World Bank Energy and Extractives Global Practice

ECA region

In collaboration with

Small Hydro Power Plant in the Kyrgyz Republic: Assessment of Potential and Development Challenges

Final Report

June 2017

Supported by **the Energy Sector Management Assistance Program**

www.esmap.org

Table of Contents

Appendices

Tables

Figures

Appendix Tables

Appendix Figures

Acknowledgements

The analysis presented in this report is the result of a collaborative effort between the World Bank ECA Energy team and IFC Advisory CAS Energy & Resource Efficiency team. The report has been prepared by Katharina Gassner (Sr Energy Economist, World Bank ECA Energy Unit), Elena Merle-Beral (Sr Energy Expert, IFC Advisory Services), Olga Terenteva (Independent Energy Consultant), and Nicole Rosenthal and Denzel Hankinson (International Consultants, DH Infrastructure). Valuable input in terms of data collection and verification is due to Zamir Chargynov. Overall guidance was received by Ranjit Lamech.

The financial and technical support for this activity by the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged. ESMAP—a global knowledge and technical assistance program administered by the World Bank—assists low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is a multi-donor trustfund; for detailed information please visit www.esmap.org.

Abbreviations

BTS	Bishkekteploset
CHP	Combined heat and power plant
CoS	Cost of Service
ECA	Europe and Central Asia
EPP	Electric Power Plants
FiT	Feed-in Tariff
GoKR	Government of Kyrgyz Republic
IFI	International financial institutions
IPPs	Independent Power Producers
JSC	Joint Stock Company
KESC	Kyrgyz Electricity Settlement Center
KGS	Kyrgyzstani Som
KPI	Key performance indicators
LCoE	Levelized Cost of Energy
LIC	Large industrial consumers
MEI	Ministry of Energy and Industry
MoE	Ministry of Economy
MTTP	Medium-Term Tariff Policy
NEHC	National Energy Holding Company
NESK	National Electrical Grid of Kyrgyzstan
O&M	Operating and maintenance
OE	OshElectro (Distribution Company)
SE	SeverElectro (Distribution Company)
SHPP	Small Hydro Power Plant
TA	Technical Assistance
VE	VostokElectro (Distribution Company)

1 Introduction

The **objectives of the analysis** presented in this report are to:

1) affirm the existing estimates of small hydropower technical potential and assess the economic viability of small hydropower plant (SHPP) sites in the Kyrgyz Republic,

2) estimate the fiscal or financial support that would be required to foster SHPP development in the short- and longer-term; and

3) analyze the legal and regulatory framework for SHPPs, including challenges and barriers for private investors.

This report summarizes the findings of the analysis. The remainder of it is organized as follows:

- **Section 2** provides brief background on SHPP development in the country.
- **Section 3** analyzes the technical potential for small hydropower plant, using existing studies as reference.
- **Section 4** analyzes the cost of specific SHPP sites, in financial and economic terms.
- **Section 5** presents analysis and recommendations on the feed-in tariff (FiT) methodology for SHPPs in the Kyrgyz Republic.
- **Section 6** analyzes the potential fiscal and financial burden of SHPPs on the GoKR and end-use customers, respectively.
- **Section 7** includes recommendations on the phasing and sequencing of SHPPs, given the analysis in the previous sections.
- **Section 8** analyses the overall legal and regulatory framework for SHPP in the Kyrgyz Republic and sets forth recommendations for strengthening the framework.
- **Section 9** describes the key administrative processes and procedures necessary for the construction of SHPPs, provides examples of successful measures to take to improve the enabling environment of SHPP developers and sets forth recommendations for strengthening the existing processes.
- **Section 10** concludes.

Appendices A through H contain material which supports the analysis and recommendations in the main body of the paper.

The report is based on data and information available as of the first quarter 2017. Legal and regulatory provisions adopted[1] and SHPP projects[2] initiated since then are mentioned but not analyzed in depth in the study.

[1] On March 24, 2017 the Kyrgyz Government by its Decree #175 approved Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic. The Regulations came into force in April 2017 (ten days after official publication) and were amended again on June 14, 2017.

[2] Following the Regulations the Committee on Industry, Energy and Subsoil Use conducted a tender in May-June 2017. Based on the results of the tender the Kyrgyzstan Government on July 10, 2017 signed an agreement with Czech company Liglass Trading CZ, SRO on the construction of 10 small hydropower plants in Kyrgyzstan as well as two larger generation plant (87MW and 47MW) along the Naryn River. The transaction is not effective at the publication of this report..

2 Sector Background

The history of Kyrgyz small hydropower plant goes back to the Soviet period, when over 150 SHPPs reportedly operated in the Kyrgyz Republic. Most of them were built between the 1940s and the 1960s. When the large hydropower plant Toktogul on the Naryn River started operation in the mid-1970s and the national electricity grid was extended to the whole country, most of these small hydropower plants were decommissioned. A few remaining ones were operated by Kyrgyzenergo, the Kyrgyz vertically integrated power monopoly.

The first transfer of management control over a Kyrgyz SHPP to an independent private operator took place in 1997 under a long-term lease of the Kalininskaya SHPP to the joint French-Kyrgyz company 'Kalininskaya GES'.

The Government's Program of Denationalization and Privatization of Kyrgyzenergo in 1999 allowed transformation of the existing but not operating SHPPs into independent companies to solicit interests of foreign and local investors. In the 2000s, attempts were made, but unsuccessfully, to privatize the joint-stock company (JSC) Chakan GES, which operates the Cascade of Alamedin SHPPs; it was re-nationalized after 2010.

Several SHPP strategies were adopted over the last two decades, including the Program for Development of Small Hydropower Plants in the Kyrgyz Republic in 1999-2005 and the Program for Development of Small and Medium Hydropower for the period up to 2012. However, the ambitious objectives of these programs were not met. Only a few SHPP projects were implemented, mainly financed by international or bilateral donors. They faced regulatory, institutional, technical and financial barriers and a lack of qualified local personnel for the design, construction and operation and maintenance of SHPPs.

In 2015, the Kyrgyz Government approved a new Concept for the Development of Small Hydropower for the period up to 2017 and started improving the legal and regulatory framework for SHPPs (more details in Section 8).

Table 2.1 presents the grid-connected SHPPs, which are reported to be operating in 2016. There are also some micro hydropower plants but due to their small size and isolated mode of operation they are not registered by the Energy Regulator.

Table 2.1: SHPPs in Operation in the Kyrgyz Republic in 2016

Name of the SHPP	Capacity (MW)	Tariff 2016 tyiyn/kwh	Tariff 2016[3] US cents/kwh	Operator	Offtaker
JSC Chakan GES, including	38.5	117.7	1.71	Chakan GES JSC (state owned)	JSC Severelectro
Lebedinovkaya SHPP	7.6				
Alamedin SHPP - 1	2.2				
Alamedin SHPP - 2	2.5				
Alamedin SHPP - 3	2.1				
Alamedin SHPP - 4	2.1				
Alamedin SHPP - 5	6.4				
Alamedin SHPP - 6	6.4				
Small Alamedin HPP	0.4				
Bystrovskaya SHPP	8.7				
Kalininskaya SHPP	1.4	139.60	2.03	LLC Kaliniskaya GES	JSC Severelectro
Issyk-Atinskaya SHPP	1.4	--		JSC Construction Firm Ark	Own needs
Naiman SHPP	0.6	118.27	1.72	JSC Naiman GES	JSC Oshelectro
Ak-Suyu SHPP	0.5	186.52	2.71	Maryam Agricultural Cooperative	Own needs
Kyrgyz-Ata SHPP	0.2	470.00	6.82	OJSC Satellite-2005	JSC Oshelectro
Tegermentinskie GES	3.0	470.00	6.82	Tegermentinskie GES LLC	JSC Severelectro
Total	**45.6**				

Note: Listed SHPPs are from data provided by the State Agency for Regulation of the Energy Sector (2016). Micro hydropower plants (not listed) are not registered by the Energy Regulator, due to their small size and isolated mode of operation.

[3] 1USD= 68.899 KG Som as of September 1, 2016

3 Affirmation of Technical Potential

Currently there are 15 SHPPs in operation, totaling 46 MW (see Table 2.1). However, this may represent only a small portion of technical potential. Often-quoted estimates from the Ministry of Energy and Industry of the Kyrgyz Republic indicate that there is potential for five to eight billion kilowatt-hours (kWh) of electricity generation from SHPPs annually.[4] This range appears in various documents from the GoKR, most recently in the 2015 – 2017 *Concept for the Development of SHPPs in the Kyrgyz Republic,* but also as early as the 2000 – 2005 *SHPP Development Program*.[5]

The estimate is based on high-level hydrological (not site-specific) studies which are now generally viewed as unreliable and outdated by sector experts. More recent studies for the Ministry by the United National Development Program (UNDP) and United Nations Industrial Development Organization (UNIDO), have estimated that between 87 and 92 new SHPP sites are available to be developed or rehabilitated. The sites are estimated to have a total installed capacity of roughly 180 MW, with average capacity factors of 63 percent, and generation potential of around 1 billion kWh or 1,000 Gigawatt-hours (GWh) per year.[6] Box 3.1 summarizes the studies reviewed, and the level of detail they contain.

The estimate of five to eight billion kWh is much higher than what could reasonably be produced at known SHPP sites. Capacity factors for SHPPs typically range between 0.4 and 0.7.[7] The UN studies named above show capacity factors that average around 63 percent. At an average aggregate capacity factor of 63 percent, roughly 900 to 1450 MW of installed capacity would be needed to generate the five to eight billion kWh of generation potential estimated in the 2000 – 2005 *SHPP Development Program*.[8] This is a substantial amount of capacity: it would represent roughly 1/3 to 1/2 of the Kyrgyz Republic' peak demand.

The total installed capacity of the site-specific studies shown in Box 3.1 is 409 MW, which, at an average capacity factor of 63 percent would produce 2.1 billion kWh per year.[9] However, the lack of detailed information available—especially for so-called Tier 3 sites—does not support a firm conclusion on technical potential. Moreover, some sites were included in

[4] In 2015, the Ministry and Energy and Industry was dissolved, and its functions became part of the responsibilities of the Ministry of Economy. In 2016, the newly-created State Committee for Energy and Subsoil Use was made responsible for energy policy.

[5] Appendix B contains a summary of the estimates of technical potential contained in the Program, and an analysis of those estimates from the point of view of internal consistency and consistency with other studies.

[6] Estimates of SHPP potential provided in the UN sources also included 22 MW of potential capacity from rehabilitating 39 existing sites and 75 MW of capacity from constructing 7 SHPPs at existing irrigation water reservoirs. The number of plants and their combined capacities varied slightly among documents developed by the Ministry and by the UN (UNDP and UNIDO); however, this fluctuation is likely a result of rounding.

[7] International Finance Corporation, "Hydroelectric Power: A Guide for Developers and Investors", 2013, accessed 19 April 2016, http://www.ifc.org/wps/wcm/connect/06b2df8047420bb4a4f7ec57143498e5/Hydropower_Report.pdf?MOD=AJPERES.

[8] A plant's capacity factor is the ratio of its actual output over a period of time, to its potential output if it operated at its installed (nameplate) capacity over the same period of time, in other terms: Capacity factor = Annual energy production (MWh) / (installed capacity (MW) x 365 days x 24 hours).

[9] Even an average capacity factor of 63 percent may be overly optimistic. For the purpose of the economic and financial analyses in Section 4, the capacity factors of all plants were capped at 50 percent. Applying this cap results in about 0.77 - 0.85 billion kWh production annually from SHPPs.

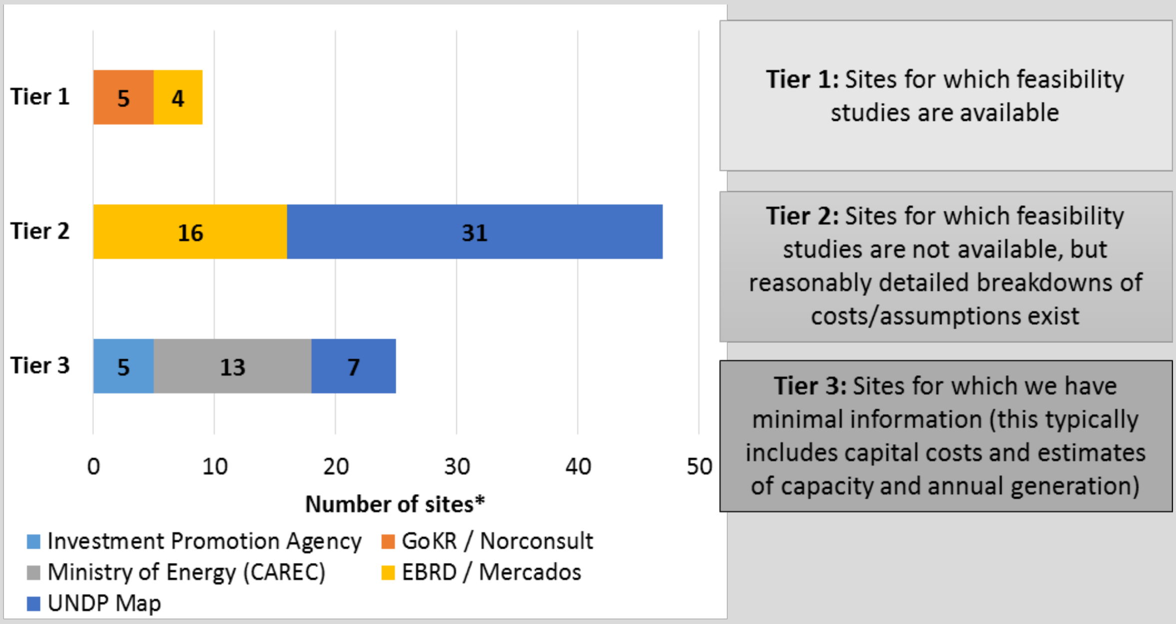
multiple studies. Best efforts were made to merge duplicate sites, but some duplicates may still exist.

Box 3.1: Studies of SHPPs in the Kyrgyz Republic

Five earlier sources of site-specific data on SHPPs in the Kyrgyz Republic were identified for this study:

- **European Bank for Reconstruction and Development (EBRD)/Mercados feasibility and pre-feasibility studies:** Phase 1 and 2 reports, prepared by consultants Mercados as part of EBRD's "Kyrgyz Republic: Strategic Planning for Small and Medium-Sized Hydropower Development" Project. These reports include feasibility studies of four sites and preliminary studies of 16 sites.
- **Norconsult studies:** Five feasibility studies conducted by Norconsult for the GoKR between 2006 and 2014.[10]
- **Investment Promotion Agency investment opportunities***:* Documents summarizing investment opportunities in five SHPPs which were developed by the Investment Promotion Agency under the Ministry of Economy of the Kyrgyz Republic in 2015.[11]
- **UNDP map:** An interactive map of potential SHPP sites which was developed under the UNDP/GEF Small Hydropower Development Project, on the basis of studies from the GoKR.[12] This map contains information for a total of 63 sites. Of these sites, 25 were already identified in other sources (Sources 1-3)), and 38 were not found in other sources.
- **Ministry of Energy (CAREC) estimates for CAREC:** Data on 13 potential SHPP sites provided by the Ministry of Energy and Industry in 2015 to a consulting team developing a financing roadmap for Central Asia Regional Economic Cooperation (CAREC).

The level of detail provided for specific SHPP sites varies by source. The potential SHPP sites were therefore grouped into three tiers, based on the level of detail provided in the source documents. The figure below summarizes the groupings. Appendix C contains more information on the programs which led to the identification of Tier 1 and 2 sites, and Appendix D contains details for each Tier 1 site-specific study.



Note: The number of sites in this figure does not include alternative analyses of a single site. There are 81 individual sites included in the analysis, but because of alternative analyses a total of 84 entries are included in the draft supply curve.

---

[10] The name of the specific agency for which the studies were completed varies depending on when the study was conducted. Studies are sited as having been carried out on behalf of: the Ministry of Energy and Industry, the State Inspection of Energy and Gas, and the State Energy Agency.

4 Cost of SHPPs Relative to Alternatives

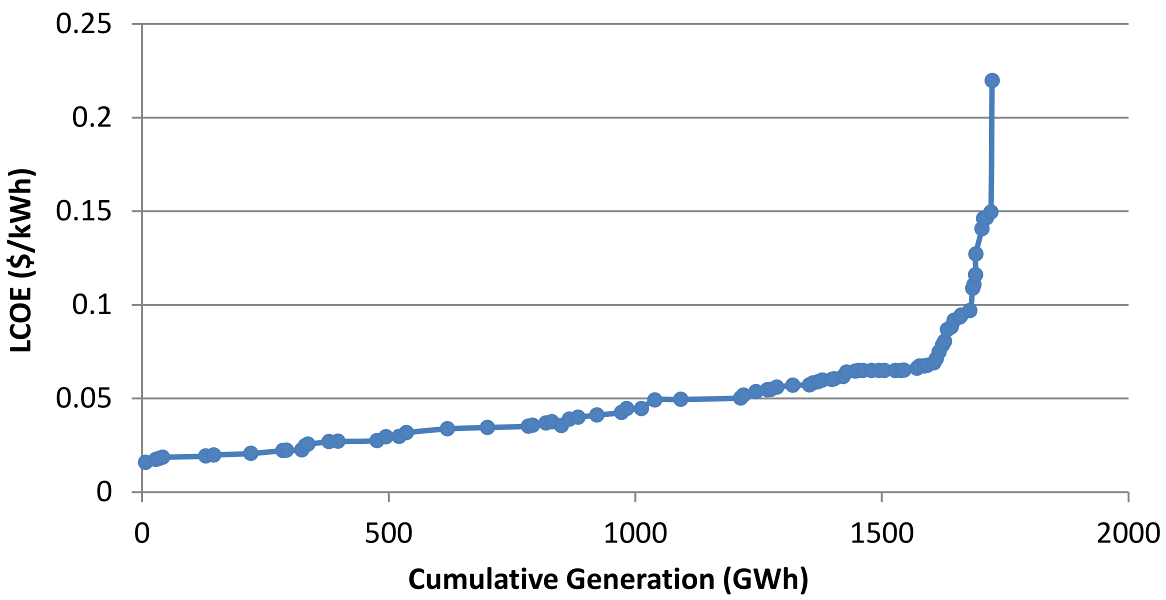
Many of the site-specific studies identified in Section 3 contain sufficient information on cost and plant characteristics to allow for the estimation of levelized costs of energy (LCoE), and to develop a supply curve for SHPPs in the Kyrgyz Republic. Appendix E summarizes the plant characteristics used, and the assumptions made.

Section 4.1 shows estimates of the LCoEs in economic terms which includes quantifiable externality costs and the social opportunity cost of capital, and compares them to the economic costs of alternative supply, including imports and electricity generation from a rehabilitated Bishkek Combined Heat and Power Plant (CHP).[13]Section 4.2 shows the same analysis in financial terms. Externality costs are excluded from the financial analysis, and the opportunity cost of capital used is an opportunity cost which would more closely reflect private investors' expected returns to equity and debt on an SHPP project.

4.1 Economic Analysis

Figure 4.1 shows the levelized *economic* cost of energy from the SHPP sites identified in the studies in Box 3.1. The LCoEs are ranked from least cost generation (left) to highest cost (right). As noted in Section 3, all plants identified by site-specific studies are included, but obvious duplicates are eliminated. Where conflicting cost information was available for the same site, the more recent or more detailed estimates were used (for example, Tier 1 estimates were used instead of Tier 2 estimates, and Tier 2 estimates instead of Tier 3).

Figure 4.1. Economic Supply Curve for SHPPs



[11] Investment Promotion Agency under the Ministry of Economy of the Kyrgyz Republic, "Energetics," accessed on 25 March 2016, http://www.invest.gov.kg/en/investment-projects/investment-projects/energetics/

[12] Ministry of Energy and Industry of the Kyrgyz Republic, "Map of Kyrgyzstan: Small Hydropower Development," accessed on 27 April 2016, http://energo.e-sot.kg/?lang=en. At the time of this study's completion, the map was no longer available.

[13] Detailed cost assumptions for Bishkek CHP and imports can be found in Appendix F.

The estimates of economic cost assumed opportunity costs of capital, capital (CAPEX) and operating costs (OPEX), and externality costs:

- For opportunity costs of capital:
  - A discount rate of 5 percent, as a proxy for the social opportunity cost of capital.[14]
  - Discounting over the life of the asset, plus its construction period. Where information on asset life or construction period of an SHPP was not available, a life of 30 years was assumed, with a construction period of 2 years.
- For capital and operating costs:
  - The studies described in Section 3 contain estimates of CAPEX and OPEX for many plants, as well as estimates of capacity factors. If cost data were not available, estimates were developed based on a formula used by the United States Oak Ridge National Laboratory. If data on capacity factors were not available, or where studies showed capacity factors higher than 50 percent, a value of 50 percent was assumed. Capacity factors, in other words, were capped at 50 percent. Appendix E contains more detail on the cost assumptions used for the SHPPs.
  - Capital costs of the Bishkek CHP were based on actual rehabilitation costs. Operating costs were not known, and were therefore assumed based on international benchmarks. Detailed assumptions and sources are listed in Appendix F.
  - The costs of imports were based on recent import prices from Kazakhstan and Tajikistan. Detailed assumptions on imports are listed in Appendix F.
- Externality costs:
  - A capacity penalty was applied to the SHPPs, to reflect the need, with intermittent generation such as run-of-river, seasonal SHPPs, for "firming" or backup capacity as insurance against the SHPPs being unavailable. Box 4.1 summarizes the methodology used to estimate capacity penalties for each SHPP.
  - CO_2 emissions costs were added to the operating costs of a rehabilitated Bishkek CHP and imports, respectively.

[14] Based on a World Bank internal guidance note: "Discounting Costs and Benefits in Economic Analysis of World Bank Projects". 2016.

Box 4.1: Estimation of Capacity Penalties for SHPPs

To reflect the lower reliability of seasonal, run-of-river SHPP generation, a capacity penalty was applied to each SHPP in the curve above. The penalty effectively reflects the cost to the electricity system of standby power required to "firm up" the renewable energy capacity. The capacity penalty is calculated as follows:

$$Capacity\ Penalty = CC_a \times (1 - \frac{CF_{SHPP}}{CF_a})$$

Where:

- CC_a is the capacity cost of the alternative energy source used if the SHPP is unavailable. The Bishkek CHP plant is taken as the alternative source (based on data from the plant's modernization, begun in 2013), and a levelized rehabilitation cost used since the plant is fully depreciated.[15]
- CF_{SHPP} is the capacity factor of the SHPP plant.
- CF_a is the capacity factor of the alternative energy source. A capacity factor of 85 percent for the Bishkek CHP plant is assumed.

The figure below shows the upward shift in the economic analysis supply curve for SHPPs, when the capacity penalties are added to the levelized costs shown in Figure 5.1.

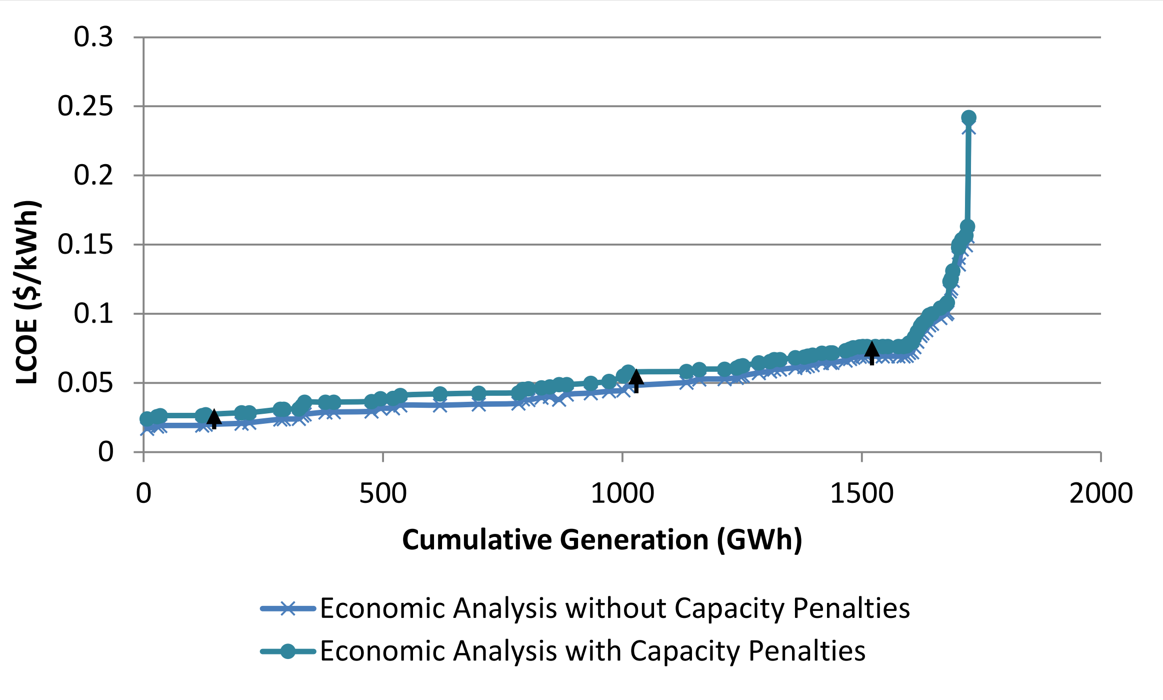


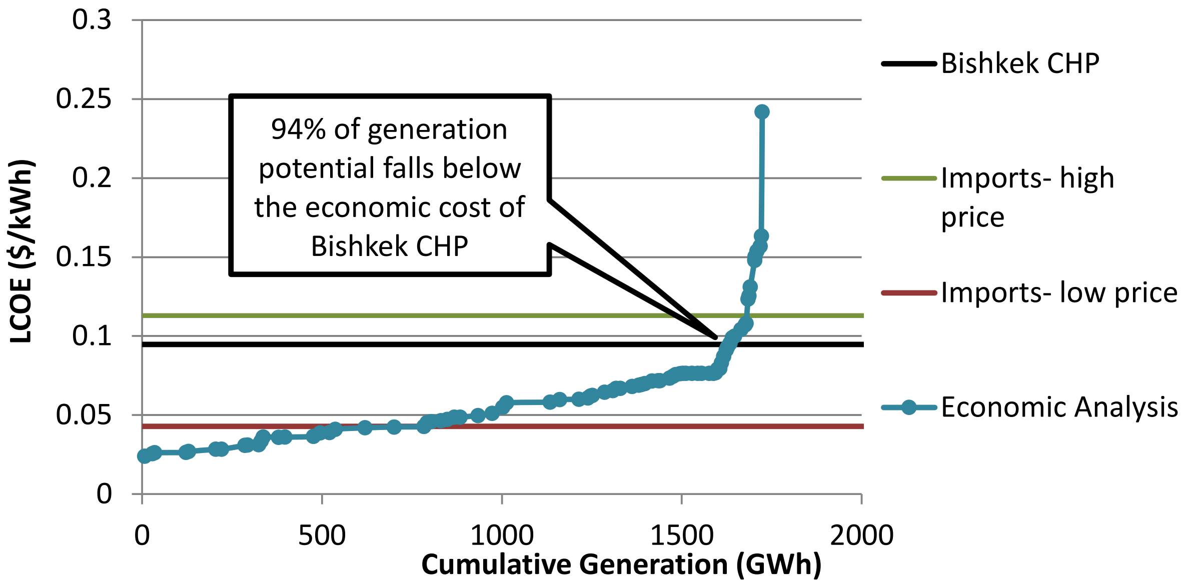
Figure 4.2 compares the economic cost of SHPPs to the economic costs of Bishkek CHP and imports.[16] The figure shows that roughly 45 percent of the generation potential falls below the lower-end estimate of the economic cost of imports. Roughly 94 percent of the generation potential falls below the economic cost of Bishkek CHP, and roughly 97 percent of it falls

[15] The rehabilitation cost includes the USD 386,000,000 cost of rehabilitating 250MW net capacity, with a 3-year construction period, assumed 20 year life, 5 percent interest rate, and a capacity factor of 85 percent.

[16] Arguably, capacity penalties should also be applied to imports if imports do not represent "firm capacity". If contracts in the Kyrgyz Republic are for energy only, and not firm capacity, the economic cost of such contracts would be higher as they would need to be "firmed up" by Bishkek CHP.

below the high-end estimate of economic cost of imports. Appendix F contains additional information on the assumptions used to estimate the costs of Bishkek CHP and imports.

Figure 4.2. Economic Supply Curve for SHPPs and Alternatives



4.2 Financial Analysis

The assumptions used to estimate the *financial* cost of plants are the same as for the estimates of economic analysis except that externality costs are excluded, and different opportunity costs of capital are used:

- Capital costs are 60 percent financed by debt, 40 percent by equity, at an interest rate of 10 percent and an expected return on equity of 18 percent;
- Equity is discounted over the life of each asset, plus its construction period. Debt is discounted over a 10-year borrowing period. Where information on asset life or construction period of an SHPP was not available, a life of 30 years was assumed, and a construction period of 2 years.

Figure 4.3 shows estimates of levelized financial costs of SHPPs and their generation potential, and compares them to the estimates of levelized economic costs from Section 4.1.

Figure 4.3. Financial and Economic Analysis Supply Curve of Potential SHPP Sites

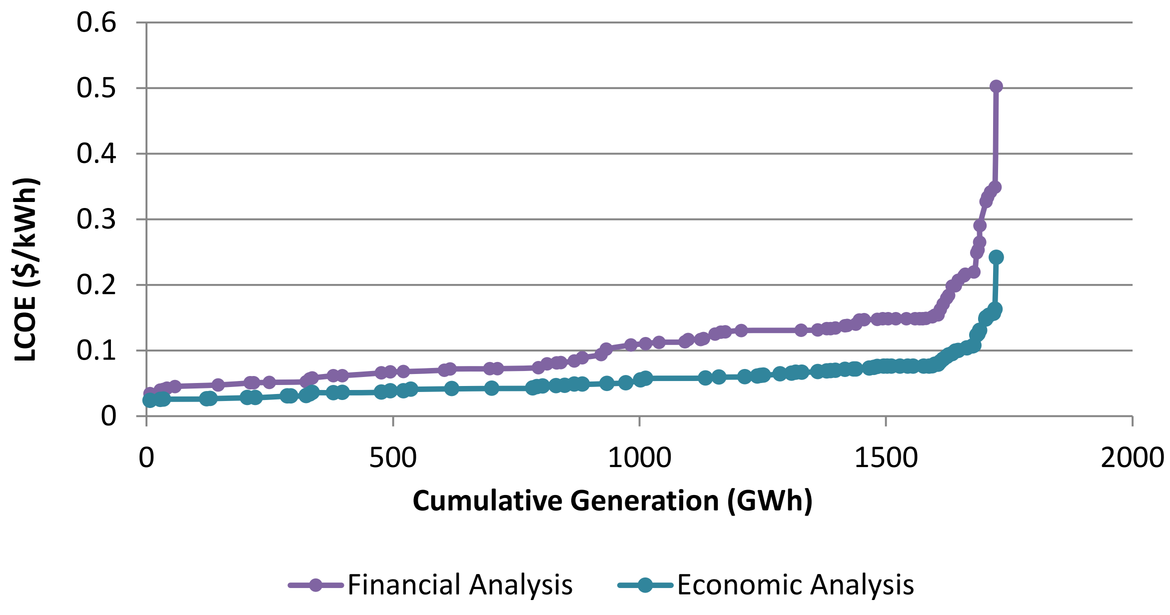
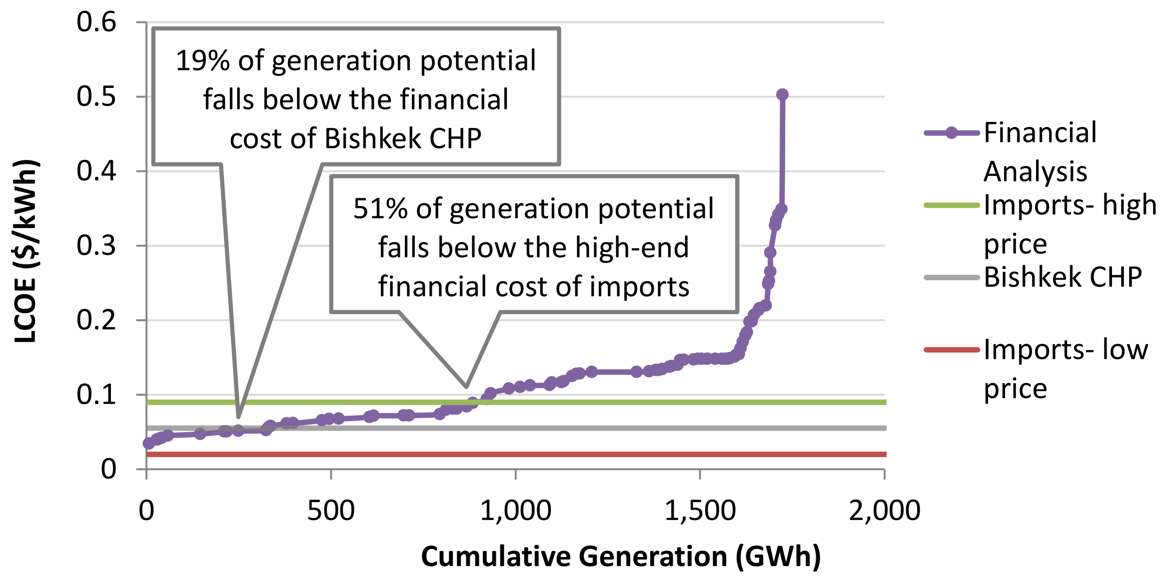


Figure 4.4 compares the levelized *financial* cost of SHPPs to their alternatives, namely, power supply from imports or Bishkek CHP. The figure shows that about one fifth of the SHPP generation is cheaper than the lower-end financial estimate of import costs. Roughly 19 percent of the generation potential falls below the financial cost of Bishkek CHP, and roughly 51 percent of it falls below the high-end estimate of the financial cost of imports.

Figure 4.4 Supply Curve of Potential SHPP Sites



5 Feed-in Tariff Analysis

The FiT for SHPPs is determined by a formula established in an order by the energy sector regulator, the State Agency on Regulation of Fuel and Energy Complex of the Government of the Kyrgyz Republic. The order "On approval of the Methodology of calculation of tariffs for electricity supplied to EPP using renewable energy sources" (August 6, 2015 NC № 1) establishes preferential tariffs for different RE technologies, including SHPPs. It has been revised by the regulator in 2016 (Order № 3 on April 11, 2016), resulting in higher FiTs for SHPPs. The methodology calculates tariffs for newly commissioned facilities that generate electricity from renewable sources. The formula for determining the tariffs is linked to end-user tariffs as follows:

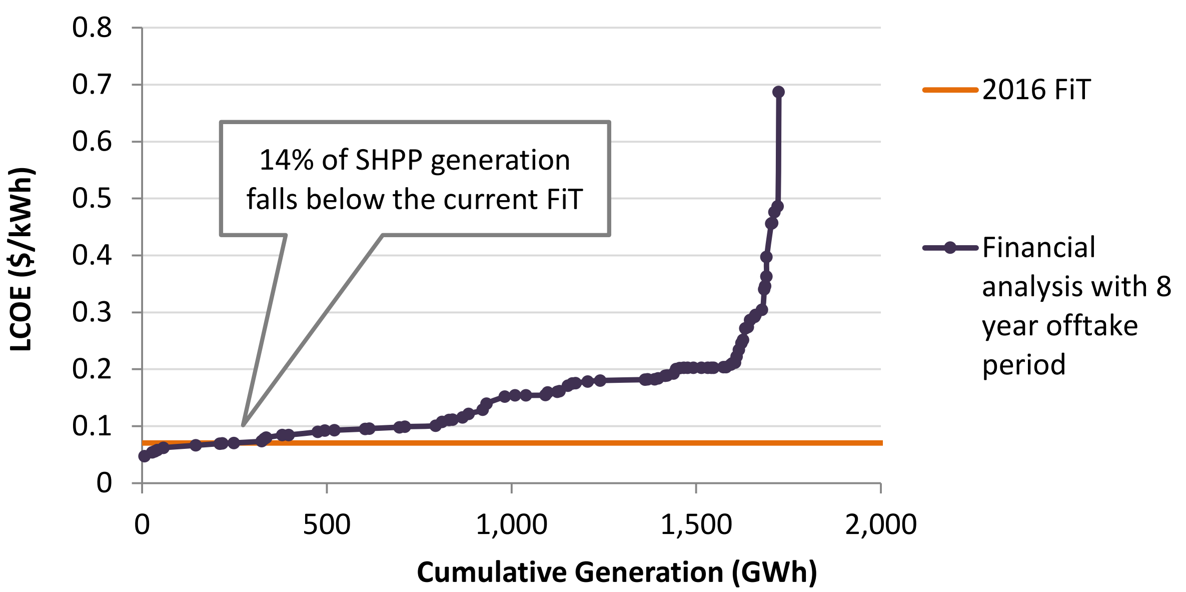
$$T = T_1 k_0$$

where:

- T is the calculated tariff, in som/kWh (equal to 4.70 Som/kWh for 2016);
- T_1 is the maximum end-user tariff currently in effect (2.24 som/kWh);
- k_0 is a coefficient that differs depending on the renewable source being used to generate energy; for hydropower, the coefficient is equal to 2.1.[17]

Figure 5.1 compares the financial cost of SHPPs to the 2016 FiT which, using the current methodology would be 0.07 USD/kWh.[18] Roughly 14 percent of SHPP generation is financially viable with a FiT at this level.

Figure 5.1. Financial Cost of Supply Curve relative to FiT (8-year Offtake)



The Order allows for payment of the FiT over a period of eight years. The estimates of SHPP costs shown in Figure 5.1 therefore assume an 8-year payback period, meaning equity and

[17] For biomass, the coefficient is 2.75; for wind, 2.5; for solar, 6.0; and for geothermal, 3.35.

[18] Box 5.1 shows the assumptions used in calculating this FiT.

debt investors recover their initial investments and required returns during that time period. At the start of 2017, an intergovernmental working group was discussing revisions to the FiT which would include a possible extension of the offtake period. The impact of longer offtake periods on the financial viability of SHPPs is shown in Figure 5.2 and Table 5.1. Figure 5.2 shows the financial supply curve in relation to the FiT, assuming the current 8-year offtake period, as well as 10- and 15-year offtake periods. With a 10-year offtake period, 19 percent of the SHPP generation potential falls below the current FiT. With a 15-year offtake period, 28 percent of the SHPP generation potential falls below the current FiT. Table 5.1 details the percent of viable SHPP sites and percent of viable generation (in MWh) under each offtake period.

Figure 5.2. Financial Cost of Supply Curve relative to FiT (8-, 10-, and 15-Year Offtake)

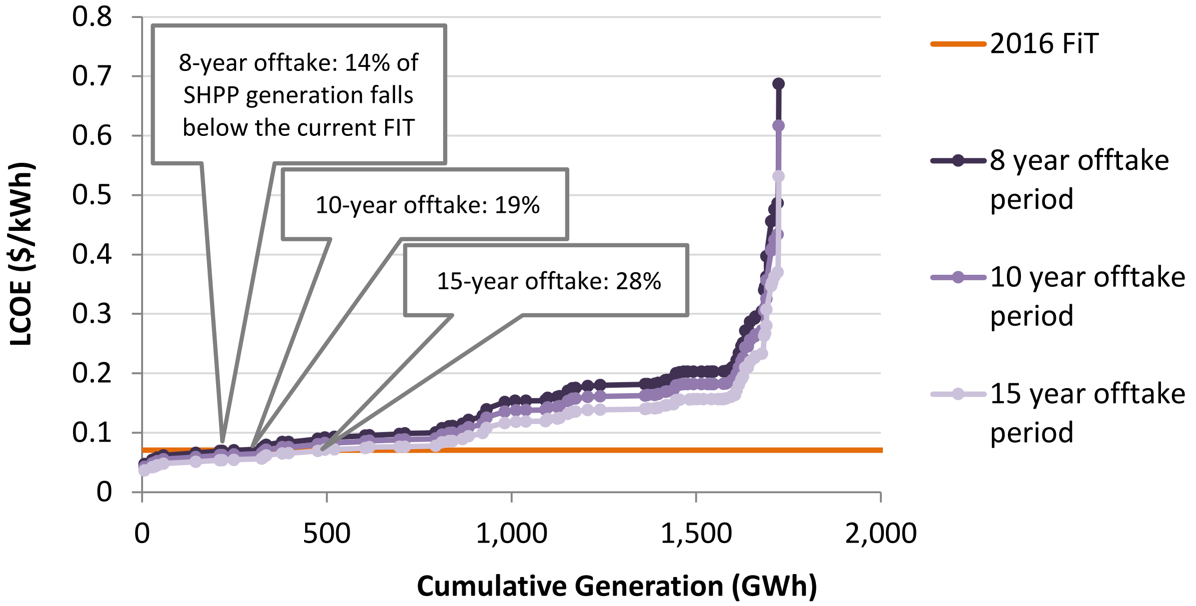


Table 5.1: SHPP Financial Viability under 8,10, and 15 Year Offtake Periods (2016)

	8-year Offtake		10-year Offtake		15-year Offtake	
	Viable Generation (MWh)	Viable SHPPs (no. of sites)	Viable Generation (MWh)	Viable SHPPs (no. of sites)	Viable Generation (MWh)	Viable SHPPs (no. of sites)
Viability under the 2016 FiT	14.44%	11.11%	19.20%	13.58%	27.62%	18.52%

Note: Percent viable generation is based on the total potential generation included in this study, and the percent of SHPPs is based on the total number of potential SHPPs included in this study.

The level of FiT, and the length of the offtake period, however, appear to be less of a deterrent to investment in SHPPs than the creditworthiness of the off-takers, which in the case of the Kyrgyz Republic are the four regional distribution companies (See more details in Sections 8 and 9). Another key problem for SHPP project bankability includes the lack of indexation of the tariff to inflation and exchange rate fluctuations (see Box 5.1).

Box 5.1: Development of the FiT formula

The current formula does not allow for automatic adjustments of the RE tariff to inflation and to the changes in the exchange rate of the Kyrgyz Som to USD or another hard currency. The regulation adopted in April 2016 only states that the RE tariff shall be reviewed by the Energy Regulator every year on August 1 in accordance with the Kyrgyz legislation. Since the Kyrgyz legislation is not explicit about this question, there is a risk that this annual "manual" adjustment might lead to the loss in revenues for RE generators.

The initial RE tariff methodology adopted in August 6, 2015 allowed partial indexation according to the following formula:

$$T = T_1 \left[k_1 \frac{PI}{100} + k_2 \frac{ER_1}{ER_2} \right]$$

Where :

T- the set tariff (KG Som/kWh);

T1 – maximum value of the current tariff for end-users excluding import component (KG Som/kWh);

- T1 = maximum tariff * k_0, (coefficient, for hydropower equal to 2.1)

k_1 -, coefficient which is adjusted based on the actual rate of inflation and is equal to 0.5;

PI - the consumer price index for the previous year;

k_2 – coefficient which is adjusted based on the KG som to USD currency rate and is equal to 0.5;

ER_1 - arithmetic average rate of Kyrgyz Som to the US dollar for the previous year;

ER_2 - arithmetic average rate of Kyrgyz Som to the US dollar for the year preceding the previous year.

The Energy Regulator was supposed to review RE tariff every year based on official data on inflation and changes in the KG som to USD currency rate.

The formula revised by the Energy Regulator in April 2016[19] reads as follows:

T = Tм x K,

where:

T - the set tariff (KG Som/kWh);

Tм - maximum value of the current tariff for end-users[20] (KG Som/kWh);

K - coefficient applied to the maximum value of the current tariff for end-users as set forth by the Law on Renewable Energy:

- hydropower – 2.1
- biomass – 2.75
- wind – 2.5
- solar – 6.0
- geothermal – 3.35

Source: RE tariff methodology adopted in August 2015 and subsequently replaced in April 2016.

[19] Amended by the Energy Regulator's Order № 3 on April 11, 2016

[20] The new formula refers to the maximum value of the current tariff for end-users and currently the nonresidential tariff is the highest

6 Fiscal and Financial Burden of SHPPs

The level of fiscal and financial burden imposed by SHPPs will depend on the level of the FiT, the volumes of electricity SHPPs generate, and the extent to which the FiT differs from the average cost of generation in the Kyrgyz Republic.

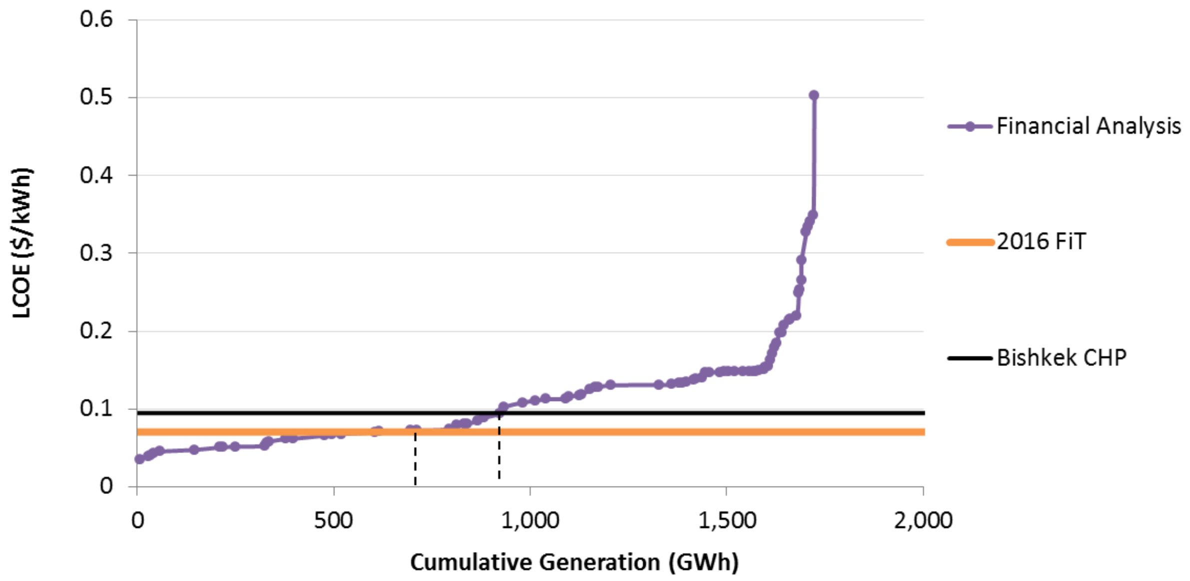
An economic argument can be made for setting the FiT equal to the economic cost of Bishkek CHP (.095 USD/kWh, or a 34 percent increase from the 2016 FiT). Bishkek CHP is the highest cost generation that could be avoided as a result of running the SHPPs.[21] GoKR would therefore be justified in encouraging the development of all SHPPs with economic costs lower than the economic cost of the marginal plant. Electricity generated by SHPPs is electricity which Toktogul does not need to generate and which can be stored as water in its reservoirs. Water stored at Toktogul in turn displaces the need to operate Bishkek CHP (or import electricity). Generally speaking, the economic benefit of running an SHPP is therefore equal to the difference between the economic cost of that SHPP, and the economic cost of Bishkek CHP as the marginal plant. The exceptions to this general statement are that if the SHPP is unavailable (for example, because of seasonality of water flows) or if Toktogul's reservoirs are full, the economic benefits of the SHPPs are zero. Kyrgyz electricity demand in recent years, however, suggests that is unlikely that Toktogul's reservoirs will again reach their full levels in the future. SHPPs could therefore be valuable in helping to keep Toktogul's reservoirs available for meeting more peak hours during winter.

Whether the burden is financial or fiscal depends on whether the GoKR (a) passes the higher costs of SHPP generation to customers in the form of higher end-user tariffs, or (b) subsidizes SHPP generation by transferring to the off-takers the difference between their cost of purchases from SHPPs and the revenue they receive from customers for the electricity they sell to SHPPs. Some combination of partial cost pass-through (a) and subsidy (b) could also be considered.

If GoKR were to set the FiT equal to the economic cost of the Bishkek CHP (T_1 = USD 0.095), it would add roughly USD 44.7 million in financial costs to the sector annually, or USD.0047 per kWh consumed in 2016 (assuming the addition of 922 GWh of SHPPs).

[21] Import costs were also examined in relation to the levelized costs of SHPPs (shown in Figure 5.4), but import costs may not represent the marginal cost in future years, as Kyrgyzstan has recently been able to negotiate more favorable import prices with Kazakhstan than initially foreseen, and imports from Tajikistan may become more widely available because of investments in transmission infrastructure associated with CASA-1000.

Figure 6.1. Financial Cost of SHPP Generation as Compared to the Current FiT and Economic Costs of Bishkek CHP



Average household consumption is roughly 4,900 kWh per year, which means an average monthly household bill (at current average residential tariffs of KGS 1.029/kWh) of roughly 420 Som (roughly USD 6.30).[22] Adding USD.0047/kWh (KGS.31/kWh) to residential tariffs would mean average monthly bills of KGS 422/kWh, a 0.5 percent increase over what residential customers currently pay. Current electricity bills are low, with electricity representing only 2.5 percent of total household budgets on average.[23]

[22] Average household consumption and average residential tariff based on 2016 Techno-Economic Indicators for the Energy Sector

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

7 Phasing and Sequencing of SHPP Development

The sites identified in Section 3 total 409 MW, at an estimated investment cost of roughly US$ 1 billion. Of these, roughly 386 MW (with an investment cost of US$ 828 million) could be developed to produce energy with an LCoE lower than the economic cost of Bishkek CHP, the maximum FiT recommended in Section 6.

Making a theoretical economic case for a higher FiT is, however, much easier than making the practical or political case for one. GoKR may understandably want to set more modest targets for SHPPs in the short- to medium-term. The analysis in Sections 4 and 5 indicates that the current FiT may already be high enough to attract some level of sector investment in SHPPs. The barrier to investment, as also mentioned in Section 5, is not so much the level of the FiT or the length of the payback period as it is the poor creditworthiness of the regional distribution companies as off-takers. Government will need to prioritize measures to improve their creditworthiness, or other mechanisms which guarantee payment to SHPP developers for their output.

GoKR could also, as an alternative to a FiT, consider site-specific tenders for SHPPs in which bidders compete on the level of tariff they are willing to accept (sometimes referred to as auctions or reverse auctions). If GoKR takes this approach—tendering for development of specific sites or offering incentives for the development of specific sites—it will want to prioritize development of those sites.[24] Plants with feasibility studies should be top priority, as they are likely to attract investor interest more quickly than plants without them. Investors would do their own feasibility studies but having a third-party feasibility study available upfront makes it easier to identify the sites as a potential investment opportunity, and is likely to make development of the site move more quickly.

Roughly 120 MW of sites are Tier 1 sites as described in Box 3.1, and of those, roughly 40 MW could be developed at lower financial costs than the 2016 FiT. It would make sense to begin looking in detail at whether there are any serious environmental or social barriers to investing at these sites and start developing a mechanism to address remaining legal and regulatory barriers. Roughly 185 MW of the known sites are Tier 2 sites (for which some detailed data are available), and of those, roughly 50 MW could be developed at lower financial cost than the 2016 FiT. It would make sense for Government to begin developing feasibility studies for these sites. The Tier 1 and Tier 2 sites are listed in Table 7.1.

The recommendation is that GoKR focus initially on the sites with pre-feasibility or feasibility studies. These are, primarily, the sites studied by Norconsult and Mercados. The sites included in these studies have reasonably good technical information behind them. Their LCoEs are also broadly representative of the range of LCoEs identified in the supply curve first presented in Section 4. Sites identified in the UNDP map could be a focus of follow-on studies.

Figure 7.1 shows the LCoEs, on an economic basis, for the SHPP sites identified by each source. This figure also highlights sites for which alternate analyses have been conducted, either by a single source (e.g. NorConsult ran alternatives of a single site) or between sources (e.g. Mercados studied the same site that was studied by Norconsult).

[24] The FiT approach is inherently not site-specific, but specific sites could be given priority in terms of the Government support that would be offered.

Figure 7.1. Supply Curve by Data Source (Economic Analysis)

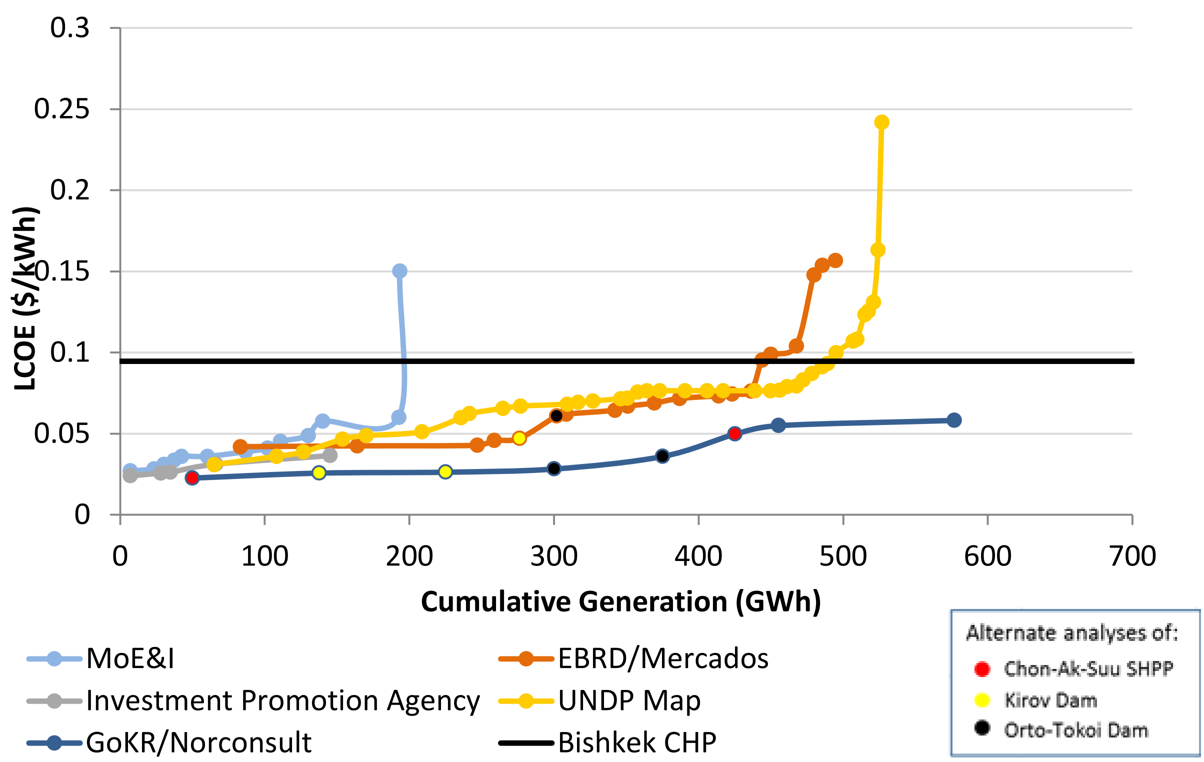


Table 7.1: Priority SHPP Sites

Tier 1 Sites	Source	Net Capacity (MW)
Kirov Dam - transmission to Kazakhstan	GoKR/Norconsult	20.0
Orto-Tokoi Dam- alt 1	GoKR/Norconsult	18.0
Total		38.0
Tier 2 Sites		
Sandalash-1	UNDP Map	9.9
Jiptik	UNDP Map	4.2
Kirovskaya	EBRD/Mercados	21.0
Kara-Suu	UNDP Map	14.8
Total		49.9

Note: These sites were prioritized based on financial costs which are lower than the FiT calculated using the 2016 methodology. These costs were not adjusted for the current 8-year offtake period offered under the FiT.

8 Policy and Legal Framework

8.1 National SHPP Policies

Along with unbundling of the electricity sector, the Kyrgyz Government consistently declared SHPP development one of the Government's priorities. Several national policies and strategies[25] adopted by both the Parliament and the Government aimed at the development of enabling conditions for private investments in construction of new SHPPs and technical modernization and rehabilitation of abandoned SHPPs. In particular, early on the 'National Energy Program of the Kyrgyz Republic for 2008-2010' and the 'Strategy of Fuel Energy Sector Development until 2015'[26] called for technical modernization, reconstruction of decommissioned SHPPs and for construction of new SHPPs with total capacity of 187 MW and annual output of 1 billion kwh.

The Program for Development of Small Hydropower Plants in the Kyrgyz Republic in 1999-2005 was aimed at developing small hydro power plant to achieve a better balance between generation and consumption in the provinces and reduced transmission and distribution losses. This Program was developed before the unbundling of Kyrgyzenergo and envisaged the following:

- Rehabilitation and modernization of 9 plants (total capacity 42 MW)
- Restoration of 20 plants out of operation or demolished (total capacity 18.6MW)
- Construction of 26 plants at new sites (total capacity 69 MW)
- Construction of 7 plants at existing reservoirs established for the purpose of water supply and irrigation (total capacity 73.8 MW).

The Program for Development of Small and Medium Hydropower[27] for the period up to 2012 approved by the Kyrgyz President in 2008 identified private investments as the main source for financing SHPPs and encouraged private participation through Public-Private Partnerships[28] such as BOT (Build - Operate - Transfer), BOO – (Build – Own – Operate) and BOOT (Build - Own - Operate – Transfer).

The ambitious objectives of the above-mentioned programs were not fulfilled.

In 2015, the Kyrgyz Government approved the Concept for the Development of Small Hydropower in the period up to 2017[29] along with an action plan, which envisaged developing and revising several important pieces of secondary legislation to remove barriers for developing SHPPs. The Concept also described rationale and grounding for SHPPs

[25] Appendix G provides a list of policy documents, laws and regulations relevant to SHPP development.

[26] Approved by Decree of the Kyrgyz Parliament # 346-IV on April 24, 2008.

[27] Program for Development of Small and Medium Hydropower approved on October 14, 2008 by the Kyrgyz President's Decree №365.

[28] In 2012 Law on Public-Private Partnerships (PPPs) in the Kyrgyz Republic was adopted to establish the necessary legal framework for engaging private partners in designing, financing, construction, rehabilitation, reconstruction of assets, as well as the management of existing or newly created assets, including infrastructure assets. Article 3 of this Law authorizes PPPs in generation, transmission and distribution of electric and thermal power.

[29] Approved by Decree of the Kyrgyz Government adopted on July 20, 2015 № 507.

development, including economic, technical and technological, ecological, social and gender aspects. At the same time, the Concept recognized a need for drafting a Strategy for Development of Renewable Energy, including small hydropower, which has not been realized so far.

At the end of 2015, the Ministry or Energy and Industry was abolished. The renewables agenda, and with it the focus on SHPPs, was taken up again by the newly established State Committee for Energy and Subsoil Use in mid-2016.

8.2 Primary legislation

The primary legislation governing the SHPP sector includes: Energy Law, Electricity Law, Law on Renewable Energy, Law on Licensing and Permit System, Land Code, Water Code and a number of regulations listed in Appendix G. The Law on Investments and the Law on Public Private Partnership are also relevant to SHPP development because they create a general framework for involving private parties in projects in Kyrgyzstan.

8.2.1 Definitions

As of 2017, the Kyrgyz legislation provides for a number of definitions, such as "primary energy resource", "renewable energy resource", "hydropower" , "traditional energy" and "small power generation capacities" which do not provide in all instances consistent definition and classification of hydropower plants eligible for support envisaged by the Kyrgyz Law on Renewable Energy.

The common understanding under stakeholders is that small hydropower plants below 30 MW are eligible for the preferential treatments, however, such understanding cannot be fully supported by the existing legal definitions.

Article 3 of the Kyrgyz Law on Renewable Energy (RE Law)[30] defines "hydropower" as energy generated by installations using energy of water, which in turn is defined as a type of renewable energy. This definition – which does not differentiate hydropower installations by size – can imply that all hydropower, including large hydropower plants, represent renewable energy and therefore could be entitled to the preferential treatment authorized by the RE Law.

The same article further defines 'traditional energy' as energy received from nonrenewable resources or generated by a hydropower plant with installed capacity of 30 MW and above. It should be noted that this term is not used in the text of the law and is only mentioned in the article with definitions. It may be assumed that the legislative intention was to exempt "traditional energy" hydropower plants above 30 MW from the preferential treatment and limit the support to hydropower plants with the capacity below 30 MW - which should be considered as nontraditional. However, there is no such clear legal definition in the RE Law..

The Electricity Law[31] defines a hydropower plant with capacity over 30 MW as a large one but does not define large hydropower plants as traditional energy. In January 2016, an amendment was introduced to the Electricity Law that defined "small power generation

[30] Adopted on December 31, 2008 (last amended on July 25, 2016)

[31] Article 2, , Electricity Law of the Kyrgyz Republic (last amended on January 20, 2016)

capacities" as hydro- and thermal power plants with capacity between 1 MW and 30 MW[32], without defining the plants with the capacity below 1 MW. This amendment provides for a legal classification of hydropower plants into large and small ones, however it does not clarify whether big plants/traditional energy are exempted from support stipulated in the RE Law and only small power generation capacities/nontraditional energy are eligible for support stipulated in the RE Law.

The Energy Law[33] defines energy generated of water as both a primary energy resource and a renewable energy resource. This Law states that all primary energy resources located in the Kyrgyz Republic are the exclusive property of the State and such resources, except for renewable energy, may only be exploited on the basis of a license. Based on the abovementioned, this provision creates a confusion on whether large hydropower plants can also be exempt from licensing along with the small hydropower plants.

Given the prevailing general understanding regarding what type of hydropower plants are considered supported by the RE Law (hydropower plant below 30MW), the described inconsistencies do not necessarily constitute a practical challenge for SHPP developers. But they do demonstrate lack of clarity in legal definitions and impair consistency and predictability of the overall legal framework. The described inconsistencies may also open the door to developers of somewhat larger size hydropower plants (eg, 35MW) to challenge the government for the same type of preferential treatment as smaller plant.

8.2.2 Key laws relevant to SHPP

The **Electricity Law** sets forth several provisions relevant to SHPPs:

a) **Exemption from the generation license** for electricity generated from renewable energy sources (as well as electricity for own use generated from any source of energy with capacity below 1,000 kW). However, RE plants must still obtain a license for the *sale* of their output.[34] The Law on Licensing and Permit System has the same provisions.[35]

b) **Guarantees third party access to the national grid**[36]: the Holder of the Transmission License through the National Grid cannot restrict access to the National Grid, or impose unreasonable requirements on users of or sellers to the National Grid.

c) **Call for bids for construction of new generation**[37]: Details of the tender procedure and the criteria for the selection of bids and identification of the winner are

[32] Article 2, Electricity Law of the Kyrgyz Republic (last amended on January 20, 2016)

[33] Article 4, Energy Law of the Kyrgyz Republic, adopted on October 30, 1996 (last amended January 14, 2015)

[34] Articles 5 and 18, Electricity Law of the Kyrgyz Republic, adopted on January 28, 1997 (last amended on January 20, 2016)

[35] Article 15, Law on Licensing and Permit System in the Kyrgyz Republic, adopted October 19, 2013 (last amended May 28, 2015)

[36] Article 13, Electricity Law of the Kyrgyz Republic.

[37] Articles 19 and 20, Electricity Law of the Kyrgyz Republic

expected to be established by a governmental decree. The Kyrgyz Government in March 2017[38] adopted a decree on SHPP tenders.

d) **Requirement to conduct a water use study** prior to construction to assess the use of water resources for purposes other than electricity generation. All expenses and losses incurred by the local population as the result of construction of a hydropower plant shall be included in the cost estimate of the project. [39]

e) **Requirement to conduct an environmental impact assessment**[40] prior to construction. The assessment reports must be made available to the public and subject to public inquiry.

The **Law on Renewable Energy**[41] establishes an incentive framework for the development of renewable energy, including SHPPs. However, most provisions listed below are not yet implemented in practice:

1. **Incentives** for design, construction and operation of installations using renewable energy sources, such as:
    a. exemption from customs duties on import and export of equipment, installations and spare parts;
    b. relief from licensing of generation;
    c. guaranteed project payback period (no more than eight year);
    d. right to sell the output to consumers under commercial agreements or use the generated electricity for own needs;
    e. guaranteed purchase of the RE output by the largest distribution company in the region where the RE installation is located – if this output has not been consumed by the RE owner or supplied under commercial agreement;
    f. during the project payback period, a preferential offtake tariff (see Section 6 above);
    g. after the project payback period, the tariff shall be set by the Kyrgyz Government for each SHPP individually based on a calculation of justified generation costs plus fair profit;
    h. tariffs shall be subject to indexation on an annual basis. The law does not specify the characteristics of indexation.
2. **Least cost connection point** for the RE installation to the grid.
3. Obligation on the RE owner to bear all costs related to construction of transmission lines to the grid interconnection point.

[38] On March 24, 2017 the Kyrgyz Government by its Decree #175 approved Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic.

[39] Article 10, Electricity Law of the Kyrgyz Republic

[40] Article 29, Electricity Law of the Kyrgyz Republic

[41] Adopted on December 31, 2008 (last amended on July 25, 2016)

4. **Guaranteed nondiscriminatory access** of RE output to the grid and obligation on the national transmission and distribution companies to ensure unobstructed transit of RE power to consumers.
5. **Compensation of additional cost of the distribution companies for purchase of RE** output by including this cost into the distribution company's tariff.

All these provisions can be implemented only when subsequent secondary legislation is developed and adopted – which so far is lacking.

The **Water and Land Codes** establish a general framework for the use of water and land. There are no clear procedures for granting water rights and allocation of land for SHPP construction yet (see Section 9). The key provisions of these Codes relevant to SHPPs include:

1. Rivers, lakes, water reservoirs, irrigation canals as well as land occupied by hydro technical constructions are classified as Water Fund Lands and are the exclusive property of the state.[42]
2. Water Fund Lands may be used for construction and operation of energy facilities, including RE facilities.[43]
3. Water is considered a natural resource; therefore water users are supposed to pay for using the water resources[44] and they are entitled to recover the costs related to these payments[45]. Currently no fee for use of water for electricity generation is applied, as discussed in Section 9.

In June 2016, several amendments were introduced into the Land Code and the Water Code. In particular, Article 82[46] of the Land Code was amended to introduce a new category – Energy Sector Lands – on which the construction of power plants, including RE plants, is authorized. Article 92 of the Land Code was amended to explicitly authorize the use of Water Fund Lands for construction of facilities using RE sources. The Water Code was amended accordingly[47]. A special decision of the Government is required for the provision of Water Fund Lands for the construction of RE installations.

The **Law on Investments in the Kyrgyz Republic**[48] authorizes the Kyrgyz Government[49] to conclude investment agreements for implementation of investment projects which are i) identified by the state development programs in the prioritized areas; or ii) initiated by an investor.

---

[42] Article 4, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)

[43] Article 90, Land Code of the Kyrgyz Republic, adopted June 2, 1999 (last amended July 30, 2016)

[44] Article 48, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)

[45] Article 42, Water Law of the Kyrgyz Republic adopted January 14, 1994 (last amended July 30, 2013)

[46] Item 1-1, Article 82, Land Code of the Kyrgyz Republic, adopted June 2, 1999 (last amended July 30, 2016)

[47] Article 85, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)

[48] Law on Investments in the Kyrgyz Republic, adopted on March 27, 2003 N 66 (last amended February 13, 2015)

[49] Article 11-1, Law on Investments in the Kyrgyz Republic, , adopted on March 27, 2003 N 66 (last amended February 13, 2015)

The investment agreement can be concluded through direct negotiations between the Government and the investor if:

a) the investment planned for the project is no less than $50 million; and
b) the investor is a reputable international company with unique skills and experience in implementation of similar projects.

However, the investment agreement cannot provide for any exemptions or privileges in addition to those specified in the Kyrgyz legislation, including setting a tariff higher than specified in the Law on Renewable Energy.

The **Law on Public-Private Partnerships in the Kyrgyz Republic**[50] defines Public-private Partnership (PPP) as a long-term (up to fifty years) interaction between public and private partners in designing, financing, construction, rehabilitation, reconstruction of assets, as well as the management of existing or newly created assets, including infrastructure assets. The law authorizes the use of PPPs for infrastructure assets and/or infrastructure services in generation, transmission and distribution of electric and thermal power. There is no prohibition in the PPP Law to apply the PPP framework to small hydropower development.

The PPP law provides for government economic and financial support, as well as for a number of state guarantees[51] to a private partner and/or a project company.

Private partners may initiate a PPP project and apply to the public partner with a proposal.[52] If the public partner accepts the proposal initiated by the private partner, the PPP project shall be subject to tendering and further process envisaged by the PPP Law. The private partner announced as the winning bidder has a right to establish a project company to implement the PPP project. The public partner may act as a co-founder of the project company, provided that its shareholding shall not exceed one third of the equity of the project company and such shareholding is not prohibited by the legislation of the Kyrgyz Republic.

A number of legal amendments aiming to improve the legal framework for SHPPs came into force on June 27, 2016.[53] The following laws were amended to specify the following:

a) **Land Code** – to introduce a new category – Lands of the Energy Sector – and authorize provision of the Water Fund's Lands into temporary use for allocation of RE based on the decision of the Kyrgyz Government. A corresponding amendment was made in the Water Code.
b) **Law on Natural Monopolies** – to obligate distribution companies to purchase the RE output in compliance with the RE Law.
c) **Law on State Statistics** - to obligate the National Statistics Agency to establish and keep the Register on extracted, generated, imported, processed, transformed, kept and consumed renewable sources of energy.

---

[50] Law on Public-Private Partnerships in the Kyrgyz Republic, adopted on February 22, 2012 N 7 (last amended June 22, 2016).

[51] Article 14, Law on Public-Private Partnerships in the Kyrgyz Republic, adopted on February 22, 2012 N 7 (last amended June 22, 2016).

[52] Article 20, Law on Public-Private Partnerships in the Kyrgyz Republic adopted on February 22, 2012 N 7 (last amended June 22, 2016). Please see annex 2 for more details.

[53] These amendments were approved by the Government's resolution on July 15, 2015 and later approved by the Parliament and signed by the Kyrgyz President in June 2016.

d) **Law on National Academy of Sciences** (NAS) – to add new functions of the NAS - scientific research on RE and development of scientific and technical programs for RE implementation.

A number of regulations need to be developed to solidify the legal basis and make the new amendments practically implementable.

8.2.3 Planned legal reforms

On December 9, 2016, the Kyrgyz Parliament posted on its website a Draft Law "On Introducing Amendments to Certain Legislative Acts of the Kyrgyz Republic in the Area of Renewable Energy Sources" for public review and consultation. The proposed amendments were developed by a small working group that was established by the Fuel, Energy and Mineral Resources Committee of the Kyrgyz Parliament in June 2016. It included mainly representatives of the Kyrgyz RE Association and private investors/developers of SHPP projects; public stakeholders attended some of the meetings.

The following laws of the Kyrgyz Republic are proposed to be amended:

1) the Tax Code
2) the Law on Renewable Energy
3) the Electricity Law
4) the Law On Nature Conservation Areas
5) the Code on Administrative Responsibility
6) the Land Code.

The proposed amendments include the following provisions:

- Additional exemptions and preferences for RE;
- Extending the preferential tariff period to 10 years; setting the RE tariff at the value of the maximum tariff for end-users after the preferential period;
- Significant improvements and clarifications in the land allocation process;
- Clarifications that construction of SHPPs shall be implemented based on a competitive bidding procedure;
- Creating a compensation mechanism for distribution companies for purchasing renewable electricity – as part of the national electricity end-user tariff-setting;
- Priority payments for RE electricity based on the power purchase agreement (PPA). The standard PPA shall be approved by the Government;
- Priority dispatching regime for the RE output;
- Administrative fines for non-fulfillment and/or improper fulfillment of obligation to buy RE output;
- Assigning a number of functions/responsibilities to the Authorized body for Promotion and Support of the RE Use. This highlights the need for a clear institutional framework and Government support and oversight for RE.

No amendments were proposed to the Water Code and this suggests that water rights are not considered by the existing developers to be a significant barrier.

The set of proposed amendments demonstrates that the level of understanding of the key barriers to the RE development is increasing. However, amendments initiated by the

Parliament cannot be adopted without Government's concurrence and the discussion of the amendments has not progressed further according to the information gathered in the context of this report.[54]

8.3 Secondary legislation

A systemic regulatory framework for the development and operation of SHPPs is still under development. The few regulations in force by the end of 2016 include:

1) Regulations on the Procedure for Construction, Acceptance and Grid Connection of SHPPs approved by Resolution No. 476 of the Government of the Kyrgyz Republic on July 28, 2009 (discussed in Section 9)
2) Renewable Energy Tariff Methodology approved by the Order No.1 of the Energy Regulator on August 6, 2015 and amended on April 11, 2016 (discussed in Section 5).

With assistance of the United Nations Development Program (UNDP), the Kyrgyz Ministry of energy and industry has drafted a number of regulations, which have not been finalized yet:

a) Rules for Preparation and Conclusion of Water Supply Agreement;
b) Regulations on Provision of Land Allotments for SHPP Construction;
c) Regulations for Grid Connection of Generation Facilities, Electric Networks and Electric Installations of Consumers to the National Grid and Distribution Companies;
d) Methodology for the Grid Connection Fee for SHPPs;
e) Standard power purchase agreement; and
f) Standard water supply agreement.

According to the assessment conducted for this report, the draft documents still require significant review and revision to address the concerns of SHPP developers, financiers and other stakeholders, and to make them practically enforceable.

8.4 Issues, challenges and possible recommendations

8.4.1 SHPP Policy

While the Kyrgyz strategies mentioned earlier set quantitative targets for SHPP development, they do not sufficiently clearly articulate the underlying strategic objective of RE development as an integral part of the overall energy sector development. Generally SHPPs are considered as sources of unexploited energy potential and most of the policies state their quantitative potential for additional electricity output. However, most of the SHPPs have their operation maximum during summer time and this is the period when the Kyrgyz energy system already generates sufficient power for domestic supply and exports, if hydrological conditions allow, but the system faces power shortages during winter months. Analysis of how RE development could best help mitigating the major challenges of the Kyrgyz power system have not been made explicit, nor has an economic analysis of costs and benefits of SHPPs compared to

[54] It is our understanding that the described proposed amendments have not been yet approved by the Kyrgyz Parliament before summer 2017 vacation.

alternative power supply options (and taking into account possible energy savings) been spelt out. In absence of such analysis clear answers to the following questions are still open:

- How can SHPPs enhance reliability of the country's energy system, improve domestic power supply throughout the year and throughout the country, as well as environmental and social conditions of the population, and at which cost?
- How much new SHPP generation does the power system need immediately as opposed to the medium and long term?
- Which potential hydro sites should be developed following which priorities? What type (reservoir- based or run-of-river) is most attractive? In which sequence (priority order) and in which timeframe?

Recommendations

The Kyrgyz Republic will benefit from an updated policy for the SHPP sector development with clearly specified strategic goals based on solid economic and technical analysis.

8.4.2 General energy sector issues

Barriers to third party investment in SHPP are linked not only to the legal/regulatory framework for SHPP but also to more fundamental energy sector issues. Until a solution to these issues is articulated, developers, private investors and operators will unlikely be attracted to the Kyrgyz small hydropower sector without additional incentives and guarantees.

- **Cost-recovery problem**. The whole electricity sector (generation, transmission, distribution) suffers from underinvestment. The electricity tariffs are low and do not cover all investment and O&M costs. The government understands the need to raise electricity tariffs to cost-recovery levels but this is politically challenging because of concerns about capability of the population and industry to pay higher energy bills. Against this background, preferential tariffs for SHPP and other RE sources may seem too generous and create opposition.

- **Problematic enforceability of commercial contracts** is a very serious barrier to private investment. After the sector unbundling, both JSC Power Plants and JSC National Grid have suffered from partial and delayed payments from the distribution companies (DisCos). To remedy this situation, the Kyrgyz Government established a transit bank account in the state-owned RSK bank. All cash payments from the final customers of the distribution companies are accumulated at the RSK bank, which distributes the funds among GenCo, NESK and the DisCos based on the decisions of the Energy Regulator.[55] Under the current settlement scheme DisCos have no incentives to reduce losses, improve financial discipline and duly implement commercial contracts. Despite recent improvements in the fund

[55] The Regulator establishes the proportion of the cash allocation accumulated in the transit account at RSK-Bank among the power sector companies according to the Regulations on the Procedure of Settlement and Allocation of Funds, approved by the Government in May 2016.

allocation procedures, enforceability of commercial contracts in the power sector still remains problematic.

- **Lacking mechanism to recover the costs of RE support**. The Law on Renewable Energy obligates distribution companies to purchase electricity generated by RE plants. However, in practice, such a compensation system has not been yet developed and unless the tariff policy and the overall cost recovery basis are revised there is neither incentive nor enforcement mechanism to implement this primary law provision with distribution companies. Low end-user electricity tariffs do not cover all investment and O&M costs and do not allow DisCos to cover the difference between the preferential tariff for RE and the electricity purchase price approved by the Energy Regulator The preferential tariff for RE is high compared to the purchase price for electricity generated by the national generation company, which is approved by the Energy Regulator.[56] Unless the Energy Regulator develops a clear and implementable mechanisms to compensate additional costs incurred by a distribution company to purchase the RE output, the Discos will continue not "welcoming" RE generation, which explains long hurdles to connect new plants, as well as non-payments or delayed payments for RE electricity.

Recommendations

The new SHPP policy should be an integral part of the overall strategy to develop the power system and improve operations of the electricity sector. Sound tariff policy and cost recovery along with duly managed power companies with strong financial discipline and responsible commercial operations are prerequisites for attracting investors to build new SHPPs. The Government of Kyrgyzstan can take the following actions to improve the current situation:

- Continue gradual increase of electricity tariffs throughout the supply chain to cost-recovery levels, including an investment component.
- Introduce targeted social support measures for low-income households rather than subsidizing electricity for all users.
- In the short-term: introduce a clear and enforceable mechanism to compensate additional costs incurred by a distribution company to purchase RE output; such costs should be included by the Energy Regulator into the electricity tariff for final users and spread evenly across distribution companies.
- In the medium term, encourage fully commercial operations in the power sector and enforce commercial contracts. In the meantime, to attract investors, consider providing payment guarantees backed by the government to make SHPP projects bankable.

8.4.3 Legal framework for SHPP

In various legal acts, inconsistency or lack of clarify in the provisions relevant to SHPPs persist. In particular, unclear and inconsistent definitions of hydropower and renewable energy

[56] It varies from the lowest of 48.00 tyiyn/0.70 US cents for Jalalabadelectro to the highest of 64.50 tyiyn/0.94 Us cents for Severelectro effective April 1, 2016 (1 USD= 68.899 KG Som as of September 1, 2016)

create uncertainty as regards eligibility criteria for support under the RE Law. Legislation on water use and water use payments also needs harmonization.

The Kyrgyz approach to treat all hydro plants with the capacity below 30 MW as small HPPs is different from best practices worldwide. Larger size SHPPs (20-30 MW) do not have the same development challenges and environmental impacts compared to 1 MW or 100 kW plants, so it makes sense to differentiate the legal status – and the consequent permitting/licensing requirements – further by the size of the plant.

The proposals for legal amendments that have been initiated by the Parliament in 2016-17, if adopted, would improve and strengthen the legal and regulatory framework for RE, including SHPP.

Complex and unclear process of land allocation is one of key barriers to SHPP development. The recent amendments to the Land Code that authorize a new category of land (energy sector land) is an important step forward. However, further amendments are needed to clarify and simplify the procedure, as part of the broader legal reforms mentioned above.

Exemption from customs duties authorized by the Law on Renewable Energy may be affected by accession of the Kyrgyz Republic in 2014 to the Customs Union formed by Russia, Kazakhstan, Belarussia and Armenia and may limit equipment import options for SHPP development.

Recommendations:

- ✓ Differentiate the legal status of SHPPs – and the consequent permitting/licensing requirements – further by the size of plants or by characteristics linked to their environmental and social impact. Several sub-categories can be introduced, e.g. micro, mini and small, as well as distinctions between slight, medium or severe impact.
- ✓ Continue legal reforms for RE in open and transparent consultations with key sector stakeholders and sector institutions. These reforms should aim to create a balanced and sustainable framework addressing the concerns of both private and public parties.

9 Regulatory Processes for Developing SHPPs Projects

9.1 Overview

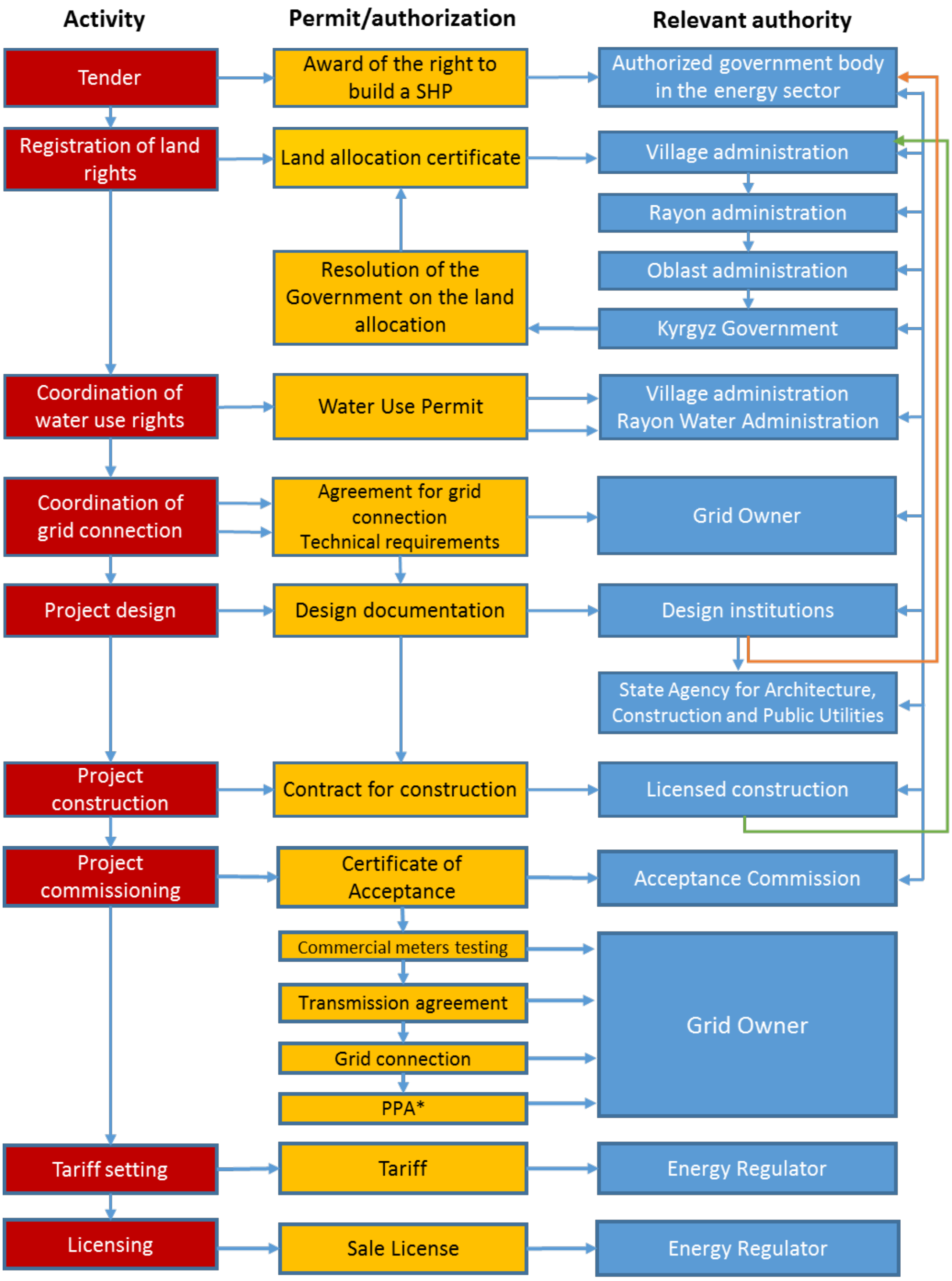
This section describes the administrative and regulatory processes that developers need to go through to prepare, construct and operate SHPPs. As mentioned earlier, the current regulatory framework for SHPPs is underdeveloped, in particular in the area of secondary legislation. In 2009, the Kyrgyz Government approved the Regulations[57] on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks (the Regulations); however, a number of important issues were not addressed in this document.

[57] Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009.

Figure 9.1 summarizes the key SHPPs project development steps[58] as defined by the above-mentioned Regulations and other legislation in force. Each of these steps is described hereinafter in more detail.

[58] The process below is described based on the SHPP specific Regulations, however, for larger plants (>30MW) the cycle would be similar but could be more complicated.

Figure 9.1 : Preparation and Implementation Cycle of SHPPs



*If the output is sold to the grid owner.

Note: The Regulations do not obligate either the RE developer or the local design institution to obtain approval of the design documentation. In this figure, we assumed that the design institution would obtain such approval from the State Agency for Architecture, Construction and Public Utilities, which is a regular practice in other countries in the region.

Table 9.1 below summarizes the timeframe for obtaining administrative and regulatory permits as specified in the Kyrgyz legislation.

Table 9.1: Timeframe for Obtaining Administrative and Regulatory Permits

Permit/Authorization	Relevant Authority	Timeframe as specified in the Law
Tender Award	The authorized government body in the energy sector	Asspecified in the tender documents[59]
Land Allocation Certificate	Local administration based on the resolution the KG Government	Not clearly specified No less than 60-75 days (and may last for months)
Water Use Permit	Local administration	Not clearly specified No less than 60 days (and may last for months)
Technical Requirements for Grid Connection	Grid Company	10 days
Project Design Approval	State Agency for Architecture, Construction and Public Utilities	60 days
Certificate of Acceptance	Acceptance Commission	Not specified
Physical Grid Connection	Grid Company	3 days provided full compliance with the project documentation and testing requirements
PPA and Transmission agreement	Grid Company	N/A
Tariff	Energy Regulator	30 days
Sale License	Energy Regulator	30 days

Issues and challenges

- A single regulation that specifies the full cycle for preparation and implementation of SHPPs is missing. Information on all the required processes and procedures is difficult to obtain and often controversial or unclear, as discussed in more detail below. To address this concern, many countries put in place a "single window" that help developers and investors to navigate through the regulatory requirements for RE projects (see Box 9.1). Such a body does not exist in Kyrgyzstan.

- The sequencing of key regulatory procedures makes it extremely difficult, if not impossible, for the developer to obtain commercial financing. To have a bankable project and get financing, the developer needs certainty on the following key questions early in the project development process: i) land/water rights and authorization to build; ii) grid connection; and iii) power purchase agreement and the offtake tariff. However, in

[59] Item 30, Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic approved by the Kyrgyz Government by its Decree #175 on March 24, 2017 (amended on June 14, 2017).

Kyrgyzstan, the level of tariff is determined and the PPA is signed after the construction of the plant.

Recommendations

- ✓ It is advisable to change the timeframe of key steps: the developer should be able to sign the PPA and obtain the preferential tariff from the Energy Regulator before the construction[60]
- ✓ There should be clear and transparent rules for obtaining all the permits, authorizations and licenses with clear application requirements, roles and responsibilities of the involved authorities, and explicit deadlines. Table 9.2 lists key characteristics of best-practice permitting procedures.
- ✓ Regulations should envisage a mechanism for better coordination of SHPP development procedures at the national and local levels.

Box 9.1: Single Window or One-stop-Shop: International Experience.

"One-stop shop" is a focal point for investors interested in developing and financing RE projects in the country. It provides the necessary information and support to facilitate permitting/authorization for RE projects. It can exist in different forms, for example:

- Websites or electronic guidebooks with process maps and contact details such as:
  - www.renewableenergy.go.ke
  - http://russiagogreen.ru/ru/investorguide/
- A public agency that acts as a "single window" for any industrial project, including RE projects:
  - Department of Trade and Industry in South Africa
- A specific energy agency or RE agency (committee, department, office):
  - Danish Energy Agency
  - Hawaii State Energy Office
  - UK's Office for Renewable Energy Deployment under Department of Energy and Climate Change

Possible functions of a single window include:

- Providing detailed information on all processes and procedures for building and operating a RE plant
- Constantly updating market participants on new regulations and rules
- Supporting potential investors in obtaining all relevant permissions
  - Processing applications for various permits
  - Connecting developers/investors with relevant authorities and other stakeholders
  - Facilitating interactions with relevant authorities, helping to resolve disputes
- Helping authorities to streamline administrative procedures

[60] There is a precedent of setting the preferential tariff for a new SHPP prior to its commissioning and signing a PPA. The Energy Regulator has set tariff for Tegermentinskie GES LLC at 4.7 KG Som (6.82 US cents) even though the plant is still under construction and negotiations with JSC Severelectro on the PPA are ongoing.

Table 9.2: Characteristics of best-practice permitting regimes worldwide

Key principles of the regulatory framework	**Checklist to evaluate specific procedures**
Legal consistency	
Consistency of regulatory requirements with primary legislation.	Is the procedure required by legislation? Are there any inconsistencies between different pieces of legislation?
Transparency	
Availability and reliability of information on required procedures (cost, application process and timing, information requirements, prerequisites/sequencing, decision criteria, etc.) Information on projects granted provisional and final authorizations, and their expiry dates Information on the planned expansion of the national and regional grids In auctions and tenders: quality and transparency on what is bid out	Does the procedure specify: (i) all documents required for the application; (ii) decision-making criteria (in which cases a positive/negative decision can be taken?); (iii) standard documents (e.g. application forms) that are easily available and a timeline for when responses can be expected; (iv) the cost for the investor?
Institutional capacity	
Clear division of responsibilities between the authorities Adequate technical capacity in approving agencies No overlap or duplication of procedures and verifications among different authorities.	Which body is responsible for the procedure? Does it have the capacity to conduct the procedure in the proper manner and within the established timeframe? Can this body rely on information and decisions from other authorities?
Clear time frame	
Explicitly specified and enforceable deadlines for approving authorities and project developers Clear provisions to convert a preliminary permit or resource license to a full permit where applicable	Does the regulation specify a clear deadline for the whole procedure and each of its individual steps? What ensures that the responsible authority meets the deadlines ? Is the timeframe for the validity of the license/authorization specified? When can a provisional license be revoked?
Public consultation	
Mandatory stakeholder consultation on key decisions with environmental and social impact (if not physical meetings, then good virtual mechanisms and public announcements) Clearly defined rights of stakeholders and processes by which they can register opposition	Is public consultation required by regulation? How is it to be conducted and in what time frame?
Monitoring and evaluation	
Regular evaluation External reviews of the regulatory regime	Is there a monitoring system to review the implementation process and to evaluate the effectiveness and efficiency of the procedure?
Enforcement and recourse	
Provisions to enforce compliance with laws/regulations Existence of a recourse mechanism for investors	Are there any penalties for noncompliance (e.g., if someone builds a small power plant without getting all the required permits)? Does a recourse mechanism exist, and is it clearly explained and accessible for investors?

Source: Permitting and Licensing Regimes for Renewable Energy Projects, WBG, 2015

9.2 Institutional framework

The Government of the Kyrgyz Republic defines energy policy and monitors policy implementation in accordance with the provisions of the Energy Law and subsequent legislation. The Government does not interfere directly into operational activities of energy enterprises but through its ministries and agencies it regulates various aspects of power sector operation. Responsibilities of various government agencies are summarized in Table 9.3 below.

Table 9.3: Functions of the Government and Government Bodies of the Kyrgyz Republic in the Electricity Sector as of September 2016

Body	Functions	Legal Foundation
Government of the Kyrgyz Republic	Grants and transfers property rights and rights for use of water, mineral and other energy resources	Energy Law
	Provides incentives and promotes a stable and favorable investment climate for the fuel and energy complex	Energy Law
	Approves functions and authorities of authorized government bodies for the energy sector and licensing	Energy Law Law on Licensing and Permit System
	Allocates land plots of water fund for temporary use	Land Code of the KR
	Sets the procedure for holding bids for construction of energy facilities and criteria for selection of bids and winners	Electricity Law
State Committee on Industry, Energy and Subsoil Use	- Develops and implements a uniform state policy in the field of studying and rational use of subsoil resources, water energy and fuel resources, renewable energy sources and the industrial potential of the country; - Participates in development of the strategy of effective development of the industry, the fuel and energy complex and subsoil resources; - Participates in development and realization of interstate programs and agreements on escalating of the industrial potential of the country, effective utilization of water energy and fuel resources, subsoil resources research, and development of mineral resources; -Creates conditions for introduction and use of renewable energy sources;	Regulations on the State Committee on Industry, Energy and Subsoil Use approved by the Governmental order of the Kyrgyz Republic of July 15, 2016 No. 401

	Registers the sites for prospective construction of small hydro power plants and monitors fulfillment of conditions of the documents that have been sent for approval; - holds annual tenders for construction of small hydro power plants included into the schedule of construction for five years; - renders assistance in making decision on land plots allocation for construction of facilities, water resources utilization, rational and secure connection of small hydro power plants to electric grids; - publishes in mass media on an annual basis the list of small hydro power plants to be built in the next five years - serves as a member of the commission on acceptance of the completed SHPP construction projects	Regulations on procedure for construction, acceptance and connection of small hydro power plants to electric networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009
Ministry of Agriculture and Processing Industry of the Kyrgyz Republic	Issues approval of the Department of Water Resources Management and Land Improvement to allocate land of the water fund for temporary use	Water Code of the KR
State Agency for Regulation of the Energy Sector	Performs licensing; sets the tariffs; resolves the disputes	Energy Law; Electricity Law;
Local Government Authorities	Allocates land plots of the water fund	Land Code Water Code
	Serves as a member of the commission on acceptance of the completed SHPP construction projects	Regulations on procedure for construction, acceptance and utility connection of SHPPs
State Agency for Architecture, Construction and Public Utilities under the Government of the Kyrgyz Republic	- conducts expert's examination and endorsement of the design documentation; - sets the lines and boundaries of buildings and structures, lines of the key engineering utilities systems and linear parameters of encumbrance; - issues permits for construction and installation works at specific sites. - participates into the work of the commission on acceptance of completed construction projects,	Regulations on the Agency for Architecture, Construction and Public Utilities under the Government of the Kyrgyz Republic approved by the Resolution No. 372 of the Government of the Kyrgyz Republic dated June 24, 2013 Regulation on procedure for

	-arranges and participates in drafting and implementation of programs, projects and activities for the energy saving and energy efficiency improvement within the scope of activity of the State Agency.	construction, acceptance and utility connection of small hydro power plants to electric grids
	-isues licenses to entities for building HPPs	Law on Licensing and Permit System
State Inspectorate for Environmental and Technical Safety under the Government of the Kyrgyz Republic	Supervision of: - requirements to industrial safety during construction, expansion, reconstruction, technical upgrade, operation, conservation and liquidation of Small Hydro Power Plants; - requirements of the land legislation on prevention of unauthorized seizure of land plots, unauthorized exchange and utilization of land plots with no entitling and certifying documents, as well as with no document allowing to perform an economic activity; - requirements of the rules for safe operation during construction, installation, adjustment of electric grids and equipment; - observance by power supply entities of the requirements of the Rules of electric installations, Rules for technical operation of gas, electric and heat-recovery devices, and their safe operation, Rules for use and metering of natural gas, electric and thermal energy, technical requirements and other normative and legal acts; - rights of legal entities and individuals who are water users; - rational use of fuel, gas, electric and thermal energy in the process of generation, transmission, distribution and consumption; - compliance with norms, technical regulations, and other normative and legal acts regarding efficient and safe operation of newly manufactured, reconstructed, repaired, and delivered power equipment and performance by enterprises, organizations and institutions of energy tests of energy-consuming installations and equipment in use, newly commissioned, reconstructed and upgraded;	Regulation on State Inspectorate for Environmental and Technical Safety Under the Government of the Kyrgyz Republic approved by Resolution No. 136 of the Government of the KR dated February 20, 2012

	- carrying out activities as set forth in the technical specifications by release to service of newly commissioned and reconstructed electric and thermal power installations, pursuant to the normative and legal acts; - compliance of the completely constructed installations with the project documentation and normative and legal acts; and - carrying out building, bank protection, dredging works, extraction of sand and gravel, laying cables, pipes and other communication lines at water bodies. - Detects the cases of unauthorized water use, damage of water infrastructure structures and facilities of the water fund, violation of the rules and regulations for maintenance and safe operation; - Takes part in approval of the relevant documents in the process of transfer / transformation of lands from one category to another, and from one type of holding to another; and - Participates in consideration of land-related disputes.	
State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic	Environmental examination (feasibility study and project design for construction, reconstruction, expansion, upgrade, conservation and liquidation of facilities regardless of their cost estimate, departmental subordination, and ownership forms if their implementation may have an environmental impact; projects of investment, complex and targeted social and economic, scientific and technical and other national-level programs associated with the use of natural resources).	Regulation on the Procedure for State Environmental Expert's Examination in the Kyrgyz Republic approved by Resolution No. 248 of the Government of the Kyrgyz Republic dated May 7, 2014
Center for Standardization and Metrology (CSM) under the Ministry of Economy of the Kyrgyz Republic	Provides metrological services for economic entities (calibration, verification of measuring instruments, certification of testing and diagnostics equipment, etc.)	Regulations on CSM approved by Resolution No. 91 of the KR Government dated February 12, 2010

9.3 Site selection and preparation of SHPP projects

The legal framework in place allows several options regarding the entry regime (market opening mechanism) for SHPPs, i.e. how exactly investors/developers are invited to develop projects, for example through competitive selection only or are unsolicited proposals allowed? The recently adopted Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic focus primarily on procedural issues and states that tenders shall be conducted for sites identified by the authorized state body in the area of energy policy based on recommendations of the Scientific and Technical Council under this state body[61]. Appendix H of this report outlines international experience with different entry regimes for renewable energy developers. In Kyrgyzstan, several SHPPs were constructed in the past without any tenders. However, the Electricity Law requires a call for tenders for construction of new power generation without specifying the capacity thresholds. This implies that a tender must be conducted prior to the construction of any power plant, regardless its size.

At the same time, the Investment Law implies that a relatively large power plant (or a number of smaller HPPs) can be built in the context of an Investment Agreement between a private investor and the Government of Kyrgyzstan. An Investment Agreement can be signed without any tender for projects with the value USD 50m and more.

The Renewable Energy Action Plan for 2016 stipulated the adoption of a standard Investment Agreement between the Government and the RE developer. If designed properly, such a standard investment agreement could be a positive step from Investor's perspective (if signed early in the project development process): it can provide certainty on key aspects of the project and improve the project's bankability. However, implementation and enforcement of such agreements might be challenging. The Investment Promotion Agency (IPA), which signs Investment Agreements on behalf of the Government, has no legal right to interfere in the operations of separate legal entities: transmission operators, distribution companies, local authorities (responsible for land), etc. Therefore, if any of these entities do not respect the engagements or guarantees stipulated by the Agreement, the IPA has no instruments to enforce the Agreement.

Under the Regulations in force,[62] the authorized government body in the energy sector must:

- Register potential SHPP sites. Currently the official registry of SHPP sites includes 63 potential projects.
- Develop a list of SHPP sites to be built in the next 5 years and publish this list in mass media on an annual basis.
- Hold annual tenders for construction of SHPPs included into the 5-year list.

Unsolicited bids/offers to build SHPPs on the sites, which are not included into the published list are neither prohibited nor explicitly allowed.

[61] Item 2, Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic approved by the Kyrgyz Government by its Decree #175 on March 24, 2017 (amended on June 14, 2017).

[62] Item 5, Regulations on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009

Issues and challenges

- The development of SHPPs can take place in several ways. A list of sites to be tendered shall be identified by the authorized government body for each tender based on the recommendations of the Scientific and Technical Council under this state body[63]. But it is not clear if SHPP projects could be developed through unsolicited proposals, too.
- The process of registration of potential SHPP projects is not specified in regulations. For example, it is unclear if a completed feasibility study (FS) is required for the registration. It is also unclear if such registry would be publicly available.
- There are no specific criteria for selecting SHPP sites from the registry into the list to be published and offered for tenders.
- There are no regulatory provisions on requirements for conducting a feasibility study (FS) for the SHPP project to be tendered. Not clear which entity would approve the FS.
- A key non-regulatory problem for SHPPs development is that the available hydrological data is often outdated. Assessments of hydropower potential at specific sites are often based on summer flows and the data of available water resources during winter is missing.

Recommendations

✓ It is recommended to differentiate the entry regimes for SHPPs by project size, for example: i) tenders for larger projects only; registration/approval on the basis of screening criteria for medium-sized HPPs, and iii) a simplified regime for micro hydro.

✓ Consider expanding the existing tender procedures based on best international practices (see Box 10.2).

✓ If a standard Investment Agreement for RE projects is developed, the critical elements to consider are the following:

- Who will be eligible for signing the Agreement?
- How to ensure the Agreement is implementable in practice?
- How to avoid excessive contingent liabilities on the Government or DisCos?

[63] Item 2, Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic approved by the Kyrgyz Government by its Decree #175 on March 24, 2017 (amended on June 14, 2017).

Box 9.2: International experience with competitive selection for RE projects

The increasing global trend is a transition from FiTs to auctions, tenders and competitive procurement of electricity generating capacity. The objective of these instruments it to procure new generation at the least possible cost. There is a large variety of types, designs and implementation details of auctions or tenders, and they are country specific. One most common feature is that the prices of electricity (or sometimes capacity) result from competitive proposals made by multiple bidders. This is a more realistic and cost-efficient way to set the offtake tariff, but the remaining characteristics of the support framework can be very similar to the FIT regime and **very often include a long-term PPA**, a priority dispatch, facilitated access to the grid, etc.

An effective auction or tender depends on a number of factors, including:

- **Existence of true competition** – both local and international – which is a factor of:

- overall investment attractiveness of the country's energy sector
- additional efforts to remove entry barriers for new / foreign players

- **Regulatory transparency** and the investors' perception about the fairness of the process
- **Addressing the risk of underbidding**:

- qualification requirements for bidders
- stringent noncompliance rules such as guarantees and penalties

- **Measures to reduce the investment risks (=** minimise the cost of capital)

- Strong legal basis for tenders or auctions
- Bankable PPA
- Sovereign guarantees; clear definitions of liabilities

- **If there is local component,** capacity targets should realistically reflect the domestic industry's capacity to deliver projects. Local content rewards, rather than requirements, are advisable.

9.4 Registration of water use and land use rights

As described in Section 8, there are no clear provisions and procedures for granting water rights and land use rights for SHPPs. Moreover, inconsistency between different laws makes the project preparation and implementation even more challenging.

Water

On the one hand, the Water Code of the Kyrgyz Republic[64] obligates water users to apply for a water use permit to the State Water Administration. The application must specify, among other issues, the amount of water planned to be used and the amount of water to be released back to the watercourse. The State Water Administration is supposed to examine the site and publish the application in the local mass media. All costs for the site examination and publication must be covered by the applicant[65]. The State Water Administration must

[64] Article 26, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)

[65] Article 29, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017J)

coordinate with the Kyrgyz Government and after this coordination send to the applicant a written decision to issue or reject the issuance of the water use permit. The overall process of obtaining a water permit takes at least 60 days. On the other hand, according to the new Kyrgyz Law on Licenses and Permits,[66] no license/permit is required for the use of water resources.

The Electricity Law requires assessment of the use of water resources for purposes other than electricity generation. Water use can be also in agriculture, fishing, tourism and transport. At present, Kyrgyzstan does not have integrated plan/strategy for management of water resources. A HPP developer or any other user does not necessarily know about possible other uses of water – at present or in the future. The Water Code includes priority order of using water from the same basin for different purposes: 1) drinking/communal services, 2) irrigation/animal watering, 3) electricity generation, 4) industry and agriculture, etc.

Land

As regards allocation of land for SHPP construction, there is only a general procedure for granting the Water Fund Lands into temporary use. According to the Land Code, the temporary (fixed-term) use of the land plot may not exceed 50 years but it may be prolonged subject to the agreement of parties[67].

The Water Fund Lands can be provided for a temporary use for construction and operation of a SHPP based on the Kyrgyz Government's decision[68]. To initiate a process, the SHPP developer must apply to the village administration and the territorial ("rayon") Water Administration. The local authorities will coordinate the application with the Water Department of the Kyrgyz Ministry of Agriculture and the National Commission on the Land Allocation.

However, if a SHPP site will be located in a different land category, for example in the Forestry Fund Land or land of specially protected natural areas, there is a need to transfer/transform the land type under a special procedure set forth by the Law on Transfer (Transformation) of Land Lots[69] and described in the Temporary Regulation on Procedure for Transfer/Transformation of Land Plots[70]. This complicated process will take no less than 75 days.

Issues and challenges

- There are no clear regulations for land plots allocation for construction of SHPPs.

[66] Law on Licensing and Permit System in the Kyrgyz Republic, adopted October 19, 2013 (last amended May 28, 2015)

[67] Article 7, Land Code of the Kyrgyz Republic, adopted June 2, 1999 (last amended July 30, 2016)

[68] Article 85, Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)

[69] Adopted on July 15, 2013.

[70] approved by Resolution #169 of the Government of the Kyrgyz Republic (dated March 19, 2014)

- It is not clear if a permit is needed for using water for electricity generation. In international practice, an official permit for the use of a specified amount of water is usually required. This is not only in the public interest but also in the investor's interest: it is a legal and contractual instrument in the case of a conflict over the use of water with other possible users upstream or downstream. Water issues are becoming more contentious as more HPPs are added into river basins.
- Because of lacking clear regulatory provisions, coordination process with local authorities is often slow, open to subjective judgements and delays.

Recommendations:

The process of allocating land for SHPP construction must be clarified and streamlined. The regulatory provisions must explicitly specify the roles and responsibilities of the relevant authorities, application requirements and clear deadlines for decisions. The regulations on land allocation should be developed in a package with the regulations for tender procedures (see section 9.3).

It is not recommended to abolish the water use permit for electricity generation; it makes more sense to clarify, simplify and streamline the process of obtaining it.

There may be a need for more systematic assessment of environmental and social impacts, including cumulative impacts from the development of multiple HPPs in the same river basin. In the medium term, the government should consider introducing a strategy for integrated management of water resources.

Box 9.3: Obtaining Land Use Rights in Kazakhstan

Developers and investors in Kazakhstan interviewed by IFC in 2015 have not listed land allocation as a major barrier (although other issues and challenges still deter private investment in renewable energy generation).

Steps and procedures to obtain land use rights (for public land):

- ✓ Investor files an **application** with the local executive body (LEB). Land Relations Department and the Department of Architecture and Municipal Planning review the application and LEB issues a **decision** that the plot can be allocated to the construction of a RE project (2 months).
- ✓ Investor develops a **land use plan** by hiring licensed entity or Land Cadaster Research and Production Center. Land Relations Department approves the plan and local executive body **grants rights to the land plot** (7 business days).
- ✓ Investor conducts an on-site **delimitation of the land plot boundaries** (within 1 month).
- ✓ Investor and the Local Executive Body **sign sales or lease agreement for land use**, based on which the Land Cadaster Research and Production Center issues **an ID for land plot**.
- ✓ Investor applies to the Public Service Center for **state registration of the rights to the land plot**.

A Developer can initially do design and measurement on the plot free of charge, and formalize the land use rights later if s/he decides to proceed with the project. However, in this case, s/he has no exclusive rights to the land plot. This is seen as a potential risk, and some developers prefer to obtain the full land use rights even for the initial project development steps. Overall, the procedures are well-documented in relevant laws and regulations, with clear responsibilities and deadlines.

9.5 Access to the grid and project design

The SHPP developer applies to the grid company in the region where the SHPP would be built and to the authorized government body in the energy sector for coordinating technological connection to the grid. Then the SHPP developer enters into a grid connection agreement with the grid company. This agreement specifies the connection fee to be paid by the developer. There is no clear and transparent methodology on how this connection fee is calculated. Although the Law on Renewable Energy stipulates shallow costs for connecting RE plants and a least-cost connection point, these provisions are not always implemented in reality, and the grid company unilaterally decides on the connection costs.

Within 10 days from the date of signing the grid connection agreement, the grid company issues a set of technical requirements that must be met in designing the SHPP and the grid connection equipment and facilities[71].

The SHPP developer together with the grid company enter into a contract[72] with a licensed design institution for design of the SHPP and associated interconnection equipment and facilities. The design institution must inform the authorized government body in the energy sector[73] about the design contract signed, specifying i) the contracted timeframe for the design, and ii) the planned timeframe for construction of the SHPP (when the design is completed).

The Electricity Law requires an environmental impact assessment (EIA) to be conducted prior to construction of a new hydropower plant. The assessment reports must be made available to the public and subject to public inquiry. However, procedures for conducting this assessment are not specified in regulations. Similarly, this Law requires an assessment of water resources for purposes other than electric generation (see section 9.4) but it is not clear at which stage and according to which procedures this assessment must be conducted. If an HPP project hurts other existing water users and does not comply with environmental requirements, in principle it would not get the environmental expertise approval. However, public hearing in the framework of EIA and the environmental expertise are done just before the construction of a HPP, when it is too late to change the site and project design.

Issues and challenges

- There is no approved methodology for grid connection fee for new generation. The grid company can request from the SHPP developer a high connection fee to cover,

[71] Scope and content of the technical requirements are specified in Item 7 of the Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009

[72] Item 9, , Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009

[73] Item 10, , Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009.

for example, the costs of upgrading the network or the substation. If several plants are connected to the same substation, there is no methodology for allocating the total cost of upgrades among them. Even though Item 8 of the Regulations[74] attempts to specify the scope of possible network upgrades, in practice a SHPP developer is left at discretion of the grid owner, and there is no mechanism to assure that the grid owner's requirements are reasonable.

- Coordination with the grid company often faces unfounded delays.
- There are local design institutions that claim having the required license, however, very few SHPPs have been designed over the last 10 years. Therefore, there are no products that can demonstrate the quality of the design work. The projects designed more than a decade ago demonstrated that local design capacity was absent or very low. All implemented SHPPs had significant foreign consultancy component. Attempts to involve local design institutions required significant oversight and capacity building from the international experts.
- It is unclear whether the RE developer or the contracted design institution is responsible for obtaining the approval of the design documentation (such approval is required by the Regulations on the Agency for Architecture, Construction and Public Utilities).
- It is not clear what entity and at what development stage is responsible for environmental impact assessment (EIA) and coordination of the project design with the relevant environmental protection and technical safety inspectorate. The same uncertainty applies to the requirement to conduct an assessment of water resources for purposes other than electric generation.
- The value of Owner's Engineers is underestimated in Kyrgyzstan. Moreover, the tariff structure hardly allows the SHPP developers to cover the cost of involving independent engineering consultants. Only IFI-funded projects engage an independent third party to review the design documentation and/or to evaluate the performance of technical and construction contractors.

Recommendations

- ✓ It is necessary to adopt and enforce regulations with detailed procedures for grid connection, including the selection of the nearest connection point, methodology for the connection fee, cost sharing if several plants connect to the same substation, list of technical requirements for connection and other details.
- ✓ Regulations should provide clear information on all other project development steps (EIA, approval of FS, grid connection, etc.) including the relevant authorities, their responsibilities, the application/approval procedures, costs and deadlines.
- ✓ It is important to ensure that environmental and social impacts of SHPPs are properly assessed and addressed. EIA requirements can differ depending on the project size and technology (with and without reservoir).

[74] Please see the English translation of some excerpts from the Regulations in Annex 5.

9.6 Construction, grid connection and commissioning

The SHPP developer and the grid company enter into a contract with a construction company certified[75] to implement the work specified by the design documentation, and hire a project designer for the project oversight during the construction, equipment installation and assembling.

The construction company contracted for construction of the SHPP project must officially notify the authorized government body in the energy sector and the State Agency for Architecture and Construction on the contract signed and the contracted timeframe for the construction, and upon completion of the construction – on the completed construction of the SHPP.

Within one month upon completion of construction, the SHPP developer must form an Acceptance Commission[76] the composition of which is specified by the Regulations[77], including representatives of the authorized government body in the energy sector.

The Acceptance Commission shall review the project documentation[78] and the quality of the construction. If the Acceptance Commission reaches a positive conclusion, it issues the Certificate of Acceptance for the power plant, which serves a formal basis[79] for the Energy Regulator to issue a license for sale of electricity. Full compliance with the project documentation is also a foundation for acceptance of the grid connection application by the grid owner.

For grid connection, the SHPP developer undertakes several steps:

a) As described above, obtain the Certificate of Acceptance, which specifies that the network from the project to the interconnection point is built in compliance with the technical requirements issued by the grid company;
b) Apply for relay protection parameters, obtain them from the grid company and implement them;
c) Develop and coordinate with the grid company the operation rules for power dispatching;
d) Apply for testing, registration and sealing of commercial meters;
e) Enter into power transmission and distribution contract for power supply to the final customer (if the output is not sold directly to the grid company)
f) Apply for the physical grid connection to the grid company and provide copies of the

[75] Item 11, , Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009.

[76] The membership of the Acceptance Commission is specified in Item 13 of the Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009.

[77] Please see the English translation of some excerpts from the Regulations in Annex 5.

[78] List of documents to be reviewed by the Acceptance Commission is specified in Item 14 of the Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009.

[79] Item 14, the Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009. Please see the English translation of some excerpts from the Regulations in Annex 5.

following:

- commercial meters testing protocol,
- power transmission and distribution agreement
- certificate of construction acceptance

Provided there is full compliance with the project documentation[80] as mentioned above, the grid company shall physically connects the SHPP to the grid within 3 days from the application date.

Issues and challenges

- Experience shows that quality of local construction is very low and this may result in delays and cost overruns due to the need to remedy the identified deficiencies. Low local technical capacity may require additional foreign expertise and thus adding to the implementation cost.
- Low capacity of construction companies and oversight authorities to ensure quality of construction works and equipment may create additional risks for developing SHPP projects at existing irrigation reservoirs. Given that big irrigation reservoirs are facilities of strategic importance it could be desirable to hire independent international companies for oversight of design, procurement and construction of new SHP projects at the irrigation reservoirs. But this will add to the implementation cost.
- The State Agency for Architecture and Construction requires a fee for the project construction oversight and this fee is based on a percent of the project cost estimate. However, it is unlikely that the existing tariff structure will allow the SHPP developer to cover the cost of such supervision, which is reality adds little value to the project.
- The process for obtaining the Certificate of Acceptance is reported to be very exposed to corruption and bride solicitations.
- Commissioning of newly constructed plants is also challenged by outdated rules and norms. For example, staffing regulations require employing at least three full-time engineers for management and at least two operators working in one shift regardless of the size of the generators and the operating regime. Such requirements put additional burden and together with low tariffs decrease attractiveness of the sector for new investors.
- The steps required to physically connect the SHPP to the grid leave the SHPP developer at discretion of the grid company and there is no mechanism to protect the SHPP developer from possibly excessive requirements of the grid company. For example, the dispatching rules may obligate the SHPP to have additional personnel on-duty that would add to the cost of operation.
- It is reported that coordination process with the grid owner faces unfounded delays. The grid owner only accepts the application for grid connection provided there is full

[80] Specified in Item 14 of the Regulation on Procedure for Construction, Acceptance and Connection of Small Hydro Power Plants to Electric Networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009. Please see the English translation of some excerpts from the Regulations in Annex 5.

compliance with the project documentation, however, review for compliance is open to subjective judgements and may result in delays.

Recommendations:

- ✓ Construction norms and rules should be amended to take into consideration the peculiarities of SHPP construction and operation.
- ✓ Regulations should provide clear information on construction and commissioning procedures including the relevant authorities, their responsibilities, the application/approval processes, costs and deadlines.
- ✓ Grid connection rules, timeframes and procedures must be more explicitly described in technical regulations.

9.7 Operation

The SHPP developer may use the generated electricity for own needs or sell it under commercial contracts. The Law on Renewable Energy also guarantees the purchase of the output, which has not been consumed by the SHPP owner or supplied under commercial agreement, by the largest distribution company in this region where the SHPP is located.

The SHPP developer shall apply to the Energy Regulator for setting a tariff that will be based on the RE Tariff Methodology as described in Section 6. The Energy Regulator must set a tariff within 30 days upon application.

For operation of the SHPP, the project developer needs a power purchase agreement, as well as a power transmission agreement if the SHPP developer chooses to sell the output to a commercial client rather than to the distribution company. The electricity generated by the SHPP and supplied to the distribution company shall be metered by installed commercial meters.

The SHPP developer must also apply for a sale license to the Energy Regulator who must issue the license within 30 days upon application.

Issues and challenges

- As discussed in section 9.1, obtaining the tariff level and signing the PPA after the construction of the plant does not allow raising commercial financing.
- There is no standard PPA and no standard transmission services agreement.
- There have been practically no new SHPP projects commissioned in the last 10 years and there is no practical experience in enforcing preferences authorized by the Law on Renewable Energy
- Unreliable availability of the grid creates additional challenges for supplying the SHPP's output to the grid and requires a carefully designed metering and billing procedure to be built into the contract with the distribution company.
- Lack of professional operational staff is another problem. Ability of SHPP's developers to hire qualified professional staff is hampered by a number of factors, such as emigration and retirement of qualified workers, lack of vocational training

opportunities and inability to pay salaries comparable to salaries paid at the state-owned companies where experienced workers receive various bonuses and long service premiums.

- Communities have no experience in managing commercial businesses in general and SHPPs in particular.

Recommendations

- ✓ Metering and billing procedure should be specific and detailed.
- ✓ The RE developer should be able to obtain the preferential tariff from the Energy Regulator before the construction.
- ✓ Standard agreements, including PPA and transmission agreement should be developed. The existing drafts of the grid connection regulations and model agreements must be significantly improved to ensure their applicability and enforceability.

10 Conclusion

There is a clear economic justification for small hydro power plants (SHPPs) in the Kyrgyz Republic as compared to the marginal cost of electricity generation in form of Combined Heat and Power (CHP) generation or imports. Beyond the economic justification, a reasonable proportion of SHPP generation is financially viable under the current (2016) feed-in-tariff (FiT), although the 8-year limitation on tariff guarantee constrains this proportion. A 15-year limit would double the proportion of SHPP capacity deemed financially viable.

Regardless of economic and financial viability, the commercial viability (bankability) of SHPPs is compromised because of lack of credit worthiness of the designated off-takers (distribution companies). Although some improvement has taken place in recent years, energy sector revenues are estimated at 21% below the cost of service in 2016.[81] Sector companies are kept afloat by yearly government loans but are still obliged to curtail O&M expenses, repairs and investments. Reputably developers of SHPP capacity invited into Kyrgyz Republic as independent power producers (IPPs) are unlikely to deem the payment risk represented by distribution companies that lack cost-recovery tariffs as acceptable.

Two paths are seen as open to government in this context:

a) In the short-term, advance a limited number of pre-selected SHPP projects with payment to IPPs backstopped by a government guarantee.

b) In the longer-term, continue improvements in the enabling legal and regulatory environment:

- improve creditworthiness of power sector by increasing tariffs to cost recovery level and allowing distribution companies to pass through the added cost of small hydro plants to end-users;
- address outstanding legal and regulatory barriers, e.g. in the areas of land and water rights allocation.

[81] World Bank (2017), Analysis of the Kyrgyz Republic's Energy Sector, PPIAF.

Appendix A: LCoE Inputs for Potential SHPP Sites

	Net capacity (MW)	Capacity factor (%)	Capital cost ($/kW net)	Fixed O&M ($/kW-year)
Ak-Terek HPP	3.50	50.00	$ 1,741	$ 32
Kulanak HPP (upper)	12.00	50.00	$ 2,721	$ 50
Kurkureu HPP 1	1.60	50.00	$ 1,020	$ 19
Kurkureu HPP 2	3.70	50.00	$ 1,088	$ 20
On-Archa HPP (reconstruction)	1.38	42.19	$ 1,183	$ 22
Ala-Archa HPP	2.00	50.00	$ 1,959	$ 36
Chon-Kemin HPP2	6.80	32.38	$ 1,264	$ 23
Chon-Kemin HPP3	4.10	50.00	$ 1,486	$ 27
Chon-Kemin HPP4	3.20	36.03	$ 1,768	$ 33
Ibragimov HPP	0.54	14.42	$ 2,015	$ 37
Kalinin HPP (reconstruction)	1.60	50.00	$ 1,360	$ 25
Karakol HPP	1.60	50.00	$ 1,224	$ 23
Kulanak HPP (lower)	6.00	50.00	$ 1,632	$ 30
Tortgulskaya	3.00	44.90	$ 1,393	$ 55
Orto-Tokoyskaya	20.00	46.18	$ 1,568	$ 35
Sokulukskaya-5	1.50	50.00	$ 2,780	$ 55
Oy-Alma	7.70	50.00	$ 3,009	$ 45
Kirovskaya	21.00	45.12	$ 1,477	$ 35
Arashan SHPP	2.15	50.00	$ 3,595	$ 55
Taldysuyskaya-1	2.78	50.00	$ 8,414	$ 55
Taldysuyskaya-2	2.07	50.00	$ 8,995	$ 55
Lenger	3.00	50.00	$ 3,710	$ 55
Chatkalskaya	6.15	50.00	$ 3,670	$ 45
Arpatekti-2	4.00	50.00	$ 3,410	$ 55
Oytal (Laytala)	4.05	50.00	$ 5,541	$ 55
Papanskaya	20.00	47.37	$ 1,661	$ 35
Kugartskaya	4.00	50.00	$ 1,800	$ 55
Aksuyskaya-1	1.98	50.00	$ 3,096	$ 55

Chon-Keminskaya-1	4.20	50.00	$ 3,224	$ 55
On-Archa	1.38	50.00	$ 5,203	$ 55
Aksuyskaya-2	1.73	50.00	$ 4,965	$ 55
Ak-Burinskaya-1	5.85	50.00	$ 2,851	$ 45
Kurkureu	1.30	50.00	$ 8,800	$ 55
Ala-Archa SHPP	1.60	50.00	$ 884	$ 16
Alamedin (2 SHPPs)	4.80	50.00	$ 952	$ 18
Chunkurchak SHPP	1.50	50.00	$ 979	$ 18
Karakulskaya SHPP	18.00	50.00	$ 1,481	$ 27
Oytal SHPP (KR Invest)	7.20	50.00	$ 1,239	$ 23
Jeti-Oguz	0.88	50.00	$ 4,424	$ 81
Jiptik	4.23	50.00	$ 1,620	$ 30
Juuku	1.46	50.00	$ 3,583	$ 66
Jyrgalang	0.58	50.00	$ 12,086	$ 222
Kara-Oy	1.06	50.00	$ 3,326	$ 61
Kara-Suu	14.82	50.00	$ 1,218	$ 22
Kara-Suu-2	2.75	50.00	$ 3,076	$ 57
Karkara	2.29	50.00	$ 3,235	$ 59
Kayyngdy	1.61	50.00	$ 3,520	$ 65
Alamudun	0.71	50.00	$ 8,033	$ 148
Kylanak	2.65	50.00	$ 5,137	$ 94
Kylanak-2	7.41	50.00	$ 3,139	$ 58
Kyrkyreu	1.38	50.00	$ 4,115	$ 76
Lebedinovka	1.61	50.00	$ 4,320	$ 79
Leninpolskaya	1.46	50.00	$ 3,715	$ 68
Sandalash-1	9.88	50.00	$ 1,481	$ 27
Sandalash-2	6.17	50.00	$ 2,026	$ 37
Sopu - Kyrgan	1.39	50.00	$ 4,775	$ 88
Barscoon	3.70	50.00	$ 2,137	$ 39
Susamyr-1	4.41	50.00	$ 3,310	$ 61
Susamyr-2	8.82	50.00	$ 2,260	$ 42
Susamyr-3	5.29	50.00	$ 3,003	$ 55
Tabylgyty-1	1.32	50.00	$ 2,841	$ 52
Tabylgyty-2	0.62	50.00	$ 5,195	$ 95
Tup-1	1.06	50.00	$ 3,905	$ 72
Tup-2	1.15	50.00	$ 3,698	$ 68
Beles	0.60	50.00	$ 6,088	$ 112

Chandalash	6.17	50.00	$ 2,707	$ 50
Dzhidalik	1.24	50.00	$ 5,982	$ 110
Gulcha	0.79	50.00	$ 6,379	$ 117
Isfaram-Sai	1.72	50.00	$ 3,201	$ 59
Juumgal	2.00	50.00	$ 3,564	$ 66
Lyangar	1.50	50.00	$ 3,564	$ 66
Min-Kysh	2.50	50.00	$ 3,564	$ 66
Sary-Jaz	5.00	50.00	$ 3,564	$ 66
Tagap	2.50	50.00	$ 3,564	$ 66
Tayan	3.50	50.00	$ 3,564	$ 66
Kygart	4.00	50.00	$ 3,564	$ 66
Shamsi SHPP	10.00	34.25	$ 1,880	$ 28
Tar River SHPP-30 MW alternative	30.00	46.23	$ 2,805	$ 42
Orto-Tokoi Dam-alt 1	18.00	47.56	$ 1,261	$ 15
Orto-Tokoi Dam-alt 2	18.00	47.56	$ 1,733	$ 21
Kirov Dam - transmission to Kazakhstan	20.00	50.00	$ 1,180	$ 18
Kirov Dam - transmission to Kyrgyzstan	20.00	50.00	$ 1,145	$ 17
Chon-Ak-Suu SHPP	11.40	50.00	$ 2,737	$ 33
Chon-Ak-Suu SHPP- alt. financial analysis	11.40	50.00	$ 1,000	$ 12

Appendix B: 2000 – 2005 SHPP Development Program

It is assumed that the Ministry's estimate of five to eight billion kWh potential SHPP output was initially developed in the late 1990s based on hydrological studies conducted by the Kyrgyz Scientific and Technical Center for Energy (KNTTS "Energy") and JSC Kyrgyzenergo during the Soviet era. These estimates appear to rely on general hydrological conditions instead of specific SHPP sites, taking into consideration small rivers having a flow of at least 2 m^3/s during winter months. Interviews with local experts confirm this understanding. The local experts said they thought the studies were high-level instead of site-specific, and warned that they were probably now outdated.

B.1 The Estimates

The 2000 – 2005 *SHPP Development Program* provides information on technical potential for SHPPs by Oblast and the small rivers that are proposed for development. The information is summarized in Appendix Table B.1.

Appendix Table B.1: Estimated Technical Potential by Oblast, (2000-2005 SHPP Development Program)

Oblast	Technical Potential (mln kWh)	Small Rivers Proposed for Development
Chui	500	▪ Chon-Kemin ▪ Issyk-Ata ▪ Alamedin ▪ Ak-Suu ▪ Kara-Balta ▪ Ala-Archa ▪ Shamsi ▪ Sokuluk
Issyk-Kul	1,700	▪ Jergalan ▪ Turgen-Aksu ▪ Aksu ▪ Karakol ▪ Arashan ▪ Jeti-Oguz ▪ Djuuku ▪ Ak-Sai ▪ Akterek ▪ turas ▪ Chon-Aksu ▪ Tup ▪ Sary-Jaz ▪ Kuylyu ▪ Inylchek Akshiirak
Talas	320	▪ Uch-Koshoy ▪ Karakol ▪ Talas ▪ Urmaral ▪ Kurkureusu
Naryn	1,600	▪ On-Archa ▪ Kokdzherty ▪ Alabuga ▪ Bashi ▪ Kokomeren ▪ Karakol ▪ Suek ▪ Zhumgal ▪ Minkush ▪ Dzhuanaryk ▪ Karakudzhur ▪ Kochkor ▪ Susamyr ▪ Kekerim
Osh	2,300	▪ Kara ▪ Tar ▪ Karakuldja ▪ Iasi ▪ Cox ▪ Akbura ▪ Isfayramsay ▪ Shahimardan ▪ Khodjabakirgan Kyzylsu ▪ Aravansay ▪ Karakol ▪ Kurshab
Jalal-abad	1,600	▪ Aflatun ▪ Padshaata ▪ Karasu (right) ▪ Karasu (left) ▪ Tentyaksay ▪ Kugart ▪ Mailu ▪ Chatkal ▪ Torkent ▪ Chichkan Uzunahmat
Total	**8,020**	

Source: Republic of Kyrgyzstan, "Development Program: Small Hydropower in the Kyrgyz Republic for 2000-2005."

B.2 Analysis of the Estimates

A due diligence check of the reasonableness of the range of the estimates of technical potential was conducted by comparing it to assumptions made in subsequent studies, some of which were aggregations of site-specific studies. The studies consulted included the Ministry of Energy's "Concept for the Development of Small Hydropower in 2015-2017", a 2013 Ministry presentation on the development of renewable energy sources, a 2013 UNIDO report on small hydropower development worldwide, and various documents related to the

UNDP/GEF *Small Hydropower Development Project*.[82,83] Estimates from these studies are shown in Appendix Table B.2. The table shows three categories of estimates: potential rehabilitation of existing SHPPs or building on existing irrigation reservoirs; site-specific studies of potential new SHPPs; and estimates of overall generation potential.

Appendix Table B.2: Summary of Estimates for SHPP Potential in the Kyrgyz Republic

Source*	Year	Metric	Installed capacity (MW)	Generation (billion kWh)	# of sites
1.) Potential for rehabilitating or building on existing sites (site-specific)					
UNIDO	2013	Rehabilitation of existing SHPPs	22	n/a	39
UNDP/GEF	2015		22	0.1	39
UNIDO	2013	New SHPPs on existing irrigation reservoirs	75	n/a	7
UNDP/GEF	2015		75	0.2	7
2.) Potential for new SHPPs (site-specific)					
MoE&I presentation	2013	New SHPPs	180	1	90
UNDP/GEF	2015		178	1	87
MoE&I-concept	2015		180	1	87
UNIDO	2013		178	n/a	92
3.) Estimates of overall potential					
UNIDO	2013	SHPP potential (up to 10 MW)	275	n/a	
UNIDO	2013	SHPP potential (up to 30 MW)- low	500	n/a	
UNIDO	2013	SHPP potential (up to 30 MW)- high	900	n/a	
UNDP/GEF	2015	Technical potential from small rivers and streams		5-8	
MoE&I presentation	2013			5-8	
MoE&I-concept	2015			5-8	

Some studies provide estimates of generation potential, some provide estimates of potential in terms of installed capacity, and others provide estimates of both generation potential and installed capacity. Estimates of total SHPP potential from UNIDO documents were presented in terms of capacity instead of generation. UNIDO estimated that there is between 500 and 900 MW of capacity in SHPP sites smaller than 30 MW. The methodology used for the estimate is not clear, but it appears that the UNIDO study may have mistakenly estimated

[82] "Renewable Energy Sources Development," Ministry of Energy and Industry of the Kyrgyz Republic, accessed 19 April 2016, http://www.unescap.org/sites/default/files/C_Kyrgyz_Orozaliev_E.pdf.

[83] United Nations Industrial Development Organization (UNIDO) and International Center on Small Hydro Power (ICSHP), "World Small Hydropower Development Report 2013", accessed 19 April 2016, http://www.smallhydroworld.org/fileadmin/user_upload/pdf/WSHPDR_2013_Final_Report-updated_version.pdf

installed capacity using the 2000 – 2005 *SHPP Development Program's* estimate of five to eight billion kWh, and applying a capacity factor of 100 percent. Appendix Table B.3 shows the results of this calculation.

Appendix Table B.3: UNIDO Annual Energy Generation Estimates with Capacity Factor of 1.0

(includes sites up to 30 MW)	**Estimated Potential Capacity**	**Capacity Factor***	**Est. Annual Generation ** **
Low estimate	500 MW	1.0	4.38 billion kWh
High estimate	900 MW	1.0	7.88 billion kWh

Source of capacity estimates: UNIDO, "World Small Hydropower Development Report 2013"

Note: * Capacity factor is the ratio of the actual annual energy production of a power plant to the hypothetical maximum annual energy production assuming continuous generation at the full design power rating;
** Annual energy generation = Power (MW) x 365 days x 24 hours x Capacity Factor.

The level of capacity estimated by UNIDO, given average capacity factors in the Kyrgyz Republic, would be more consistent with generation potentials of 2.75 to 5 billion kWh, considerably lower than the levels estimated in the 2000 – 2005 *SHPP Development Program*.

Appendix C: Overview of Projects for Tier 1 and 2 Site Identification

Three donor-led projects provide the basis for the identification of Tier 1 and 2 sites: Norconsult (Tier 1 sites), EBRD/Mercados (Tier 1 and 2 sites), and UNDP (Tier 2 and 3 sites). The following subsections describe each of the projects.

C.1 Norconsult

In 2003 the Norwegian Ministry of Foreign Affairs extended their technical assistance to Kyrgyzstan through an SHP assessment and selection of sites for feasibility assessments. The program was implemented by Norconsult AS.

The SHP assessment identified low tariffs and low collection rates the key barriers in SHPP development. Therefore, it was determined that the final selection of sites for feasibility assessments should be subject to a review of the likelihood of obtaining sufficiently high tariffs and collection rates to allow for a satisfactory return on investments.

The following sites were selected for feasibility studies:

- Kirov Dam
- Chon Ak Suu
- OrtoTokoi Dam
- Shamsi
- Tar River

The feasibility studies for each site are described in Appendix D.

C.2 EBRD/Mercados

EBRD's Strategic Planning for Small and Medium Sized Hydropower Development Project was implemented by AF-Mercados EMI and carried out in three phases.

Phase I - Assessment of Potential Sites and Selection of Pilot Projects

A list of 154 potential sites was narrowed down to 20 sites, from which 4 sites were selected for feasibility studies. The four sites were selected to meet the following criteria:

- Small-sized new construction project (<10 MW);
- A medium-size new construction project (<30 MW);
- A rehabilitation of destroyed/abandoned small- or medium-size HPP;
- An installation of power generation units at an existing irrigation reservoir.

The selection process involved a preliminary financial and economic analysis. Investment costs and levelised costs of electricity were estimated for each candidate SHPP. The selection process was based on a least cost planning methodology that aims to minimize of the cost of supply for the forecasted load. In addition, sites were assessed based on technical, commercial, socio-economic, environmental and economic considerations. The following four sites were selected:

- Orto-Tokoyskaya SHPP

- Oy-Alma SHPP-2
- Sokuluskaya SHPP-5
- Tortgulskaya SHPP

Phase II – Development of Feasibility Studies

In Phase II, initial investment costs were updated, taking into consideration additional information from site surveys and more detailed engineering designs. The updated cost data was used to prepare financial analyses of the four projects. In addition, recommendations were made concerning the attractiveness of investments for each project. The results of these feasibility studies are detailed in Appendix D.

Phase III – Preparation of Tender Documents

Phase III involved soliciting interest from potential investors and preparing tender documents for the four SHPPs. A consortium of MERCADOS EMI and JSC RysHydro developed a package of tender documents. In January 2015, The MEI formed a tender commission and posted an invitation for expression of interest. Tender documents were bought by eight companies and three companies were prequalified. However, the tender process was delayed and has not been carried out. The MEI was abolished in November 2015. ~~The State Committee could potentially tender the four SHPPs, but the Deputy Chairman of the State Committee may refrain from doing so due to the perceived risk of tender failure and criticism from the Government, Parliament and the public.~~

C.3 UNDP

In 2010-2015 UNDP/GEF implemented the Small Hydropower Development Project. Part of this project involved updating 30-year old hydrological data for the 65 most promising sites for SHPP development, and preparation of an interactive maps in the GIS format. The project also conducted feasibility studies for selected small hydroelectric power plants. Other achievements of this project are as follows:

- Passage of a set of amendments to relieve SHPPs from licensing and amendments to the Law on Renewable Energy, to introduce a coefficient for the RE tariff, and to ensure free access to the grid at the least cost
- Development of several draft legal and regulatory acts including the following:
  - Amendments to the Land Code, Water Code and Law on Natural and Authorized Monopolies
  - Draft model power purchase agreement for SHPPs
  - Draft regulations on grid connection for SHPPs
  - Draft Methodology for the Grid Connection Fee for SHPPs
- Preparation of technical documentation for the following SHPPs:
  - 1.6 MW plant at the Karakol River (the feasibility study and drawings were submitted to the investor Herrmann Verfaltungs GmbX and LLC "Karakol Energy”)

- 0.54 MW plant[84] at the Beles River, Batken Oblast (the feasibility study and drawings were submitted to T.Ibragimov's LLC)
- 6.7 MW plant at the Chandalash River (environmental impact assessment was submitted to the investor Herrmann Verfaltungs GmbX and LLC "Chandalash Energy")
- Technical documentation for reconstruction of Kalininskay SHHP was submitted to French-Kyrgyz JV

- Preparation and publication of several information booklets, training handbooks and manuals [85]
- Training and capacity building activities, including a study tour to learn Montenegro's experience on small hydro power plants and energy efficiency.

[84] According to UNDP reports construction of the 0.54 MW plant has started.

[85] Mainly for installations of 1.5 kW – 25 kW

Appendix D: Overview of Tier 1 Feasibility Studies

This appendix provides a summary of feasibility assessments implemented under the EBRD-funded Strategic Planning for Small and Medium Sized Hydropower Development Project (implemented by MERCADOS EMI) and under the Norwegian SHPP Development Program implemented by Norconsult AS (Tier 1 sites identified in Section 3). An overview of the feasibility studies is presented in Appendix Table D.1. More detailed descriptions of each study are provided in the following subsections.

Appendix Table D.1: Overview of Feasibility Studies

	Month and Year of Feasibility Study
Norconsult AS Feasibility Studies	
Kirov Dam	November 2006
Chon Ak Suu SHP	September 2007
Orto-Tokoi Dam*	September 2009
Shamsi SHP	October 2012
Tar River SHP	May 2013, modified in April 2014
AF-MERCADOS EMI Feasibility Studies	
Oy-Alma SHP -2	July 2011
Orto-Tokoi Dam*	July 2011
Sokulukskaya-5 SHP	July 2011
Tortgulskaya SHPP	July 2011

*The Orto-Tokoi Dam site was studied by both Norconsult and AF-MERCADOS EMI

D.1 Kirov Dam (Norconsult AS, November 2006)

Norconsult assessed the hydropower potential below the Kirov Dam, which could be an electricity source for export to Kazakhstan. Currently the release of water from Kirov Dam is used for irrigation and community purposes (primarily for Kazakhstan's irrigation requirements). Hydropower development below the dam was suggested based on an energy production simulation model considering operation of the power plant fully in compliance with the existing water release rules. Two output options were considered: 23.7 MW and 20 MW. A 20 MW plant was recommended as the preferred option, with mean annual production estimated at 91.4 GWh.

D.2 Chon Ak Suu River (Norconsult AS, September 2007)

Norconsult assessed the hydropower potential of the Chon Ak Suu River at Gregorevka on the north shore of Lake Issyk-Kul. This site could potentially provide power for hotels and resorts in the area. The Chon Ak Suu SHPP could have an annual energy capability of 55 GWh. Simulations showed that 50 GWh was available in 27 out of the 30 years, and could be considered firm energy, while the remaining 5 GWh was considered seasonal or secondary energy. If the Chon Ak Suu SHPP was connected to the National Grid substation, the entire potential output could be utilized, and an increase in local demand of as much as 50 GWh (the annual firm capability) could be accommodated.

The economic evaluation of the project showed a 7.5 USc/kWh energy cost. This was based on application of a discount rate of 13 percent, and the assumption that the entire mean annual production of 55 GWh was sold. Construction costs were estimated to USD 27.2 million, including transmission to the substation in Gregorevka.

The Chon Ak Suu water flow is currently used for irrigation and other community purposes. The hydropower development site is located entirely upstream of the irrigation canal intakes, but no interference with the water use regimes was foreseen as plans included only run-of-the-river development.

D.3 Orto-Tokoi Dam (Norconsult AS, September 2009)

The SHPP potential at the Orto-Tokoi Dam was assessed by both Norconsult and AF-Mercados EMI. The following is a description of the Norconsult study.

SHPP potential below the Orto-Tokoi Dam near to Lake Issyk-Kul was considered for potential power supply agreements with hotels and resorts in this area. Currently, water released from the Orto-Tokoi Dam is used for irrigation and community purposes (primarily for Kazakhstan's irrigation requirements). Hydropower development below the dam was suggested based on an energy production simulation model considering operation of the power plant fully in compliance with the existing water release rules. Based on annual water releases requirements, the maximum output is estimated at 18 MW, with mean annual production of 75 GWh.

Two alternatives for the water way were suggested: use of an existing tunnel with construction of a new short tunnel (Alternative 1) or construction of a new independent tunnel only for HPP use (Alternative 2). Appendix Table D.4 shows the results of the economic evaluation of the project under each alternative.

Appendix Table D.2: Energy Costs for Alternative 1 and 2

	Energy cost (USc/kWh)	
	13% discount rate	**7% discount rate**
Alternative 1	4.3	2.5
Alternative 2	5.9	3.4

The feasibility study identified several technical problems which still require investigation and clarification before further steps can be taken. In addition, further studies are needed to detail the impacts on socio-economic environment, realization of private and foreign investments and credits, clarification as CDM project, probable consumers of the produced electric energy, etc.

D.4 Shamsi River (Norconsult AS, October 2012)

Norconsult prepared a prefeasibility study for a small hydropower development on the Shamsi River in north-eastern Kyrgyzstan.

The initial assessment included two potential sites: Shamsi-1 (Alternative 1) is located 27.8 km upstream of the river mouth and Shamsi-2 (Alternative 2) is located 16.4 km upstream of the mouth. Alternative 2 was determined to be more attractive due to lower infrastructure costs (access roads and transmission lines) and higher energy output. Both alternatives have similar low environmental and social impacts. Only Alternative 2 (later named Shamsi SHP) underwent the final evaluation stage.

The prefeasibility evaluation for the Shamsi SHP project was based on a power plant with a maximum release through the turbines of 8.5 m^3/s. Simulations on daily mean flow basis showed that on the average 30 GWh of electric energy could be produced annually.

The economic evaluation of the project showed an energy cost of 8.7 USc/kWh. This cost was based on the application of a 10 percent discount rate and the assumption that the entire mean annual production of 29.9 GWh was sold.

The Shamsi River is used for irrigation and other community purposes. The entire Shamsi SHPP is located upstream of the intake of the main irrigation canals, but no interference with existing water use is foreseen, as the development concept was pure run-of-the-river with no flow regulation.

D.5 Tar River (Norconsult AS, May 2013, modified in April 2014)

Norconsult AS has prepared a prefeasibility study for a hydropower development on the Tar River in South-eastern Kyrgyzstan. The SHPP could have a maximum installed capacity of 62 MW, with an average 232 GWh of electric energy produced annually.

The economic evaluation of the project showed an energy cost of 7.65 USc/kWh based on a discount rate of 10 percent, and the assumption that the entire mean annual production of 232 GWh is sold. Based on the economic and financial evaluation, the 62 MW installed capacity did not seem to be viable at the current tariff levels in Kyrgyzstan. The report finding was that project was financially viable at a tariff of 8.24 USc/kWh, and economically viable at a tariff of 7.65 USc/kWh.

In 2014, the MEI requested a study on an alternative hydropower development with maximum 30 MW installed capacity. The study showed that the project was not economically or financially viable at the current tariff levels. The project is financially viable at a tariff of 9.56 USc/kWh, and economically viable at a tariff of 9.00 USc/kWh. To make the project financially viable at a tariff of 6.00 USc/kWh, the project cost must be reduced by as much as 38 percent. This reduction did not seem realistic to the study's authors.

Currently, the Tar River water flow is used mainly for irrigation purposes while other type of users could have minor impact on water balance in the river. No interference with existing water use was foreseen, as the development concept was pure run-of-the-river with no flow regulation.

D.6 Oy-Alma SHPP -2 (AF-Mercados EMI, July 2011)

As part of Phase II of the EBRD-funded Strategic Planning for Small and Medium Sized Hydropower Development Project, a feasibility study for development of Oi-Alma HPP-2 in the Kara-Kulzha, Osh Region was conducted. Installed capacity of 770 kW was considered, with estimated yearly power generation of 54.493 MWh.

Two investment scenarios were assessed: one in which the project bears the grid connection costs (these are included in the CAPEX) and one in which transmission lines and road construction are finance by the government. Estimated costs per kWh are shown in Appendix

Table D.3. The distribution of investment costs through time is presented in Appendix Table D.4.

Appendix Table D.3: Oy-Alma Costs per kW

	Cost per kW
Installed capacity including network connection, roads, settlements, etc.	2383 USD
Installed capacity excluding network connection, roads, settlements, etc.	1409 USD

Appendix Table D.4: Oy-Alma Alternatives 1 and 2

Alternative / Year	**Investment costs ('000 USD)**				
	-4	-3	-2	-1	0
Alternative 1: Incl. Transmission and Roads	0	9.300	4.500	4.500	51
Alternative 2: Excl. Transmission and Roads	0	5.478	2.651	2.651	30

Yearly O&M costs were estimated at 45 USD per kW.

D.7 Orto-Tokoi Dam SHPP (AF-Mercados EMI, July 2011)

The SHO potential at the Orto-Tokoi Dam was assessed by both Norconsult and AF-Mercados. The following is a description of the AF-Mercados EMI study.

As part of Phase II of the EBRD-funded Strategic Planning for Small and Medium Sized Hydropower Development Project, a feasibility study for development of the Orto-Tokoy SHPP in the Ton District, Issyk-Kul Region was conducted. An installed capacity of 20,000 kWh was considered, with estimated yearly power generation of 80.941 MWh.

Two investment scenarios were assessed: one in which the project bears the grid connection costs (these are included in the CAPEX) and one in which transmission lines and road construction are finance by the government. Estimated costs per kWh are shown in Appendix Table D.5. The distribution of investment costs through time is presented in Appendix Table D.6.

Appendix Table D.5: Orto-Tokoi Dam SHPP Costs per kW

	USD/kW
Installed capacity including network connection, roads, settlements, etc.	1252USD
Installed capacity excluding network connection, roads, settlements, etc.	770 USD

Appendix Table D.6: Orto-Tokoskaya Alternatives 1 and 2

Alternative / Year	Investment costs ('000 USD)				
	-4	-3	-2	-1	0
Alternative 1: Incl. Transmission and Roads	9.000	6.000	6.000	4.000	30
Alternative 2: Excl. Transmission and Roads	5.534	3.689	3.689	2.459	18

Yearly O&M costs were estimated at 35 USD per kW.

D.8 Sokulukskaya-5 SHPP (AF-MERCADOS EMI, July 2011)

As part of Phase II of the EBRD-funded Strategic Planning for Small and Medium Sized Hydropower Development Project, a feasibility study for development of Sokulukskaya 5 SHPP in the Sokuluk District of Chu Region was conducted. An installed capacity of 1,500 kW was considered, with estimated yearly power generation of 9.089 MWh.

Two investment scenarios were assessed: one in which the project bears the grid connection costs (these are included in the CAPEX) and one in which transmission lines and road construction are finance by the government. Estimated costs per kWh are shown in Appendix Table D.7. The distribution of investment costs through time is presented in Appendix Table D.8.

Appendix Table D.7: Sokulukskaya-5 SHPP Costs per kW

	USD/kW
Installed capacity including network connection, roads, settlements, etc.	2288 USD
Installed capacity excluding network connection, roads, settlements, etc.	1828 USD

Appendix Table D.8: Sokulukskaya-5 Alternatives 1 and 2

Alternative / Year	Investment costs ('000 USD)				
	-4	-3	-2	-1	0
Alternative 1: Incl. Transmission and Roads	0	0	2.600	700	42
Alternative 2: Excl. Transmission and Roads	0	0	2.133	574	34

Yearly O&M costs were estimated at 55 USD per kW.

D.9 Tortgulskaya SHPP (AF-Mercados EMI, July 2011)

As part of Phase II of the EBRD-funded Strategic Planning for Small and Medium Sized Hydropower Development Project, a feasibility study for development of Tortgulskaya SHPP in the in the Batken District, Batken Region was conducted. An installed capacity of 3,000 kW was considered, with estimated yearly power generation of 11.858 MWh.

Two investment scenarios were assessed: one in which the project bears the grid connection costs (these are included in the CAPEX) and one in which transmission lines and road construction are finance by the government. Estimated costs per kWh are shown in Appendix Table D.9. The distribution of investment costs through time is presented in Appendix Table D.10.

Appendix Table D.9: Tortgulskaya SHPP Costs per kW

HPP installed capacity	3000 kW
Cost of 1 kW of installed capacity including network connection, roads, settlements, etc.	858 USD
Cost of 1 kW of installed capacity excluding network connection, roads, settlements, etc.	753 USD

Appendix Table D.10: Tortgulskaya Alternatives 1 and 2

Alternative / Year	Investment costs ('000 USD)				
	-4	-3	-2	-1	0
Alternative 1: Incl. Transmission and Roads	0	0	2.000	500	75
Alternative 2: Excl. Transmission and Roads	0	0	1.755	439	66

Yearly O&M costs were estimated at 55 USD per kW.

Appendix E: Underlying cost assumptions for LCoE

The estimate of the LCoE for each SHPP site relies principally on information provided in source documents. Proxies, based on international benchmarks, were used when data were not available from the original source, or were perceived to be unreliable. The following subsections summarize the ranges of each LCoE input and the approach to estimating inputs where values were unavailable or unreliable. The specific inputs used to calculate the LCoE for each SHPP site are provided in Appendix A.

Capital Costs

Capital costs ranged from USD 813/kW to USD 11,106/kW, with an average of USD 3,015/kW. The cost of infrastructure associated with SHPP sites (e.g. transmission lines), as listed in the original sources, was included in these costs whenever possible. In the absence of available data on transmission costs, a premium of 8.83 percent has been added to capital costs, based on the average additional cost of transmission in the Tier 1 sites. This premium was added to the capital costs of UNDP map sites (both Tier 2 and 3) and all other Tier 3 sites. There is uncertainty about which costs have been included in Tier 3 estimates because very little detail was available on the breakdown of these estimates. Capital cost estimates provided in data from the Ministry of Energy tended to be substantially lower than capital cost assumptions from other sources, however, which leads us to suspect these estimates may not include the cost of infrastructure associated with SHPP sites (see Appendix Figure E.1).

Capital costs were not provided for sites identified on the UNDP map. The team's engineers, GZA GeoEnvironmental, Inc. (GZA), estimated capital costs for these sites based on an equation developed by the United States' Oak Ridge National Laboratory. The methodology uses data on a hydropower site's head and generation capacity to estimate capital expenses. The equation is:[86]

$$C_p = 110168 * H_{-0.35} * P_{-0.3}$$

Where:

C_p = Initial Capital Cost (US Dollars)

H = Head (meters)

P = Plant Power Generation Capacity (kW)

The ORNL methodology was developed using US cost data, and therefore may potentially overestimate costs for construction in the Kyrgyz Republic. Costs for electro-mechanical equipment (turbine, generator, transformers, etc.) are assumed to be similar, but civil works costs are likely to be lower in the Kyrgyz Republic due to lower material and labor prices.

GZA's estimates were compared to capital costs of 29 other potential SHPP sites in the Kyrgyz Republic to confirm that the estimates were within the same range. The comparison between GZA averages and the reference averages suggests that the GZA unit cost estimates for initial capital costs are closely in line with other estimates for capital costs of similar SHPPs. The average of the 29 reference sites was $ 3,275 per kW and the average of the GZA estimates was $3,662 per kW, or 12 percent higher.

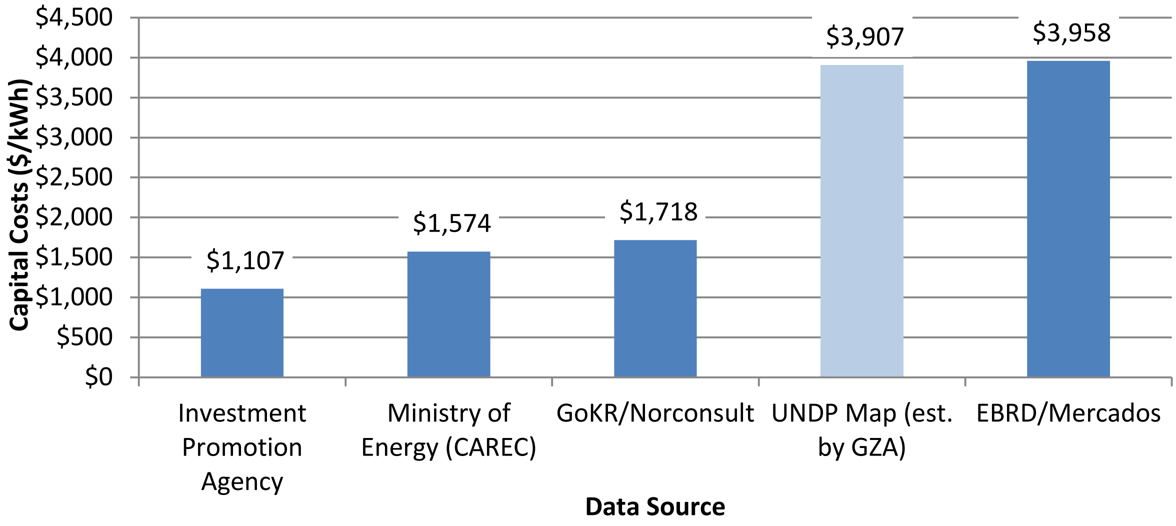
The capital cost estimates developed by GZA also include a separate cost item for diversion canals because the proposed SHPP sites generally use a diversion canal to convey flow from

[86] The constant in this formula excludes the cost of any transmission infrastructure required to connect plants.

the intake diversion to the headpond above the powerhouse. GZA estimated canal costs per meter based on the assumption of a three meter deep by three meter wide canal lined with 0.25 meters of concrete, and an estimated unit price of USD355 per linear meter of canal.[87] The transmission requirements for the sites from the UNDP map were unknown and therefore could not be incorporated GZA's estimate of the capital costs associated with these sites. In place of transmission cost data, the 8.83 percent premium to capital costs was applied.

Appendix Figure E.1 compares the average capital cost estimates for each source.

Appendix Figure E.1: Average Capital Cost, by Source ($ per kW)



Operating and Maintenance (O&M) Costs

O&M costs ranged from USD 12/kW to USD 222/kW, with an average of $52/kW. The feasibility studies for the Tier 1 sites had estimates of O&M costs but O&M cost estimates were not available for most Tier 2 and 3 sites. Estimation of O&M costs for these sites relied on two international benchmarks. Tier 2 sites studied by EBRD/Mercados used the following assumptions for average annual O&M costs:

- HPPs up to 5 MW: 55 USD/kW;
- HPPs from 5 - 15 MW: 45 USD/kW; and
- HPPs from 15 - 50 MW: 35 USD/kW.

O&M costs for the remaining Tier 2 and 3 sites were assumed to be 2 percent of initial capital costs, based on recommendations from GZA. This assumption aligns with typical international benchmarks for SHPP O&M costs.[88]

[87] GZA determined the unit price for the diversion canal based on unit costs from the 2014 feasibility study of Tar HPP conducted by Norconsult.

[88] In addition to the expert opinion from GZA, DHInfrastructure consulted the following sources for international benchmarks of O&M costs for SHPPs:

International Renewable Energy Agency (IRENA), "Renewable Energy Technologies: Cost Analysis Series: Hydropower," June 2012, accessed 16 May 2016, http://www.irena.org/documentdownloads/publications/re_technologies_cost_analysis-hydropower.pdf

Plant Capacity

The capacity of the sites ranged from 1 MW to 30 MW, with an average plant size of 7 MW. Information on plant capacity was provided in source documents for all sites except for 31 sites from the UNDP map for which technical information on the head and flow was available. For these sites, GZA independently estimated the plant power generation capacity using the standard hydropower equation:

$$P = H * Q * e * 9.8 \text{ m/sec}_2$$

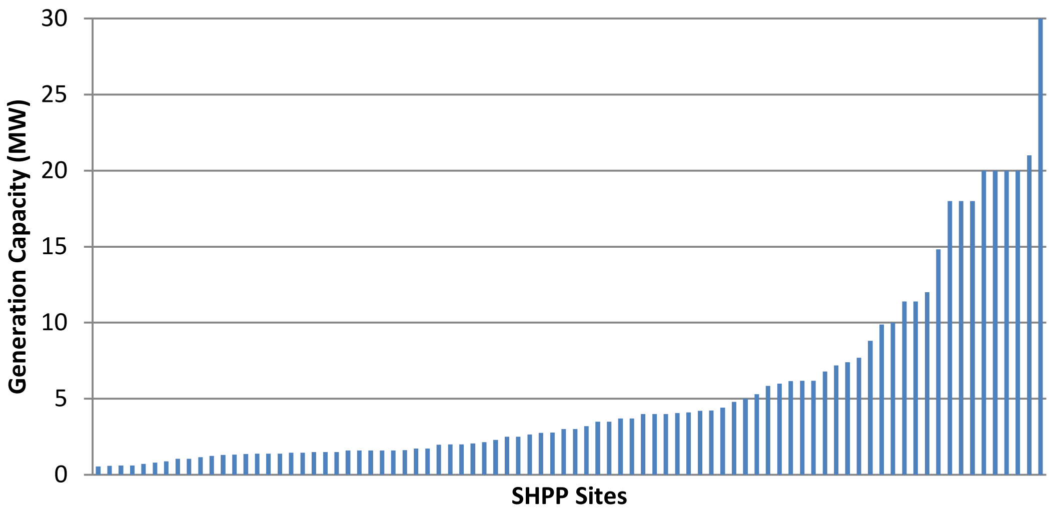
Where:

P = Plant Power Generation Capacity (kW)
H = Net Head (meters)
Q = Design Flow (cubic meter per second)
e = Average Turbine / Generator Efficiency (assumed to be 0.9)

The estimated plant capacities were 3 percent higher, on average, than the capacities provided in the source document, but ranged from being as much as 69 percent lower to 24 percent higher than the original values. The greatest difference in the capacity provided by the source and that which was calculated by GZA was 1.4 MW.

Appendix Figure E.2 shows the distribution of capacities of the 81 sites which have been included in the supply curve.

Appendix Figure E.2: Generation Capacity of SHPP Sites, (MW)



Capacity Factors

Capacity factors ranged from 14 percent to 95 percent, with an average of 52 percent. Typically, SHPPs capacity factors do not exceed 50 percent due to their intermittent operation. The studies of the 81 SHPP sites used showed 31 sites with a capacity factor greater than 50. A capacity factor of 50 percent was applied to these sites along with 38 UNDP map

International energy Agency (IEA), “Energy Technology Systems Analysis Programme: Hydropower,” May 2010, accessed 19 May 2016, http://www.iea-etsap.org/web/e-techds/pdf/e07-hydropower-gs-gct.pdf sites, and 1 Investment Promotion Agency site for which there was not adequate information to calculate capacity factors. [89]

[89] Originally, a proxy capacity factor of 63 percent was used for these sites based on benchmarks from the Ministry of Energy. A 2013 presentation by the Ministry of energy estimated potential for 90 SHPP sites, with a combined capacity of 180 MW, to generate 1.0 billion kWh, resulting in an aggregate capacity factor of 63 percent. These capacity factors, like the others in this study, were then capped at 50 percent because of some reviewers' comments on earlier drafts that 63 percent seemed to be an overly optimistic capacity factor for run-of-river hydro.

Appendix F: Estimates of the Costs of Alternatives

The cost of alternative supply options was evaluated in order to better understand the potential cost-competitiveness of SHPPs in the Kyrgyz Republic. The understanding is that the Kyrgyz Republic predominantly uses large storage hydro plants—and among them, predominantly Toktogul—to serve base load. Bishkek CHP and imports are used to serve seasonal peaks, meaning these are the marginal plants.

The following assumptions were used to determine the cost of alterative power supply:

- Imports: The import prices included in the analysis are $0.02 per kWh and $0.09 per kWh. It has been confirmed that import prices provided by external sources are within this range. As of June 2015, the Kyrgyz Republic agreed upon an import price of $0.025 per kWh with Tajikistan and was reported to pay $0.07 per kWh for power from Kazakhstan.[90] In 2016, the Kyrgyz Republic paid $0.028 per kWh for imports from Tajikistan, and had no imports from Kazakhstan.[91]
- Bishkek CHP: The LCoE of Bishkek CHP was calculated based on a number of assumptions, which are summarized in Appendix Table F.1.

[90] Putz, Catherine, "What's the Price of Tajik Electricity in Kyrgyzstan?" *The Diplomat*, 11 June 2015. http://thediplomat.com/2015/06/whats-the-price-of-tajik-electricity-in-kyrgyzstan/ (accessed 18 May 2016)

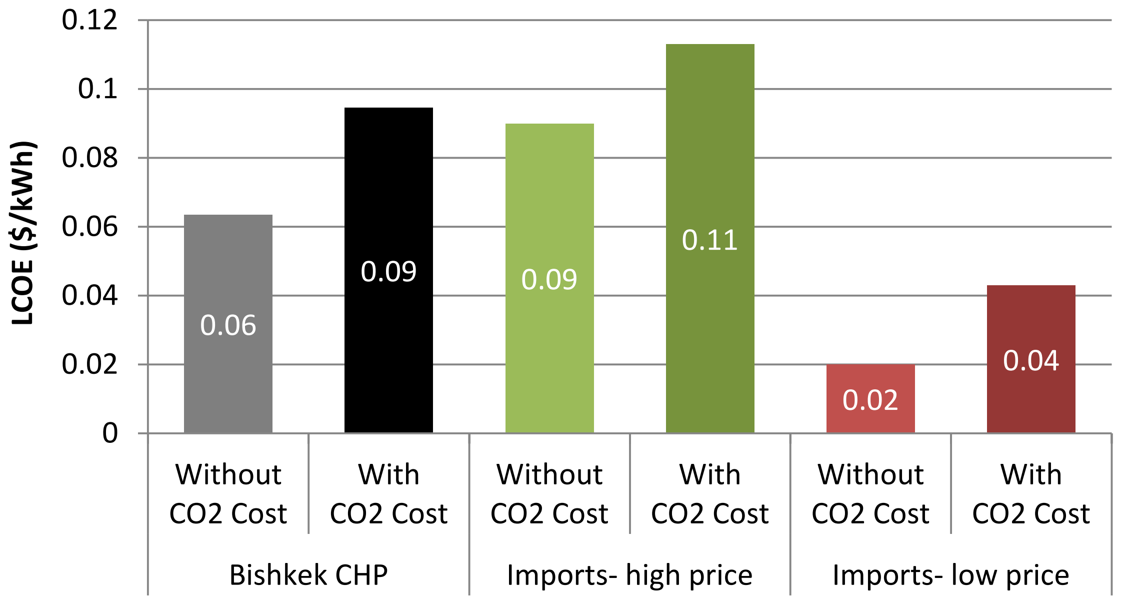
[91] Derived from import volumes and prices provided by the regulator

Appendix Table F.1: Assumptions used in Calculation of LCoE for Bishkek CHP

Input	Assumption	Notes
Fuel cost	$0.01/ kWh	Based on conversion of the weighted average cost of domestic and imported coal as of August 2014 (534.26 som/Gcal)
Non-fuel O&M	$90/kWh	▪ Data provided on actual O&M for Bishkek CHP was insufficient to calculate a reliable value; therefore, a proxy was used based on the low-end of an international benchmark of O&M costs ranging from 90-120 USD/kWh ▪ Source: IEA, "ETSAP: Combined Heat and Power, " May 2012. http://www.iea-etsap.org/web/e-techds/pdf/e04-chp-gs-gct_adfinal.pdf
Capital costs	$1,544/kW	▪ Based on total investments of USD386 million in the rehabilitation ▪ Source: Aid Data, "China loans 386 million USD for modernization of Bishkek Thermal Power Plant," http://china.aiddata.org/projects/39620?iframe=y
Financing terms (Financial)	100% debt financed with a 2% interest rate and 20-year loan tenor	Source: Ibid
Discounting (economic)	Discounting of entire asset value at 5% social opportunity cost of capital over 20 years	▪ DHInfrastructure assumption
Net capacity	250 MW	▪ Capacity is based on the two 150 MW units (net 125 MW) that are supposed to be added as a result of the rehabilitation. ▪ Source: Ibid.
Capacity factor	47%	▪ Calculated assuming new capacity of 440 MW and projected generation after rehabilitation of 1.8 billion kWh ▪ Source: Ibid.
Years of construction	3 years	▪ DHInfrastructure assumption

Emissions costs for the CHP were estimated to be 0.031 USD/kWh.[92] Emission costs for imports were estimated to be 0.021 USD/kWh.[93] Appendix Figure F.1 shows the impact of CO_2 emissions on CHP and Import Costs.

Appendix Figure F.1: Shift in CHP and Import Costs, Including Emissions Costs



[92] Based on an assumed emissions rate of 1,007 g/kWh and a carbon price forecast for 2016 of 30.94 USD/tonne (Derived from guidance note on social value of carbon. World Bank. 15 July 2014.)

[93] Based on a weighted average of electricity grid emissions factors for Kazakhstan and Tajikistan (Brander, Matthew, Aman Sood, Charlotte Wylie, Amy Haughton, and Jessica Lovell. "Technical Paper| Electricity-specific emission factors for grid electricity." Ecometrica, Emissionfactors. com (2011).) The weights were derived from the level of imports in each country in Kyrgyzstan's 2015 energy sector Techno-Economic Indicators report. The same carbon price forecast was used as for the CHP emissions.

Appendix G: List of Legal Documents Relevant to SHPP Development

The following documents were reviewed ~~by the end of 2016~~ for the preparation of the report.

1. Land Code of the Kyrgyz Republic, adopted June 2, 1999 (last amended July 30, 2016)
2. Water Code of the Kyrgyz Republic, adopted January 12, 2005 (last amended April 6, 2017)
3. Law on Licensing and Permit System in the Kyrgyz Republic, adopted October 19, 2013 (last amended May 28, 2015)
4. Energy Law of the Kyrgyz Republic, adopted on October 30, 1996 (last amended January 14, 2015)
5. Electricity Law of the Kyrgyz Republic, adopted on January 28, 1997 (last amended on January 20, 2016)
6. Law on Renewable Energy, adopted on December 31, 2008 (last amended on July 25, 2016)
7. Law of the Kyrgyz Republic on Public-Private Partnerships in the Kyrgyz Republic adopted on February 22, 2012 (last amended June 22, 2016).
8. Law on Investments in the Kyrgyz Republic adopted on March 27, 2003 N 66 (last amended February 13, 2015)
9. National Energy Program for 2008-2010 and Development Strategy for the Fuel Energy Sector until 2015 approved by the Parliament on April 24, 2008
10. The Program for Development of Small Hydroelectric Power Plants in the Kyrgyz Republic in 1999-2005 approved
11. Program for Development of Small and Medium Hydropower approved by the Kyrgyz President's Decree №365 on October 14, 2008
12. Concept for the Development of Small Hydropower in 2015-2017 approved by Decree of the Kyrgyz Government on July 20, 2015 № 507.
13. Decree of the President of the Kyrgyz Republic on the Directorate for Small and Medium Power Generation Projects in the Kyrgyz Republic dated May 2, 2008 No 155
14. Regulations on Tenders for the Right to Construct Small Hydropower Plants in the Kyrgyz Republic approved by the Kyrgyz Government by its Decree #175 on March 24, 2017 (amended on June 14, 2017).
15. Resolution of the Government "On the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic", approved by Governmental order of the Kyrgyz Republic of July 15, 2016 No. 401
16. Decree of the Kyrgyz Government #660 on Approval of the Mid Term Tariff Policy for Electrical and Thermal Energy for 2014-2017 dated November 20, 2014.
17. Decree of the Kyrgyz Government #421 on Approval of amendments to the Mid Term Tariff Policy for Electrical and Thermal Energy for 2014-2017 dated August 1, 2016.

18. Regulation on procedure for construction, acceptance and connection of small hydro power plants to electric networks approved by Resolution No. 478 of the Government of the Kyrgyz Republic dated July 28, 2009
19. Regulation on the State Agency for Regulation of FEC under the Government of the Kyrgyz Republic approved by Resolution No. 650 of the Government of the Kyrgyz Republic dated November 14, 2014
20. Regulations on the Agency for Architecture, Construction and Public Utilities under the Government of the Kyrgyz Republic approved by the Resolution No. 372 of the Government of the Kyrgyz Republic dated June 24, 2013
21. Regulation on State Inspectorate for Environmental and Technical Safety Under the Government of the Kyrgyz Republic approved by Resolution No. 136 of the Government of the KR dated February 20, 2012
22. Regulation on the Procedure for State Environmental Expert's Examination in the Kyrgyz Republic approved by Resolution No. 248 of the Government of the Kyrgyz Republic dated May 7, 2014
23. Regulation on Center for Standardization and Metrology under the Ministry of Economy of the Kyrgyz Republic approved by Resolution No. 91 of the Government of the KR dated February 12, 2010.

Appendix H: Entry regimes for renewable energy projects: International experience

Specific characteristics of licensing and permitting procedures often depend on the type of 'entry regime'—that is, the manner in which private investors enter into RE generation. Entry options range from auctions over tendering of specific sites to standardized procedures for unsolicited small plants (Appendix table H.1).

A key feature that determines the attractiveness of an entry regime is whether the RE plant will benefit from a long-term offtake agreement at a price guaranteed throughout the duration of the agreement which allows to lower the risk of recovery of the investment. Only in advanced markets where RE technologies can be deployed at or below grid parity will the absence of this feature not represent a handicap for RE development.

The size and potential number of RE projects within a given plant category play an important role in determining the type of entry regime adopted. Two or more different entry regimes can co-exist in the same country—for example, auctions for large on-grid projects and standard applications coupled with light-handed regulations for unsolicited small projects (stand-alone or connected to the grid).

Although the type of entry regime has a large impact on the sequence and the design of permitting and licensing procedures, the regulatory burden on project developers is not necessarily heavier or lighter under one regime or another, with the deliberate exception of light-handed regulation for small projects with minor anticipated environmental impact.

Appendix Table H.1. Overview of most common entry regimes worldwide (with guaranteed long-term offtake)

Entry regime	Characteristics
Approval of project applications according to prespecified screening criteria (three options)	*Approval of all applications that meet screening criteria* • Developers select their own sites and obtain required permits and available support payments in return for compliance with regulatory requirements. • The exclusive right to develop a site is granted to any qualified developer for a predetermined period over which the developer must demonstrate that the project is moving forward. • Suitable for small- and medium-sized projects to which standard screening criteria can be applied. • Recommended where the preselection of sites by a central authority does not make sense because of the large number of possible projects. • Most effective if combined with standard-term power purchase agreements, offtake conditions (including price), and connection agreements.
	Selective approval of applications • Similar to above, except that support is not offered to *all* qualified projects. • Additional screening occurs when the number of applications exceeds the number of projects that can obtain public support because of capacity caps or grid-access limitations. • Sufficient institutional capacity for stage-two screening is required, and the process has to be transparent and verifiable at each stage.

Entry regime	Characteristics
	• Selective approval substantially increases risk for developers preparing initial proposals; in most cases, competitive procurement (last option below) would be preferable in terms of transparency and predictability.
	Simplified licensing regime for small-scale or off-grid projects • Similar to universal approval but with reduced bureaucratic and administrative burden. • Fewer procedures and requirements (e.g., less rigorous environmental clearance requirements). • Increased use of standardized documents such as standard contracts, application forms, and so on. • Fast-track procedures compared with larger projects. • Simple registration rather than licensing is an option; implementation at local level can be considered. • Appropriate for rural electrification, off-grid, and isolated mini-grid projects.
Negotiated contracts	• Unsolicited proposals to government or utility and direct negotiation of offtake price and other key contract terms between project developer and relevant authority, often on the basis of an initial memorandum of understanding. • Reliance on private sector for identification of market opportunities, particularly for large, unique projects that lack comparators or replicability. • Significant governmental capacity (in-house or imported) is required to negotiate balanced contract terms. • Licenses and permits are obtained case by case. • Risk of nontransparency / corruption.
Tender of specific sites	• Call for bids for rights to develop one or more preselected RE sites at least cost. • Site and technology selection done upfront by government or utility. • Due to high transaction costs, this option is most suitable for medium-size and large projects. • Licensing and approval process can be packaged within the winning bid (winning bidder is automatically assured land-use and resource rights). • Different degrees of specification of what exactly is put up for tender, from detailed specification of connection agreement and terms of power purchase agreement, to general rights for the use of the site (with bidders specifying key contractual terms in their bids). • Assessment can be done in several stages (prequalification and selection) and be based on qualitative and quantitative criteria.
Auctions, competitive procurement, or public tendering of RE capacity	• Competitive procurement of new capacity without preselection of sites. • Key objective is to procure new generation at the least possible cost while allowing for private initiative in site selection and project design. • May be technology neutral or technology specific. • Auction may be designed in various ways, with weighting of both price and non-price factors. • Recommended in high-capacity environments with good availability of RE resources and the potential for a large number of RE projects. • Best results require coordinated grid planning to ensure interconnection of winning sites without delays.

Is there recognized best practice for permitting regimes?

Optimal solutions are case-specific but follow key common principles:
Because regulatory procedures differ from country to country, recognized good practice tends to be country-specific. For example, Tenenbaum and his colleagues (2014) describe Sri Lanka's permitting regime as very transparent and well-designed. However the authors acknowledge that Sri Lanka's experience cannot necessarily be replicated in its entirety in

other countries, warning that “it is dangerous to espouse a single best practice for all countries at all times.”

Despite the need for flexibility at the country level, it is possible to identify principles of a permitting regime that provides certainty to investors and project developers, thereby reducing their transaction costs, while also allowing public authorities to make sure that renewable resources are developed within the expected timeframe and in a sustainable and fiscally responsible way. Licensing and permitting procedures under such best-practice regimes are designed to take into consideration the available capacity of approving authorities.

As a general rule, of course, the regulatory institutions should have as much independence from political and stakeholders’ interests as possible. Best-practice regimes are also clear and transparent, stable and predictable, with enforceable processing deadlines, without retroactive changes. They contain a recourse mechanism and avoid having same information reviewed more than once by different offices. The sequencing of different procedures is logical and ensures maximum *ex ante* visibility: key regulatory decisions (on grid connection, offtake tariffs, etc.) are determined early in the project-development process so as to facilitate rather than discourage commercial financing.

A permitting regime that does not meet best-practice criteria and therefore is not attractive for private investors is marked by inconsistencies between legal/regulatory requirements and *de facto* practices. Application processes may be duplicative (for example, the same documents may require two different authorizations from the same institution), and tariffs may have to be negotiated with the national utility (or other offtaker) and approved by the regulator *after* the plant is commissioned.

As governments assess their permitting regime, each procedure should be viewed from the perspective of necessity (Is it really necessary?), effectiveness (Does it achieve its purpose?), and efficiency (Can it be streamlined, simplified, automated, or combined with other existing procedures?).