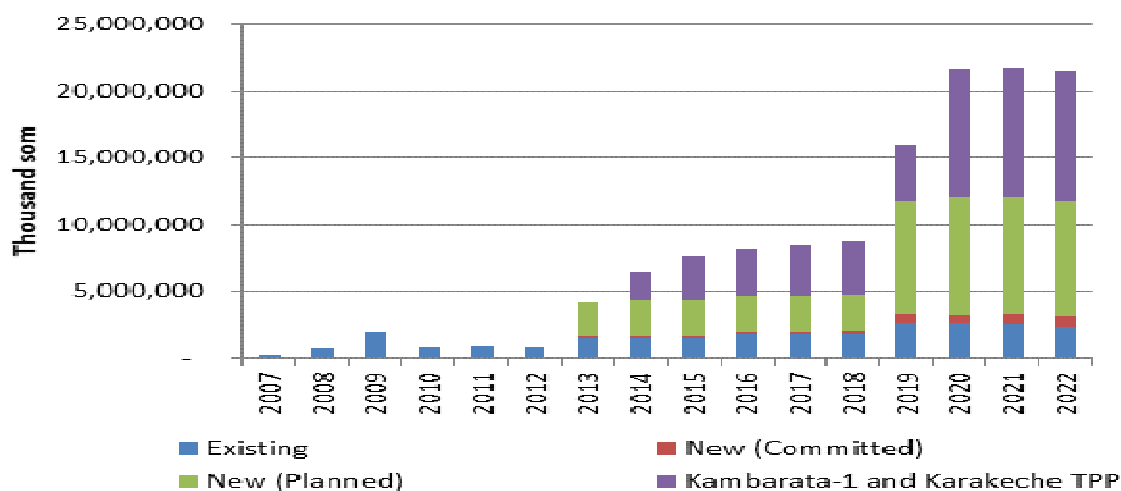
**Appendix Figure B.17 Power Sector Capital Expenditures from Own Funds and Debt Service for Capital Expenditure, 2007-2012**



Debt service for CAPEX is expected to increase further in the coming years as a result of growing repayment requirements for committed and existing loans, particularly for the generation company (EPP) and the transmission company (NESK). From 2011 to 2012 NESK took on loans of US\$398.8 million and US\$208 million for the Datka Substation and Datka-Kemin 500 kV transmission line, respectively. Principal repayment for these loans begins in 2019 and 2024, respectively. At EPP, debt repayments will begin in 2016 for a US\$ 100 million loan for the construction of Kambarata-2.

Debt service requirements for EPP will also increase in the coming years as a result of new loans for investments in rehabilitation and new generation capacity. The Asian Development Bank (ADB) has committed to provide a US\$ 55 million for the reconstruction of Toktogul HPP, which is expected to begin in 2014. This investment only partially covers the full rehabilitation costs, which are expected to reach roughly US\$ 100 million. EPP is also planning to invest in new generation capacity, including HPPs on the Upper Naryn River, Kambarata-1 and Kara-Keche TPP, but has not secured financing for these projects. Appendix Figure B.18 demonstrates the impact that these planned, but not yet committed, investments would make on the power sector's debt service requirement.

**Appendix Figure B.18. Historic and Projected Debt Service Requirements, 2007-2022**



NOTE: Debt service was calculated using actual loan terms where possible. Debt service for planned investments, was based on conservative on-lending terms from the Ministry of Finance (2% interest rate, 25 yr. maturity, 5 yr. grace period).

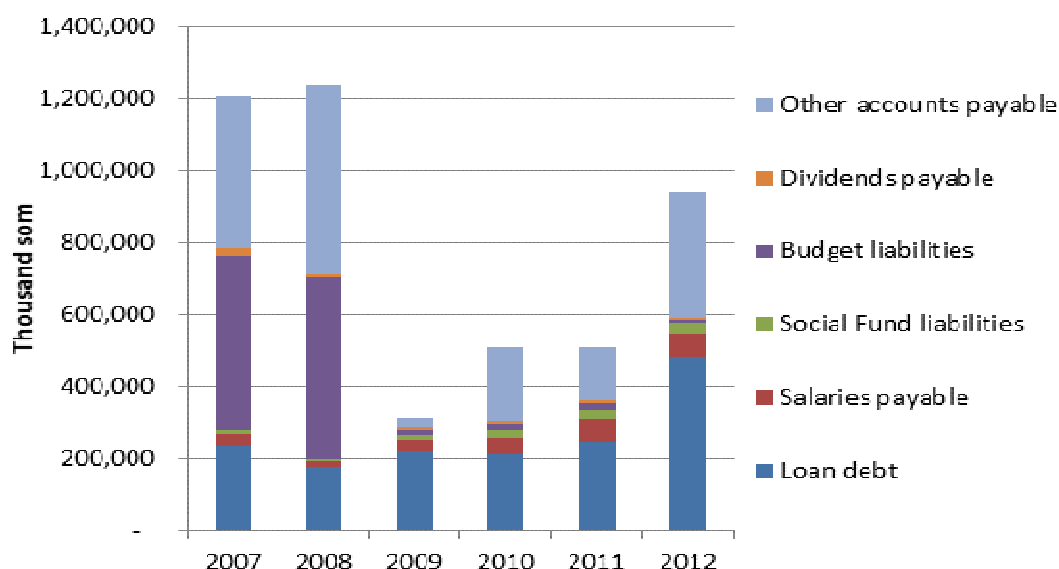
### B.2.3 Sector Liabilities

Total liabilities for the transmission and distribution companies decreased from 2007 to 2012 as a result of a write-off of accounts payable and receivable approved by the Government at the end of 2009.<sup>31</sup> Liabilities of the transmission company (NESK) and the consolidated distribution companies decreased by 22 percent and 26 percent, respectively, from 2007 to 2012. However, liabilities of NESK and the consolidated distribution companies increased annually since the write-off in 2009, indicating systemic financial challenges.

Liabilities at the transmission level drastically decreased in 2009 as a result of the government write-off. In 2009, NESK was allowed to write-off taxes owed to the Government totaling 451 million som (USD 9.5 million). NESK reported reductions of approximately 500 million som (US\$ 11.5 million) in the categories of budget liabilities and in “other accounts payable.” This combined reduction was equal to 63 percent of NESK’s total collected revenue for 2009, and resulted in an 80 percent decrease in the company’s total accounts payable. Appendix Figure B.19 demonstrates the composition of liabilities of NESK from 2007 to 2012.

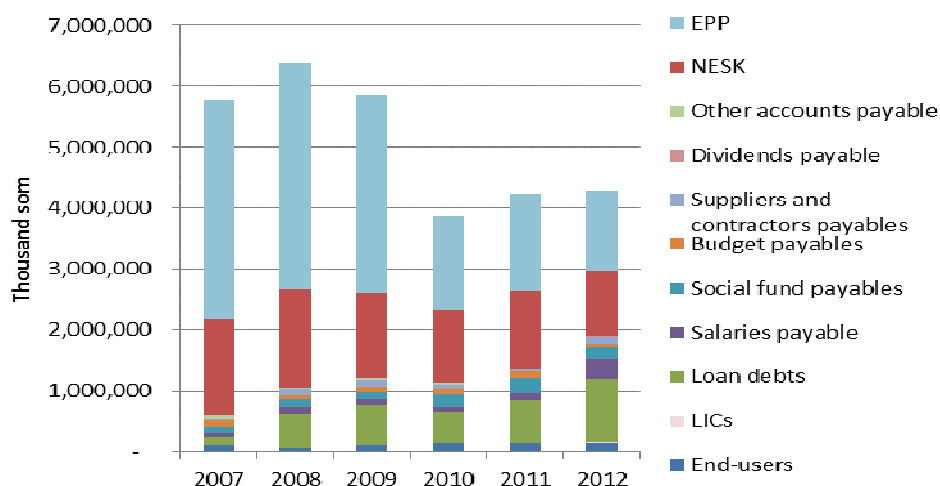
<sup>31</sup> Data was not available on accounts payable for EPP.

**Appendix Figure B.19 Liabilities of NESK, 2007-2012**



Liabilities of the consolidated distribution companies also decreased from 2007 to 2012 as a result of writing-off accounts payable. The consolidated distribution companies were allowed to write off 2.4 billion som of accounts payable to the generation company (EPP) and the transmission company (NESK). Although the write-off led to a significant drop in accounts payable, loan debts for the consolidated distribution companies grew by more than six times from 2007 to 2012, increasing from 2 percent of total liabilities in 2007 to 24 percent in 2012. The largest increase in loan debt, which occurred from 2007 to 2008, resulted from a loan to the largest distribution company (SE) for investments in rehabilitation of the power distribution system. Appendix Figure B.20 shows accounts payable for the consolidated distribution companies from 2007 to 2012.

**Appendix Figure B.20 Liabilities of Distribution Companies, 2007-2012**





## Appendix C. Fiscal Support and the Quasi-fiscal Deficit

The Government of the Kyrgyz Republic provides both direct and indirect financial support to the power sector. The Government's fiscal support for sector companies ranges from on-lending of loans from international financial institutions (IFIs) to budgetary loans and grants. The Government also provides subsidies to certain customer categories that require special assistance. Additionally, the Government provides indirect fiscal support by allowing companies to accumulate and write-off a substantial amount of taxes and other arrears owed to the Government.

Some types of fiscal support to companies, such as on-lending of loans from international financial institutions (IFIs), is common in countries like the Kyrgyz Republic where assets are state-owned and companies cannot access commercial financing for large investments. Other types of fiscal support, including budgetary loans and grants, are less common and are indicative of a sector in financial distress.

The true financial distress of the sector is not only demonstrated by the level of direct fiscal support, but also by under-spending on maintenance and capital expenditure, and by deferral of payment (often indefinitely) to other companies in the supply chain. These "quasi-fiscal" means of subsidizing the sector are, in effect, contingent liabilities which will have real fiscal consequences in the future as even greater investment will be required to rehabilitate heavily deteriorated assets. The sum of fiscal and quasi-fiscal deficits is therefore sometimes used to measure the level of subsidies to energy sector companies. Because the implicit or quasi-fiscal components of the deficit are difficult to measure directly, and "end-use" approach is used which focuses on the shortfall in revenue collected by a utility, relative to its actual costs of service.<sup>32</sup>

The following subsections analyze the fiscal support and quasi-fiscal deficits in the Kyrgyz Republic's power sector. Section C.1 estimates the fiscal and quasi-fiscal deficits and describes their main causes. Section C.2 evaluates the level of direct and indirect fiscal support to the sector from 2007 to 2012, including an assessment of under-spending on maintenance and capital expenditure.

### C.1 Estimating the Fiscal and Quasi-fiscal Deficits

The sum of the fiscal and quasi-fiscal deficits can be calculated as the difference between the actual revenue charged and collected at regulated tariffs and the revenue required to fully cover the operating costs of production and capital depreciation. Some fiscal support to the sector is "hidden" because it is not included in general government accounts until the power companies experience financial or operational distress and have to be bailed out by the Government. We estimate the sum of the fiscal and quasi-fiscal deficits using the "end-product

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<sup>32</sup> Saavalainen, Tapio and Joy ten Berge. "Quasi-Fiscal Deficits and Energy Conditionality in Selected CIS Countries." IMF Working Paper WP/06/43. International Monetary Fund. 2006. Saavalainen and ten Berge refer to the entire gap between revenue charged and collected as the "quasi-fiscal deficit" but some of that gap may be funded, in some countries, by explicit government subsidies to the utility companies and so therefore are "fiscal". This paper therefore distinguishes between the fiscal and quasi-fiscal deficits attributable to the power sector.

approach,” which quantifies the lack of revenue to cover costs based on a combination of three factors:<sup>33</sup>

- Below 100 percent collection rates
- Excess losses, measured as any level of losses (technical or commercial) above 13 percent<sup>34</sup>
- Below cost-recovery tariffs.

Appendix Box C.1 describes the method used to calculate the sum of the fiscal and quasi-fiscal deficits attributable to the power sector.

**Appendix Box C.1. “End-Use Approach” for Estimating the Fiscal and Quasi-Fiscal Deficits attributable to the Power Sector**

The “end-product approach” calculates the fiscal and quasi-fiscal deficits attributable to the power sector using the following formula:

$$\begin{aligned} (1) \text{ QFD} &= Q - R \\ (2) Q &= \frac{1}{1 - l} * (Ch + Ci + Co) * APC \\ (3) R &= (Ch + Ci + Co) * T * Ccash \end{aligned}$$

Where:

- Q = cost of production for households, industry, and other domestic users
- R = cash revenue from households, industry, and other domestic users
- l = average annual above normative commercial and technical loss rate
- Ch = household consumption
- Ci = industrial consumption
- Co = consumption of other domestic users
- APC = average cost of production per kWh
- T = average actual tariff for households, industry, and others
- Ccash = cash collection ratio for households, industry, and others.<sup>35</sup>

Source: Saavalainen, Tapio and Joy ten Berge. “Quasi-Fiscal Deficits and Energy Conditionality in Selected CIS Countries.” IMF Working Paper WP/06/43. International Monetary Fund. 2006.

The sum of the fiscal and quasi-fiscal deficits attributable to the power sector is large, but has decreased in recent years. That sum decreased by 21 percent representing a decline from 5.9 percent of GDP to 2.9 percent from 2008 to 2012. This occurred largely because of improved collections, reduced losses and an increase in non-residential tariffs in 2010. Appendix Figure C.1 shows the sum of the fiscal and quasi-fiscal deficits attributable to the power sector from

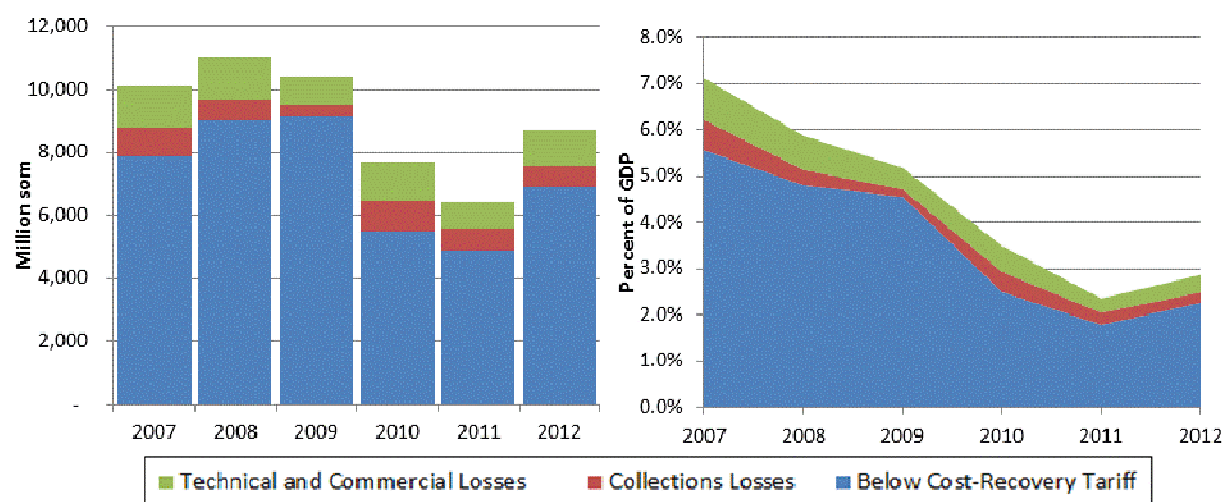
<sup>33</sup> Saavalainen, Tapio and Joy ten Berge. “Quasi-Fiscal Deficits and Energy Conditionality in Selected CIS Countries.” IMF Working Paper WP/06/43. International Monetary Fund. 2006.

<sup>34</sup> 13 percent is a conservative estimate of the normative level of losses given the age and condition of transmission and distribution assets.

<sup>35</sup> Saavalainen, Tapio and Joy ten Berge. “Quasi-Fiscal Deficits and Energy Conditionality in Selected CIS Countries.” IMF Working Paper WP/06/43. International Monetary Fund. 2006.

2007 to 2012, in million som (left) and as a percentage of GDP (right). Appendix Table C.1 shows the size of each component of the end-use approach in absolute and percentage terms.

**Appendix Figure C.1 Fiscal and Quasi-fiscal Deficits of the Power Sector, 2007-2012**



**Appendix Table C.1 Fiscal and Quasi-Fiscal Deficits by Component, 2007-2012**

(Thousand Som)	2007	2008	2009	2010	2011	2012
Technical and Commercial Losses	1,283,651	1,383,548	932,953	1,238,022	825,999	1,143,328
Collections	926,917	629,096	326,144	944,830	729,265	688,124
Below-cost recovery tariff	7,883,940	9,023,022	9,154,416	5,503,365	4,869,475	6,891,389
<b>Total QFD</b>	<b>10,094,508</b>	<b>11,035,666</b>	<b>10,413,513</b>	<b>7,686,216</b>	<b>6,424,740</b>	<b>8,722,842</b>

(Percent of QFD)	2007	2008	2009	2010	2011	2012
Technical and Commercial Losses	13%	13%	9%	16%	13%	13%
Collections	9%	6%	3%	12%	11%	8%
Below-cost recovery tariff	78%	82%	88%	72%	76%	79%

Below cost-recovery tariffs are the largest component of the fiscal and quasi-fiscal deficits attributable to the power sector, representing 80 percent of the total combined deficits on average from 2007 to 2012. The actual cost of domestic electricity service in the Kyrgyz Republic was, on average, 21 percent greater than the average end-user tariff from 2007 to 2012. This trend is projected to continue in future years, with an increasing disparity between the actual cost of service and average end-user tariffs, if tariffs are not increased. Appendix Table C.2 shows the actual cost of domestic electricity service compared to the weighted

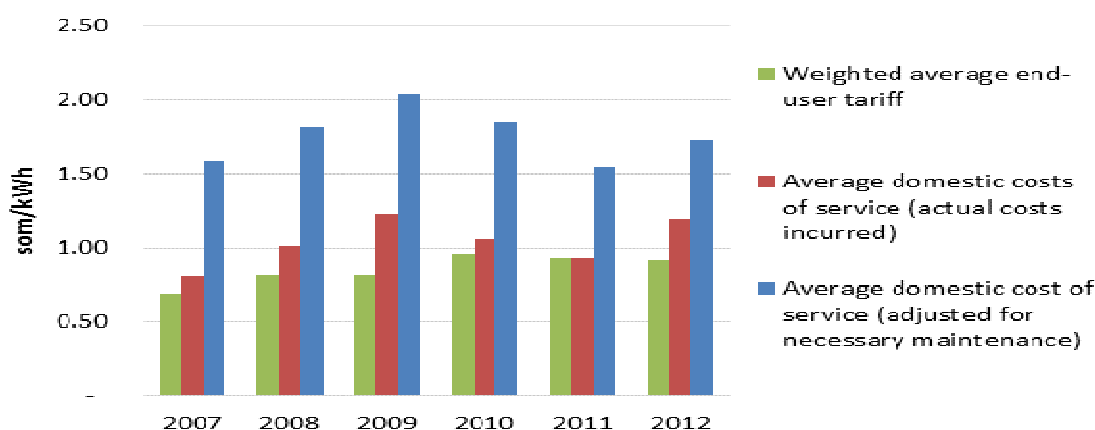
average tariff for 2007 to 2012.<sup>36</sup> This estimate of the cost of service takes into the cross subsidy from export revenue. Appendix D describes the methodology used to calculate the average cost of domestic service and presents the complete results of the cost of service analysis.

**Appendix Table C.2 Cost of Service vs. Average End-User Tariff, 2007-2012**

	Unit	2007	2008	2009	2010	2011	2012
Weighted average end-user tariff	som/kWh	0.692	0.822	0.815	0.957	0.935	0.916
Actual power sector expenses	som/kWh	0.809	1.011	1.226	1.061	0.935	1.192
<b>Difference between actual expenses and end-user tariff</b>	<b>som/kWh</b>	<b>0.117</b>	<b>0.189</b>	<b>0.411</b>	<b>0.104</b>	<b>0.000</b>	<b>0.276</b>
	<b>%</b>	<b>17%</b>	<b>23%</b>	<b>50%</b>	<b>11%</b>	<b>0%</b>	<b>30%</b>

The cost of domestic electricity service, including necessary expenditures on maintenance, is significantly larger than the cost of service reported by companies. From 2007 to 2012, the cost of service, adjusted for appropriate depreciation to cover necessary maintenance and for debt service, was 106 percent larger than the weighted average end-user tariff. This cost of domestic service including an adjustment for necessary expenditure on maintenance is the basis for estimating the below cost-recovery component of the fiscal and quasi-fiscal deficits attributable to the power sector. Appendix Figure C.2 shows the difference between the weighted average end-user tariff (green) and the cost of domestic service adjusted for necessary maintenance (blue). The complete cost of service assessment, including a projection of the cost of service from 2013 to 2030 as well as the 2007 to 2012 analysis, is included in Appendix D.

**Appendix Figure C.2 Cost of Domestic Service vs. Average End-User Tariff, 2007-2012**



<sup>36</sup> We calculated the weighted average tariff by using each customer group's share of total consumption as the weight for averaging tariffs by customer group.

## C.2 Quantifying the Fiscal and Quasi-fiscal Impact

The gap between cash collected and costs incurred has fiscal and economic consequences. This section discusses the consequences of this financial gap in terms of the impact it has already had on the fiscal budget in recent years as well as the future economic and financial impact of under-spending on maintenance and capital expenditure. Section C.2.1 discusses fiscal support provided to cover the gap in recent years. Section C.2.2 discusses the impact of the quasi-fiscal deficit and its consequences for the long-term financial sustainability of the sector.

### C.2.1 Fiscal Support

The Government has provided substantial direct fiscal support to the power sector. From 2008 to 2010, the Government provided 2 billion som to sector companies in the form of budgetary loans in addition to on-lending 35.6 billion som from IFIs. The Government also gave the generation company (EPP) a 4 billion som grant in 2010 for the construction of Kambarata 2, which was equal to 9 percent of 2010 tax revenue. In April 2010, the Government authorized EPP and the transmission company (NESK) to write-off accounts receivable from distribution companies and accounts payable to the Government. This write-off was equal to 2.4 billion som or roughly 5 percent of 2010 tax revenue.<sup>37</sup>

Fiscal support to the power sector has contributed to growing public expenditures and high fiscal deficits in recent years. In 2010, the Kyrgyz Republic had a fiscal deficit of 6.3 percent of GDP. The direct fiscal support to the sector in the form of the write-off of accounts payable and the money provided to build Kambarata 2 was equal to 8 percent of total Government spending in 2010.<sup>38</sup>

### C.2.2 Impact of the Quasi-fiscal Deficit

In order to close the revenue-expenditure gap of the sector, power companies have reduced necessary spending on maintenance and capital expenditure. The following subsections discuss the main way in which the power companies reduced expenditures, including:

- Under-spending on maintenance
- Accumulations of accounts payable to the Government
- A delay of necessary capital expenditures.

These means of closing the revenue-expenditure gap are common consequences of a fiscal and quasi-fiscal deficit because they allow the companies to show short-term profits despite mounting future expenditures. These future expenditures will likely become a direct fiscal burden to the Government in the long-term unless efforts are made to close the revenue-expenditure gap. The Kyrgyz Republic has already begun to experience the economic consequences of the fiscal and quasi-fiscal deficit in recent years when critical assets, such as Toktogul HPP, have undergone emergency shutdown due to equipment failure. Outages caused by equipment failure and lack of supply to meet demand have significant economic costs. According to estimates from the Ministry of Energy, unmet demand was equal to 36 percent of consumption in 2007, and 20 percent of consumption in 2011. Using the cost of back-up diesel

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<sup>37</sup> International Monetary Fund (IMF), "IMF Country Report: Kyrgyz Republic," May 2012, <http://www.imf.org/external/pubs/ft/scr/2012/cr12111.pdf>.

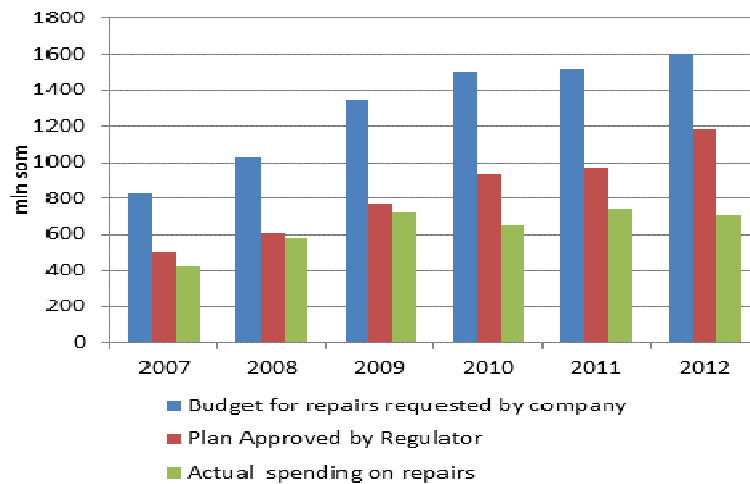
<sup>38</sup> IMF, "World Economic Outlook (WEO)," October, 2012.

generation (US\$ 0.23/kWh) as a proxy for the economic opportunity cost of unmet demand, the economic cost of unmet demand was equal to 16 percent of GDP in 2007 and 10 percent in 2011.

### Under-Spending on Maintenance

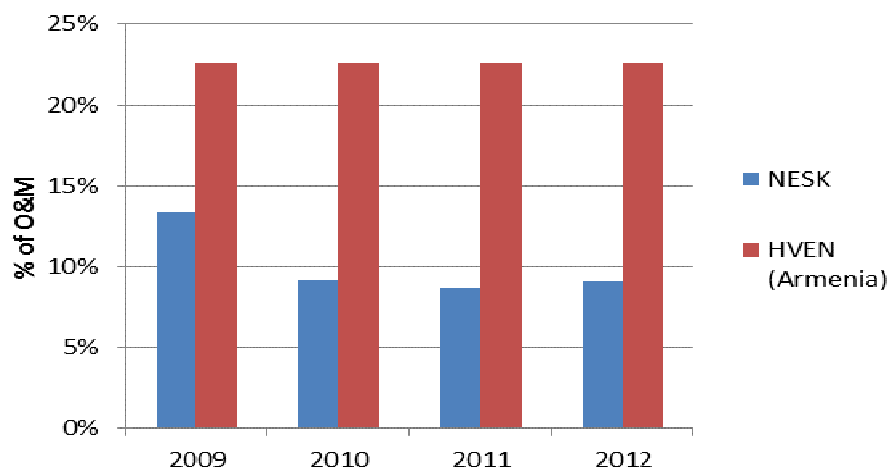
The power sector of the Kyrgyz Republic is characterized by chronic under-spending on maintenance, which has led to severe deterioration of assets. Actual spending on repairs in generation is only 50 percent of repair needs estimated by the generation company (EPP) and these estimates are below what is needed to restore reliable supply. Appendix Figure C.3 shows EPP's requested, approved and actual spending on repairs from 2007 to 2012.

**Appendix Figure C.3 Planned versus Actual Spending on Repairs at EPP, 2007-2011**



Spending on repairs by the transmission and distribution companies is significantly lower than in other countries in the region. On average, the transmission company (NESK) spends roughly half as much on repairs as a percentage of O&M as the Armenian transmission company. Appendix Figure C.4 shows spending on repairs by NESK versus the Armenian transmission company from 2009 to 2012.

**Appendix Figure C.4 Spending on Repairs as a Percent of Total O&M Costs, 2009-2012**



Under-spending on maintenance was consistently one of the largest means of funding the fiscal and quasi-fiscal deficit from 2007 to 2012. During the six year period, under-spending on maintenance ranged from 2 to 5 percent of GDP and on average represented more than half of the total fiscal and quasi-fiscal deficit.<sup>39</sup>

### Accumulation of Accounts Payable to the Government

The fiscal and quasi-fiscal deficit has also led to an accumulation of accounts payable to the Government in terms of loan repayment, taxes and other social payments. Accounts payable to Government accumulate because revenue collected from customers does not cover the cost of service, even before accounting for under-spending on maintenance. In 2010, the Government allowed the generation company (EPP) and the transmission company (NESK) to write-off 2.4 billion som of accounts payable in order to stabilize the sector and improve the financial condition of the companies.

The accumulation of accounts payable to the Government allows the power companies to continue operating below cost-recovery without direct financial consequences. Accounts payable to the Government from NESK and the distribution companies increased by 65 percent from 2007 to 2012, while the financial state of the overall sector improved from losses of over 1 billion som in 2007 to a profit of nearly 600 million som in 2011. Accounts payable from 2007 to 2012 annually represented an average of 2 percent of total Government revenue and 23 percent of sector revenue. Appendix Figure C.5 demonstrates accounts payable to the Government from NESK and the distribution companies from 2007 to 2012, including the amount written-off in 2010.

**Appendix Figure C.5 Accounts Payable to Government, 2007-2012**

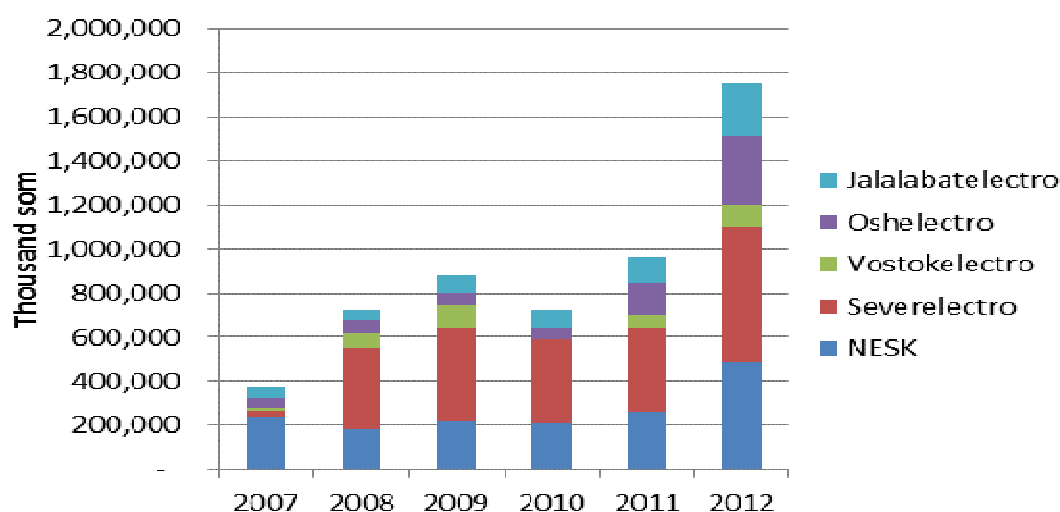


Even with the write-off, accounts payable of “loan debts” for the transmission company (NESK) and the four distribution companies has risen steadily from 2007-2012, indicating possible debt repayment problems. Debt repayment will become a growing concern as debt service is projected to increase from 10 percent of sector expenditure in 2012 to over 50 percent by

<sup>39</sup> The calculation of under-spending on maintenance and rehabilitation from 2007 to 2011 is based on estimations made by USAID in the 2011 Review of the Prime Cost of Electricity.

2020. Appendix Figure C.6 shows loans payable by NESK and Appendix Figure C.6 each distribution company from 2007 to 2012.<sup>40</sup>

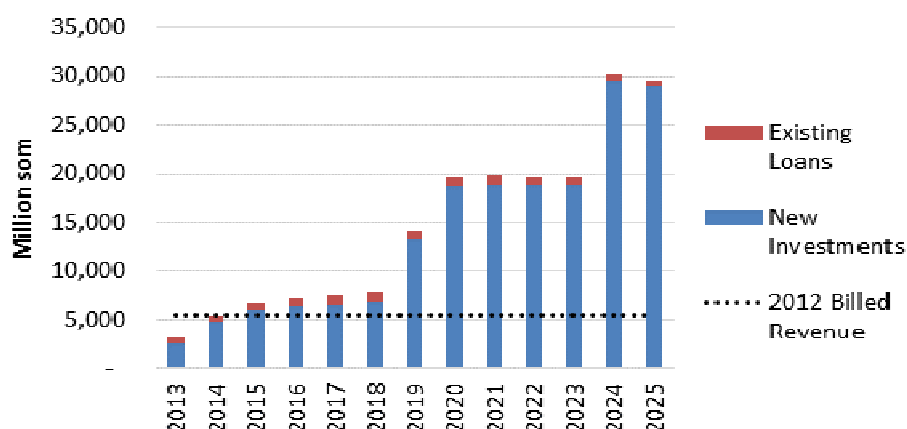
**Appendix Figure C.6 Loans Payable to the Government, 2007-2012**



### Delay of Necessary Capital Expenditure

Under-spending on capital expenditures in the past has led to a backlog of large investments needed in order to maintain reliable supply. Debt service associated with planned investments in capital expenditures will greatly increase the financial burden on the power sector in coming years. Based on investments planned by the generation company (EPP) and specified in the Power Sector Development Strategy, debt service will be more than double EPP's total revenue in 2012 by 2020, and by 2024, it will be almost 4 times as large. Investments in Kara-Keche TPP and Kambarata 1 are the drivers of this large increase in projected debt service. Total projected debt service on potential new and existing loans for EPP is shown in Appendix Figure C.7.

**Appendix Figure C.7 EPP's Projected Debt Service, 2012-2025**

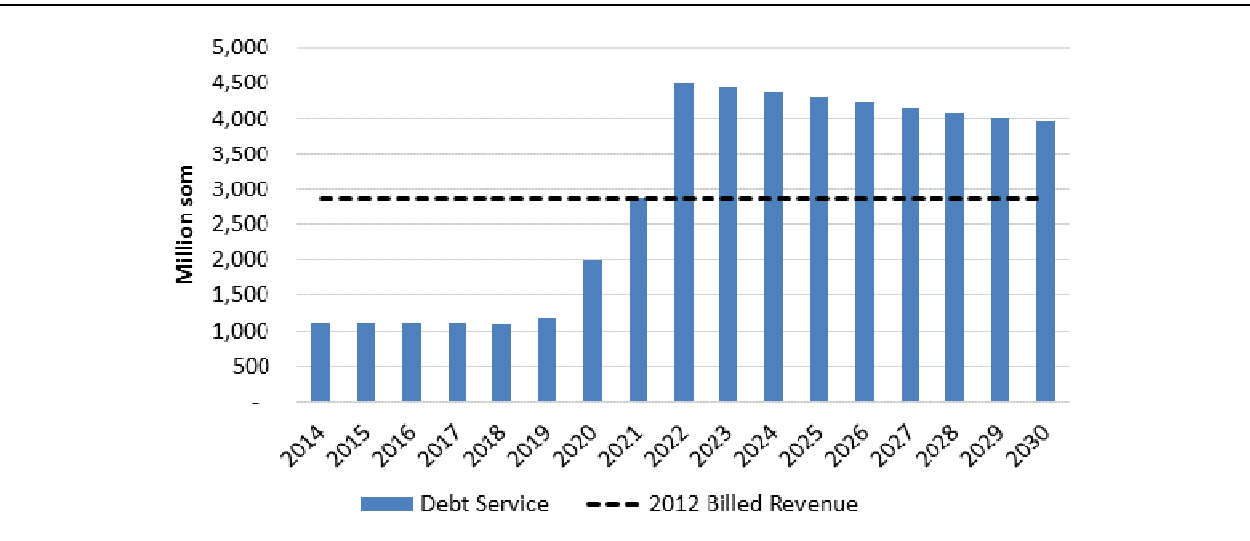


<sup>40</sup> Data was not available on accounts payable from EPP to the Government.



Large capital investments are also needed in transmission and distribution. Financing has been secured for investments in the Datka substation and Datka-Kemin 500 kV transmission line, which will increase domestic transmission capacity, reducing reliance on neighboring countries for electricity transit. The Chinese Exim Bank has provided loans of US\$ 208 million and US\$398 million, respectively, to finance these investments. Appendix Figure C.8 shows the impact these investments will have on debt service at the transmission company (NESK).

**Appendix Figure C.8 NESK's Projected Debt Service, 2012-2025**



## Appendix D. Cost of Service Analysis

This appendix presents the estimate of the cost of domestic electricity service for the Kyrgyz Republic from 2007 to 2030. The first section shows the results of the analysis, and the second section describes the methodology and key assumptions used to develop these estimates.

### D.1 Cost of Service Analysis Results

From 2007 to 2012, the cost of domestic electricity service in the Kyrgyz Republic was, on average, 21 percent greater than the average end-user tariff. This estimate of the domestic cost of service accounts for the cross subsidy that exists between domestic service and export service. The methodology used to calculate the cost of service is described in detail in section D.2. Appendix Table D.1 shows the cost of domestic electricity service compared to the weighted average tariff for 2007 to 2012.<sup>41</sup> This trend is projected to continue in future years, with an increasing disparity between the cost of service and average end-user tariffs.

**Appendix Table D.1. Cost of Domestic Service Compared to Average End-User Tariff, 2007-2012**

	unit	2007	2008	2009	2010	2011	2012
Tariff by customer class:							
<i>Industrial &amp; equated</i>	som/kWh	.80	.96	.96	1.327	1.327	1.327
<i>Budgetary users</i>	som/kWh	.80	1.00	1.00	1.327	1.327	1.327
<i>Agricultural consumers</i>	som/kWh	.80	.96	.96	1.327	1.327	1.327
<i>Population</i>	som/kWh	.62	.70	.70	.70	.70	.70
<i>Other (remaining)</i>	som/kWh	.80	1.02	1.02	1.327	1.327	1.327
<b>Weighted average end-user tariff</b>	<b>som/kWh</b>	<b>0.692</b>	<b>0.822</b>	<b>0.815</b>	<b>0.957</b>	<b>0.935</b>	<b>0.916</b>
<b>Average cost of domestic service</b>	<b>som/kWh</b>	<b>0.809</b>	<b>1.011</b>	<b>1.226</b>	<b>1.061</b>	<b>0.935</b>	<b>1.192</b>
Difference between cost of service and end-user tariff	som/kWh	0.117	0.189	0.411	0.104	0.00	0.276
	%	17%	23%	50%	11%	0%	30%

The average cost of service is expected to increase on average 5.2 to 7.5 percent annually from 2013 to 2030 depending on reforms that are made in the sector. The Note forecasted the average domestic cost of service under two scenarios:

The “**business-as-usual**” (BAU) Scenario is based on “business-as-usual” assumptions described in Box 2.1 of the body of the Note. Key assumptions of this scenario include:

- Tariffs remain at 2012 levels for all customer groups.
- Technical and non-technical losses remain at reported 2012 levels.

<sup>41</sup> We calculated the weighted average tariff by using each customer group’s share of total consumption as the weight for averaging tariffs by customer group.

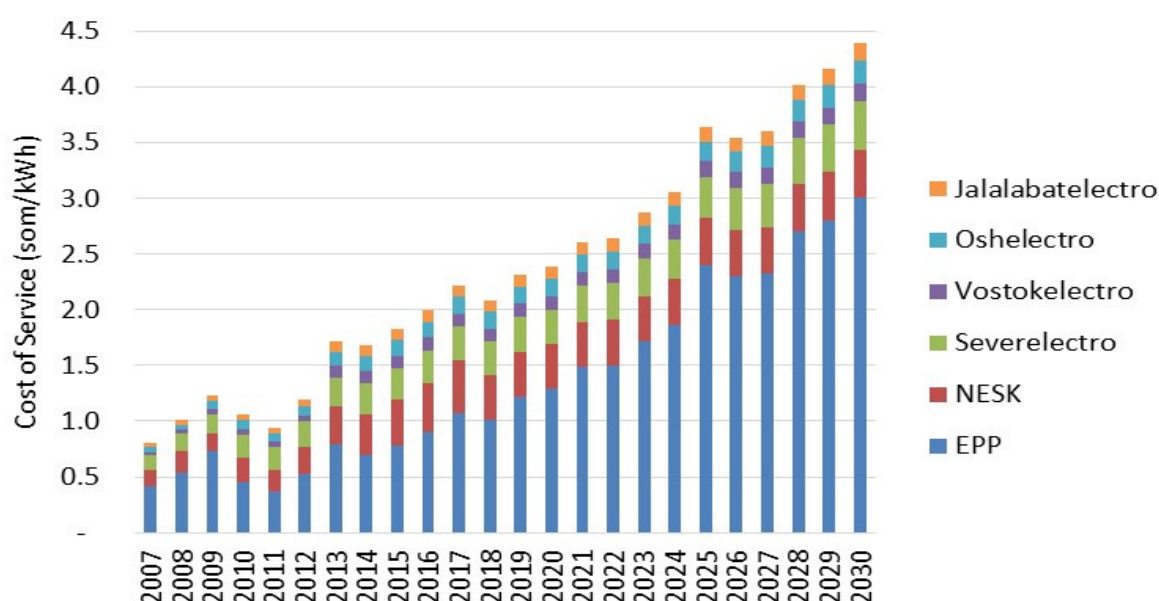
- The Upper Naryn Cascade is built in 2016 and Bishkek CHP is rehabilitated the same year.
- The available capacities of existing assets do not decrease in future years, even if there are no current plans to rehabilitate those assets.

The **Reform Scenario** assumes that a number of reforms occur, including:

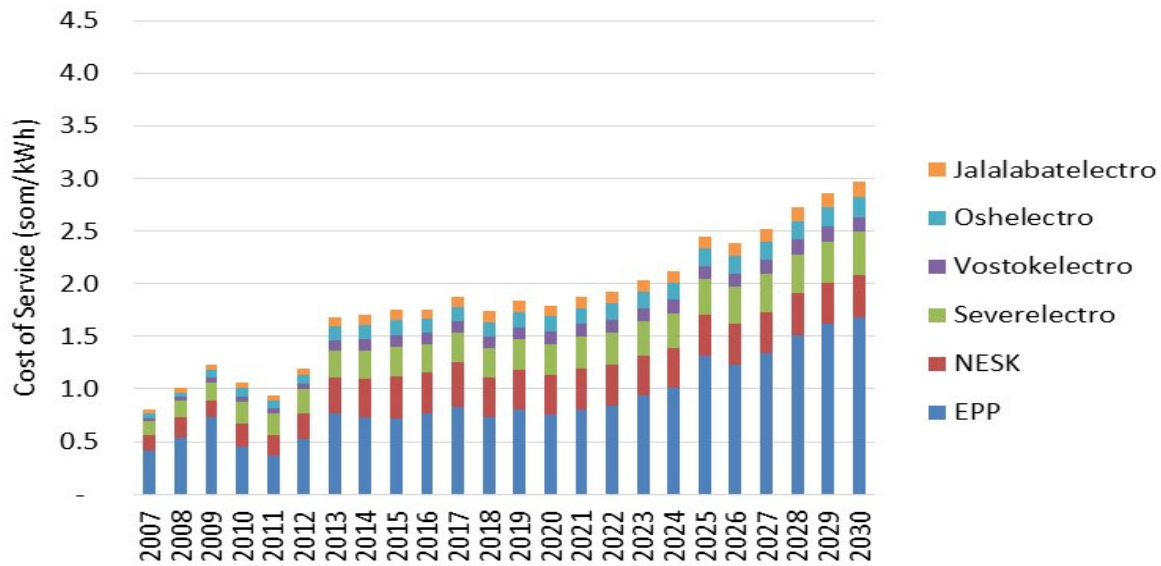
- Tariffs increase by 5 percent annually until 2020
- Companies reduce both technical and non-technical losses by 1 percent annually until 2026 and 2023, respectively, when technical losses are 11 percent and there are no non-technical losses.
- New capacity of 600 MW is constructed to meet peak demand and close the gap between winter consumption and generation available during winter months. The scenario assumes that summer power surplus generated by the added capacity will be exported at a tariff of 1.85 som/kWh (US\$ 0.04/kWh).

Appendix Figure D.1 and Appendix Figure D.2 show the cost of domestic electricity service in the Kyrgyz Republic under the two scenarios described above. The average cost of service is broken out by company to demonstrate the proportion of total costs incurred by each entity.

**Appendix Figure D.1: Average Cost of Domestic Electricity Service (2007-2030): BAU Scenario**



**Appendix Figure D.2: Average Cost of Domestic Service (2007-2030): Reform Scenario**



#### *Historical Cost of Service*

The cost of domestic electricity service increased on average 8.1 percent annually from 2007 to 2012, with a spike in the cost of service in 2009 because of large debt service payments by the generation company.<sup>42</sup> Generation, on average, constituted the largest share of total costs (48 percent), followed by distribution (33 percent), and transmission (19 percent). SE, which serves over half of all domestic consumers, constituted over half of all distribution costs. Appendix Table D.2 demonstrates the historic total average cost of domestic electricity service and the average cost broken out by company.

<sup>42</sup> The large increase in debt service payments for EPP in 2009 likely results from a 17 percent currency depreciation of the Kyrgyz Som relative to the US dollar.

**Appendix Table D.2: Cost of Domestic Electricity Service in the Kyrgyz Republic, Total Average and Average Cost by Company (2007-2012)**

	2007	2008	2009	2010	2011	2012
(KGS/kWh)						
<b>Total Cost of Domestic Service</b>	<b>0.809</b>	<b>1.011</b>	<b>1.226</b>	<b>1.061</b>	<b>0.935</b>	<b>1.192</b>
EPP	0.412	0.540	0.729	0.450	0.370	0.524
NESK	0.143	0.196	0.166	0.217	0.194	0.244
SE	0.135	0.151	0.168	0.210	0.202	0.227
VE	0.030	0.043	0.050	0.051	0.053	0.057
OE	0.053	0.035	0.065	0.082	0.069	0.086
JE	0.035	0.046	0.047	0.052	0.046	0.054
(USD/kWh)						
<b>Total Cost of Domestic Service</b>	<b>0.017</b>	<b>0.021</b>	<b>0.026</b>	<b>0.022</b>	<b>0.020</b>	<b>0.025</b>
EPP	0.009	0.011	0.015	0.009	0.008	0.011
NESK	0.003	0.004	0.004	0.005	0.004	0.005
SE	0.003	0.003	0.004	0.004	0.004	0.005
VE	0.001	0.001	0.001	0.001	0.001	0.001
OE	0.001	0.001	0.001	0.002	0.001	0.002
JE	0.001	0.001	0.001	0.001	0.001	0.001

### *Future Cost of Service*

The cost of service is projected to increase from 76 percent to 157 percent from 2013 to 2030, with an average annual growth of 5.2 to 7.5 percent, depending on the scenario. Appendix Table D.3 demonstrates the forecasted cost of domestic service by company for 2014 to 2024 under both scenarios.

**Appendix Table D.3: Forecasted Cost of Domestic Electricity Service, 2013-2023**

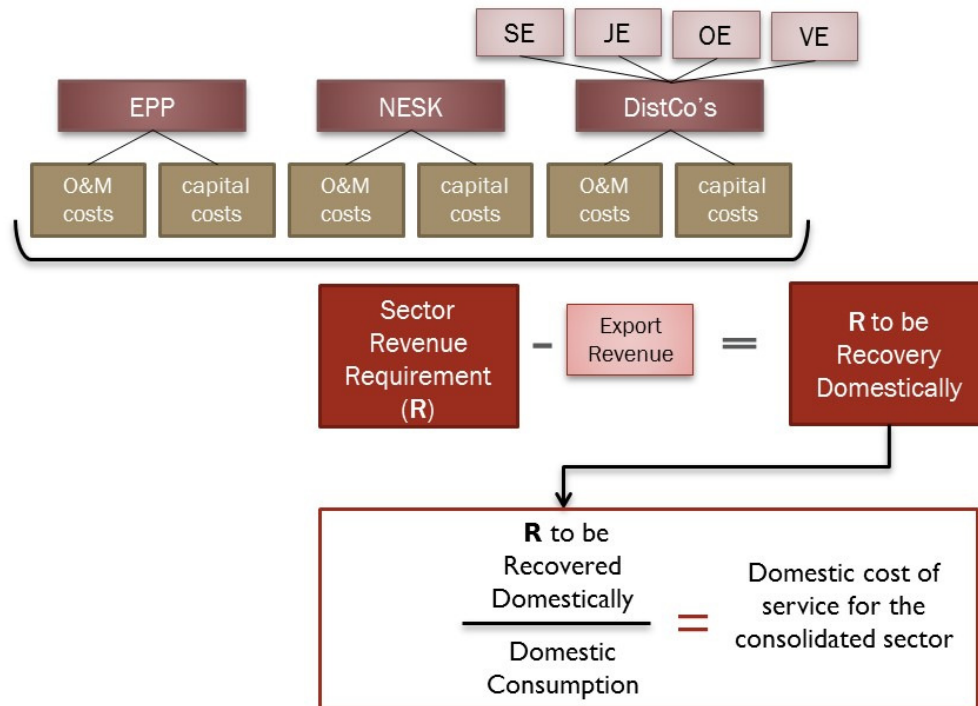
(KGS/kWh)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BAU Scenario	1.68	1.83	2.00	2.22	2.09	2.32	2.39	2.61	2.64	2.88	3.06
Reform Scenario	1.71	1.75	1.76	1.88	1.74	1.83	1.80	1.87	1.92	2.03	2.12

## **D.2 Cost of Service Methodology**

To assess the cost of electricity service in the Kyrgyz Republic, the Note first calculated the revenue required to cover all electricity-related costs, 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.3: demonstrates this calculation.

**Appendix Figure D.3: 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 2007 to 2012, the Note used actual operating and maintenance (O&M) costs by company as reported in the Technical and Economic Indicators provided by the Regulator.<sup>43</sup> 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.<sup>44</sup> For variable costs, such as material costs, an average historic unit cost per kWh was first calculated and these costs were

<sup>43</sup> The Regulator, which is under the MoE, also provided annual budgets in which each company submits its desired expenses for the year; however, these documents were only partially available for 2011 and 2012, and were in inconsistent formats. Due to the difficulty of understanding this data, we did not incorporate these documents into the cost of service analysis.

<sup>44</sup> International Monetary Fund (IMF), "World Economic Outlook (WEO) Database," October 2012, <http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx>.

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.4 contains the major categories of O&M costs.

**Appendix Table D.4. Major Categories of Operating and Maintenance Expenditures**

Variable O&M Costs	<ul style="list-style-type: none"> <li>▪ Material costs, including: <ul style="list-style-type: none"> <li>– production, maintenance and delivery services</li> <li>– auxiliary materials</li> <li>– fuel for technological purposes</li> <li>– fuels and lubricants</li> <li>– electrical energy</li> <li>– thermal energy</li> </ul> </li> <li>▪ Power purchase costs</li> <li>▪ Power transit costs</li> </ul>
Fixed O&M Costs	<ul style="list-style-type: none"> <li>▪ Salaries</li> <li>▪ Contributions to the Social Fund</li> <li>▪ Other costs</li> </ul>

- Second, we estimated the additional maintenance and capital improvement repairs that would be required to rehabilitate and maintain assets in order to restore reliable service using the 2011 USAID Review of the Prime Cost of Electricity. The Prime Cost of Service study estimated a depreciation charge based on the reevaluated asset value. Appendix Table D.5 indicates the depreciation charge and the revalued asset value for each company in the sector.

**Appendix Table D.5. Revalued Asset Base and Annual Depreciation by Company**

Company	Revalued Asset Base (2012) <sup>45</sup>	Depreciation Charge <sup>46</sup>	Annual Depreciation Expense
	<i>Thousand som</i>		<i>Thousand som</i>
EPP	86,596,668	3.33%	2,886,556
NESK	45,504,619	2.50%	1,137,615
SE	30,060,627	2.86%	858,875
VE	17,328,527	2.86%	495,101
OE	18,109,919	2.86%	517,426
JE	12,594,208	2.86%	359,835

<sup>45</sup> USAID, "Review of the Prime Cost of Electricity," March 2011.

<sup>46</sup> Depreciation charges are based on estimates of each company's average asset life. For example, assets owned by EPP are assumed to have an average asset life of 30 years; therefore, the annual depreciation charge is 1/30, or 3.33%

This approach is consistent with industry practice for estimating the maintenance and capital improvement budget as a percentage of the replacement value of the asset. We, therefore, use this depreciation charge as a proxy for the additional maintenance and capital repairs that would be required to restore reliable service. The increase in the average cost of service from 2012 to 2013 reflects this additional expenditure on maintenance and capital repairs, which was not included for past years.

### *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 2007 to 2012. We projected CAPEX for 2013 to 2030 in two ways:

- **Debt service on existing loans.** Future debt service on existing loans is calculated using the debt repayment schedule provided by the Ministry of Energy (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.<sup>47</sup>

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 investments that have secured financing or are in the process of securing financing are included in both the BAU and the Reform Scenarios. These investments are the Upper Naryn Cascade and rehabilitation of Bishkek CHP. The Reform Scenario also includes debt service for a new investment in a new 600 MW plant, which is the size of plant required to close the winter supply gap discussed in the body of the Note.<sup>48</sup> Appendix Figure D.4 shows debt service for the consolidated power sector on existing and future loans from 2014 to 2024. Appendix Table D.6 shows projected debt service on existing and future loans by company from 2014 to 2024.

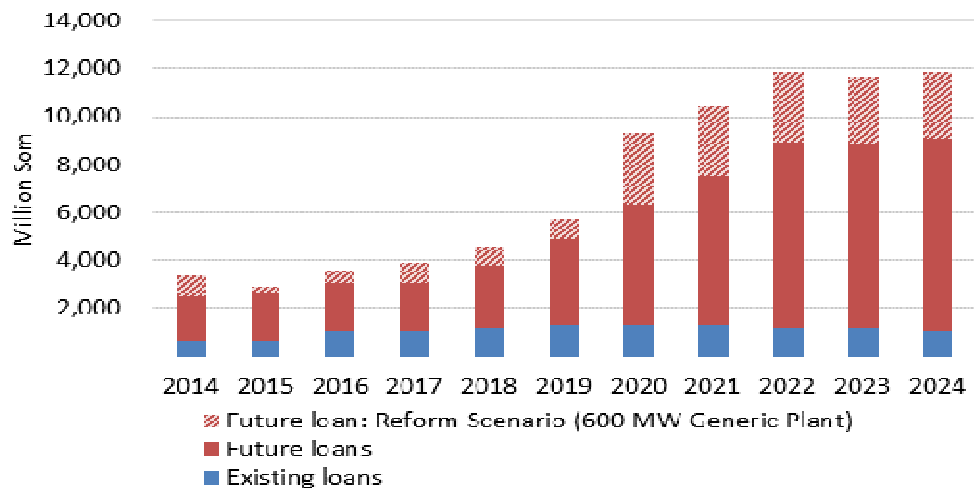
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<sup>47</sup> This assumption is based on standard IDA financing terms for the Kyrgyz Republic, effective as of July 1, 2011.

<sup>48</sup> Because it is not known which type of new generating plant the Kyrgyz Republic will next build, we have assumed costs for a generic plant with capital costs of \$1500/kW and operating costs of USD 0.015/kWh.



**Appendix Figure D.4. Debt Service on Existing and Projected Loans for the Consolidated Power Sector, 2014-2024**



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.

### Existing and Future Loans by Company, 2014-2024

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
17.1	747.0	747.0	857.9	857.9	863.6	863.6	752.7	752.7	660.2
39.6	839.6	839.6	1,455.6	2,458.3	2,489.0	2,766.3	2,729.4	2,692.5	3,120.4
84.3	568.6	853.0	853.0	853.0	2,985.4	2,942.7	2,900.1	2,857.4	2,814.8
14.0	213.2	213.2	193.3	269.5	269.5	269.5	269.5	247.1	247.1
99.7	899.7	899.7	899.7	899.7	1,732.5	2,611.9	4,256.5	4,188.4	4,120.2
100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1
2.1	92.1	92.1	92.1	92.1	322.5	317.9	313.3	308.7	304.0
9	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	3.7
8.0	48.0	48.0	48.0	48.0	168.0	165.6	163.2	160.8	158.4
4	7.4	7.4	7.4	30.0	30.0	30.0	30.0	30.0	22.6
8.6	58.6	58.6	58.6	58.6	205.2	202.3	199.4	196.4	193.5
7	5.7	5.7	5.7	21.5	21.5	21.5	21.5	21.5	15.7
8.2	38.2	38.2	38.2	38.2	133.6	131.7	129.8	127.9	125.9
<b>50</b>	<b>1,083</b>	<b>1,083</b>	<b>1,174</b>	<b>1,289</b>	<b>1,294</b>	<b>1,294</b>	<b>1,183</b>	<b>1,161</b>	<b>1,049</b>
<b>,976</b>	<b>1,976</b>	<b>1,976</b>	<b>2,592</b>	<b>3,595</b>	<b>5,051</b>	<b>6,196</b>	<b>7,792</b>	<b>7,675</b>	<b>8,022</b>

### *Domestic and Export Demand*

Actual consumption as stated in the Technical and Economic Indicators for 2007 to 2012 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.<sup>49</sup> The 2012 CAREC Report was used as the basis for many the assumptions about demand growth because of the comprehensive methodology and detailed results of its analysis. Appendix Table D.7 contains key assumptions of the demand forecast for 2013 to 2030 that are based on assumptions used in the 2012 CAREC Report. The demand growth assumptions in this Note deviate from the CAREC demand forecast in terms of tariff increases and loss reduction. Box 2.1 describes the assumptions of the “business-as-usual” (BAU) scenario used to project operational and financial performance throughout the Note.

**Appendix Table D.7. Key Demand Forecast Assumptions**

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

We project exports using the export forecast developed by the transmission company (NESK) until 2018. After 2018, we assumed that exports will increase in line with the export forecast of Central Asia South Asia Electricity Transmission and Trade Project. Appendix Figure D.5 demonstrates projected domestic and export demand from 2013 to 2030.

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<sup>49</sup> 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 Figure D.5. Projected Domestic and Export Demand under "Business-as-usual" assumptions, 2013-2030**

