Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No: PAD2164

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT

IN THE AMOUNT OF SDR 16.3 MILLION
(US$23 MILLION EQUIVALENT)

AND ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 16.3 MILLION
(US$23 MILLION EQUIVALENT)

TO THE

KYRGYZ REPUBLIC

FOR A

HEAT SUPPLY IMPROVEMENT PROJECT

OCTOBER 5, 2017

Energy & Extractives Global Practice
Europe and Central Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective August 31, 2017)

Currency Unit	=	KGS
KGS 68.990	=	US$ 1
US$ 0.708	=	SDR 1

FISCAL YEAR
January 1 - December 31

Regional Vice President:	Cyril E Muller
Country Director:	Lilia Burunciuc
Senior Global Practice Director:	Riccardo Puliti
Practice Manager:	Sameer Shukla
Task Team Leaders:	Kathrin Hofer, Yabei Zhang

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ARIS	Agentstvo Razvitiya I Investirovanya Soobschtv Kyrgyzkoi Respubliki (Community Development and Investment Agency)
BTS	Bishkekteploset
CAEWDP	Central Asia Energy-Water Development Program
CAPEX	Capital Expenditures
CHP	Combined Heat and Power
CIS	Commonwealth of Independent States
CJSC	Closed Joint Stock Company
CO	Carbon Monoxide
CPS	Country Partnership Strategy
CQS	Consultants' Qualification Selection
DA	Designated Account
DC	Direct Contracting
DCSR	Debt-Service Coverage Ratio
DH	District Heating
DPO	Development Policy Operation
EBIT	Earnings Before Interest and Taxes
EBRD	European Bank for Reconstruction and Development
ECA	Europe and Central Asia
ECAPDEV	Europe and Central Asia Regional Capacity Development
EEU	Eurasian Economic Unit
e-GP	Electronic Government Procurement
ESMAP	Energy Sector Management Assistance Program
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EPP	Electric Power Plant
ERP	Enterprise Resource Planning
FBS	Fixed Budget Selection
FM	Financial Management
Gcal	Giga Calories
GDP	Gross Domestic Product
GJ	Giga Joules
GNI	Gross National Income
GPS	Geographic Positioning System
GRM	Grievance Redress Mechanism
HSIP	Heat Supply Improvement Project
IC	Individual Consultation selection procedure
ICB	International Competitive Bidding

IDA	International Development Association
IFAC	International Federation of Accountants
IFR	Interim Un-audited Financial Report
IFRS	International Financial Reporting Standards
IHS	Individual Heat Substations
ISA	International Standards on Auditing
ISP	Implementation Support Plan
ITQ	Invitation to Quote
KGS	Kyrgyzstani Som
KyrSEFF	Kyrgyz Sustainable Energy Financing Facility
LCS	Least Cost Selection
LPB	Low pressure boiler
MBPF	Monthly Benefit to Poor Families
M&E	Monitoring and Evaluation
MOU	Memorandum of Understanding
MTTP	Medium Term Tariff Policy
MUV	Manufactures Unit Value
NCB	National Competitive Bidding
NGO	Non-Governmental Organization
NSDS	National Sustainable Development Strategy
OM	Operational Manual
O&M	Operation and Maintenance
OJSC	Open Joint Stock Company
PAC	Project Advisory Committee
PEFA	Public Expenditure and Financial Accountability
PFM	Public Financial Management
PIU	Project Implementation Unit
RAP	Resettlement Action Plan
RKDF	Russian Kyrgyz Development Fund
RPF	Resettlement Policy Framework
PAC	Project Advisory Committee
PAD	Project Appraisal Document
PDO	Project Development Objective
$PM_{2.5}$	Particulate Matter, 2.5 micrometers or less
PPD	Public Procurement Department
PPL	Public Procurement Law
PRAMS	Procurement Risk Assessment and Management System
PSIA	Poverty and Social Impact Assessment
QAA	Quality Assurance Agent
QBS	Quality Based Selection
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan

RPF	Resettlement Policy Framework
SAI	Supreme Audit Institution
SBD	Standard Bidding Document
SCADA	Supervisory Control and Data Acquisition
SECO	State Secretariat for Economic Affairs (Switzerland)
SE4All	Sustainable Energy for All
SORT	Systematic Operations Risk-Rating Tool
SSS	Single Source Selection
SUE	State Unitary Enterprise
T&D	Transmission and Distribution
ToR	Terms of Reference
USD	United States Dollars
VSD	Variable Speed Drive

BASIC INFORMATION

Is this a regionally tagged project?	Country(ies)	Financing Instrument
No		Investment Project Financing

[ ] Situations of Urgent Need of Assistance or Capacity Constraints

[ ] Financial Intermediaries

[ ] Series of Projects

Approval Date	Closing Date	Environmental Assessment Category
27-Oct-2017	31-Dec-2023	B - Partial Assessment
Bank/IFC Collaboration		
No		

Proposed Development Objective(s)

The Project Development Objective is to improve the efficiency and quality of heating in selected Project areas.

Components

Component Name	Cost (US$, millions)
Component 1: Improving supply efficiency and quality of the District Heating system in Bishkek	31.00
Component 2: Piloting efficient and clean heating stoves	5.00
Component 3: Demonstrating the benefits of energy efficiency improvements in public buildings	10.00

Organizations

Borrower :	Kyrgyz Republic
Implementing Agency :	Bishkekteploset JSC (BTS) Community Development and Investment Agency (ARIS)

PROJECT FINANCING DATA (US$, Millions)

[ ] Counterpart Funding	[ ] IBRD	[✔] IDA Credit	[✔] IDA Grant	[ ] Trust Funds	[ ] Parallel Financing

Total Project Cost:	Total Financing:	Financing Gap:
46.00	46.00	0.00
	Of Which Bank Financing (IBRD/IDA): 46.00	

Financing (in US$, millions)

Financing Source	Amount
IDA-61460	23.00
IDA-D2400	23.00
Total	**46.00**

Expected Disbursements (in US$, millions)

Fiscal Year	2018	2019	2020	2021	2022	2023	2024
Annual	1.50	2.99	4.05	7.87	10.67	14.38	4.53
Cumulative	1.50	4.49	8.54	16.41	27.08	41.47	46.00

INSTITUTIONAL DATA

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Environment & Natural Resources
Governance

Social, Urban, Rural and Resilience Global Practice

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

a. Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF

Yes

b. Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment

Yes

c. Include Indicators in results framework to monitor outcomes from actions identified in (b)

Yes

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	High
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	High
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	High
6. Fiduciary	High
7. Environment and Social	Substantial
8. Stakeholders	Substantial
9. Other	
10. Overall	High

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✔] No

Does the project require any waivers of Bank policies?

[ ] Yes [✔] No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✔	
Natural Habitats OP/BP 4.04		✔
Forests OP/BP 4.36		✔
Pest Management OP 4.09		✔
Physical Cultural Resources OP/BP 4.11		✔
Indigenous Peoples OP/BP 4.10		✔
Involuntary Resettlement OP/BP 4.12	✔	
Safety of Dams OP/BP 4.37		✔
Projects on International Waterways OP/BP 7.50		✔
Projects in Disputed Areas OP/BP 7.60		✔

Legal Covenants

Sections and Description

Schedule 2, Section V of the Financing Agreement: Except as the Association shall otherwise agree, BTS shall not incur any debt unless a reasonable forecast of the revenues and expenditures of BTS shows that the estimated net revenues of BTS for each of its fiscal years during the term of the debt to be incurred shall be at least one times the estimated debt service requirements of BTS in such year on all debt of BTS including the debt to be incurred.

Sections and Description

Schedule, Section II.B of the BTS Project Agreement: Not later than 30 days from the Effective Date, BTS shall install an accounting software specifically for the Project accounting, which will have a functionality of automatic generation of the Project financial reports as well as Statements of Expenditures.

Sections and Description

Schedule, Section II, paragraph 4 of the ARIS Project Agreement: ARIS shall, not later than two months from the Effective Date, develop a Project cycle database for Component 2 of the Project in order to track the implementation status and progress, including with regards to registered eligible households and respective household contributions, selected stove suppliers/ products and related payments, as well as the stove installation progress and related payments.

Sections and Description

Schedule 2, Section I.A, paragraph 2.a) of the Financing Agreement: The Recipient shall cause ARIS, not later than 30 days from the Effective Date, to strengthen the capacity of the ARIS Project Implementation Unit and thereafter maintain it during the entire Project implementation period with the staff, functions, terms of references and resources acceptable to the Association, and as further described in the ARIS Project Operational Manual.

Sections and Description

Schedule 2, Section I.A, paragraph 1 of the Financing Agreement: The Recipient, through the State Committee for Industry, Energy and Mining, shall establish, not later than six months after Effective Date, and maintain throughout the duration of the Project, the Project Advisory Committee (PAC) with a composition, roles, responsibilities, and resources satisfactory to the Association. The PAC shall be responsible for providing strategic guidance to the Project.

Sections and Description

Schedule 2, Section IV, paragraph 2 of the Financing Agreement: No withdrawal shall be made for payments made prior to the Signature Date, except that withdrawals up to an aggregate amount not to exceed SDR 496,000 may be made for payments made prior to this date but on or after July 30, 2017, for Eligible Expenditures from the Grant portion of the Financing under Category 1.

Conditions

Type	Description
Effectiveness	ARIS and BTS have adopted the ARIS Project Operational Manual and BTS Project Operational Manual, respectively, both in form and content satisfactory to the Association.

PROJECT TEAM

Bank Staff

Name	Role	Specialization	Unit
Kathrin Hofer	Team Leader(ADM Responsible)	Energy	GEE03
Yabei Zhang	Team Leader	Energy	GEEES
Irina Goncharova	Procurement Specialist(ADM Responsible)	Procurement	GGO03
Garik Sergeyan	Financial Management Specialist	Financial Management	GGO21
Akylai Osmonalieva	Team Member	Assistance	GEE03
Alisher Khamidov	Social Safeguards Specialist	Social	GSU03
Ani Balabanyan	Team Member	Energy	GEE01
Christian Daniel Mahler	Team Member	Energy Efficiency	GEEES
Dung Kim Le	Team Member	Assistance	GEE03
Ekaterina Romanova	Social Safeguards Specialist	Social	GSU07
Emil Zalinyan	Team Member	Economist	GEE03
Hiwote Tadesse	Team Member	Operations	GEE03
Jasna Mestnik	Team Member	Disbursement	WFALN
Ruxandra Costache	Counsel	Legal	LEGLE
Ruxandra Maria Floroiu	Team Member	Environment	GEN03
Volodymyr Tykhyy	Environmental Safeguards Specialist	Environment	GEN03
Zamir Chargynov	Team Member	Energy	GEE03

Extended Team

Name	Title	Organization	Location
Crispin Pemberton-Pigott	Heating Stove Expert		
Herkko Lehdonvirta	District Heating Expert		
Marat Iskakov	Energy Consultant		
Robert van der Plas	Household Energy Specialist		

KYRGYZ REPUBLIC
HEAT SUPPLY IMPROVEMENT PROJECT

TABLE OF CONTENTS

I. STRATEGIC CONTEXT

A. Country Context

1. **The Kyrgyz Republic, with a Gross National Income[1] (GNI) per capita of USD 1,250 in 2014, remains one of the poorest countries in the Europe and Central Asia (ECA) region**. In 2003-2014, GDP growth averaged just above 4% annually, with significant variations from -0.5% in 2010 to 10.9% in 2013. Underlying these variations have been external shocks (world food and energy price shocks in 2008), domestic events (energy supply crisis in 2009 and political turmoil in 2010), and fluctuations in gold production stemming from both geological factors and ad-hoc events (accident at the Kumtor gold mine in 2012). Mimicking the volatility of economic growth, the poverty reduction trend, while generally declining, was uneven: although the poverty rate declined from 49.7% to 17.4% between 2005 and 2014,[2] it has been stagnating since 2009 at around 18%-20% with an uptick in 2013, which underlines the high vulnerability of the population to shocks and economic slowdown. The episodes of economic growth have generally been pro-poor with consumption growth of the bottom 40% being higher than the average (4.7% versus 1% annual consumption growth between 2007 and 2012). As lower income segments gained from growth, inequality indicators have been improving: the consumption-based Gini index declined from 33% in 2005 to 27% in 2014. Nonetheless, important regional disparities persist both in terms of monetary poverty incidence and in terms of access to quality core services. Looking forward, economic growth and poverty reduction will be contingent on economic developments in Russia and Kazakhstan, the main trading partners for the Kyrgyz Republic and destinations for migrant workers.

2. **The energy sector of the Kyrgyz Republic, largely publicly owned, is critical for economic growth.** Adequate and affordable energy supply is fundamental for economic growth, higher living standards and social equity. The delivery of modern energy services helps to improve the quality of life for citizens and expands opportunities for private businesses. In the Kyrgyz Republic, energy is also a source of revenues when it can be produced in sufficient quantities to be exported, thereby helping to diversify the economy and open new markets. The provision of adequate and affordable energy supply ranks among the Government's top priorities, as reflected in the National Sustainable Development Strategy (NSDS) 2013-2017.

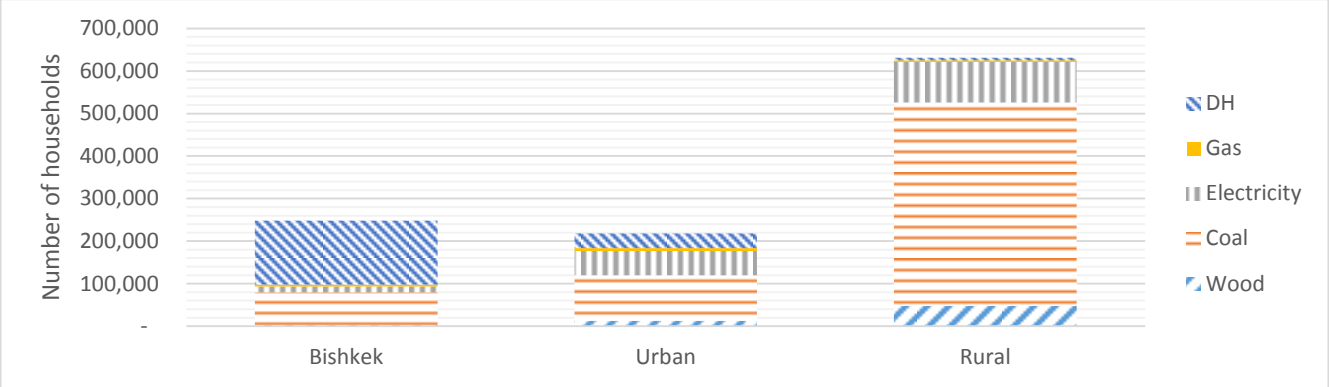
B. Sectoral and Institutional Context

3. **Access to reliable and adequate heat supply is critical for the wellbeing of the population and the delivery of public services in the Kyrgyz Republic**. Given the cold climate and long heating season, access to reliable and adequate heat supply is an essential need in the Kyrgyz Republic. Access to district heating (DH) is limited to about 17% of the 1.1 million Kyrgyz households, mainly located in Bishkek and other urban centers. The remaining 907,000 households have to resort to individual solutions to meet their heating needs during winter, including individual coal-based systems (used by around 60% of all households as primary heating source), followed by electricity (15%), wood and dung (6%), and gas (1%).[3] Adequately meeting heating

[1] Atlas Method
[2] According to the national poverty estimate (based on the national poverty line), 32.1% of the population in 2015 was considered to live in poverty.
[3] These shares refer to the primary heating source; the majority of households use more than one fuel for space heating: 52% of the households living in Bishkek, 42% in other urban areas, and 65% in rural areas use a secondary fuel to keep their homes warm.

demand, however, remains a daunting challenge for a large part of the population and an estimated 25% of residential and public heat demand in urban areas alone remains unmet every winter due to a number of key challenges the heating sector is facing, as outlined below.

Figure 1: Overview of heating solutions in use in the Kyrgyz Republic[4]



4. **Supply reliability and service quality of the largest DH system is deteriorating.** The largest DH system in the country is located in Bishkek and provides heat generated at the Combined Heat and Power (CHP) plant[5] to about 103,000 end-consumers (accounting for more than 70% of all households with access to DH). The CHP plant is operated by the state-owned company Electric Power Plant (EPP) Open Joint Stock Company (OJSC) - owning and operating all major power and heat generation assets in the Kyrgyz Republic, including the CHP plants in Bishkek and Osh. The state-owned company Bishkekteploset (BTS) OJSC operates the heat transmission and distribution network connected to the CHP plant in Bishkek.[6] Overall, the reliability of the DH system in Bishkek is deteriorating as evidenced by the number of network failures per heating season, which increased from around 50 in 1991 to more than 300 in recent years. In terms of quality of supply, around 85% of households with access to DH in Bishkek complain that their apartment is either too warm or too cold. Providing adequate heat supply is particularly difficult during peak hours and at the outskirts of the DH network, where heat and hot water supply are often insufficient, resulting in under-heated apartments and requiring customers to occasionally resort to back-up solutions, such as electric heating.

5. **High heat and water losses on the supply-side are accentuated by the widespread use of norm-based billing practices on the consumer-side.** Due to its old age and dilapidated condition, the DH system in Bishkek is characterized by high losses: thermal energy and water losses in BTS' network are estimated to account for 29% and 42% of the heat and hot water dispatched from the CHP plant (normalized average in 2013-2016), respectively. These supply-side losses are accentuated by the lack of incentives for energy efficiency on the demand-side, which is mainly due to the absence of control and metering equipment at building- and apartment-level and the related use of norm-based billing practice. In 2016, about 25% of heat energy and 34%

[4] Source: World Bank, 2015, Keeping Warm: Urban Heating Options for the Kyrgyz Republic. Urban refers to urban areas other than Bishkek.
[5] The installed capacity of the CHP plant in Bishkek (after its ongoing modernization) is 812 MW of electricity and 1,294 GCal/hour of heat. The CHP plant mainly uses coal (96%), supplemented by small amounts of natural gas (2%) and mazut (2%).
[6] Other major DH companies operating in the country include: Bishkekteploenergo (owned by the city of Bishkek, and operating heat-only-boilers and related networks that serve about 26,000 customers in Bishkek) and Kyrgyzhilkommunsoyuz (municipally-owned, and operating heat-only-boilers and related networks providing heat to about 53,000 customers in 24 cities).

of hot water was invoiced based on metering[7] and the rest based on normative consumption. This means that the majority of customers served by BTS are billed for heat and hot water based on norms, rather than actual consumption, with little incentives to consumers to save energy.

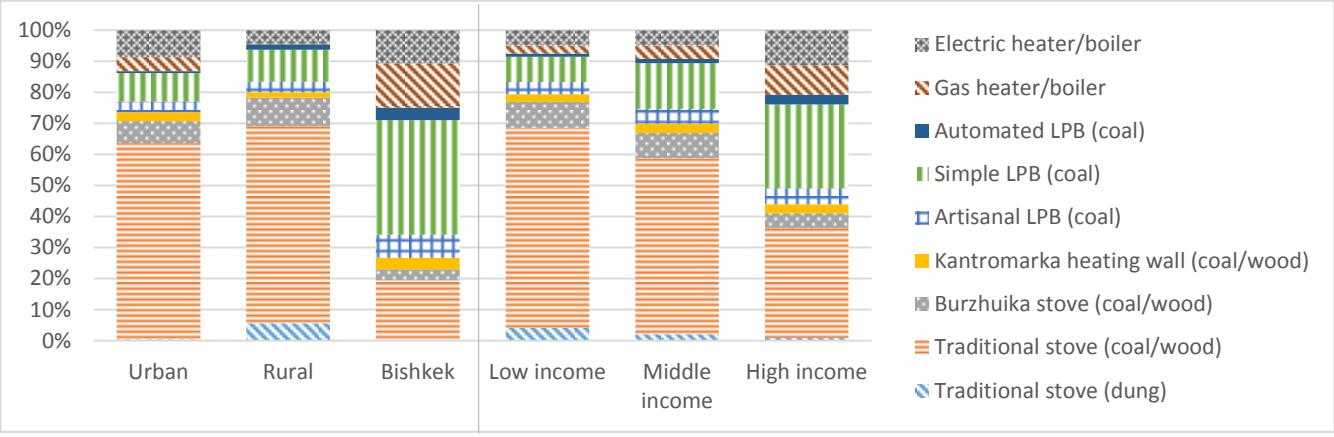
6. **Low tariffs have been the key reason for the sector's decline.** The underlying reason for the continued decay of assets and financially weak energy sector companies are the low end-user tariffs for heat, hot water and electricity, which remain significantly below cost-recovery levels[8] despite substantial improvements in the last three years: in 2014, the Government adopted a new Medium-Term Tariff Policy (MTTP) for electricity, DH and hot water for 2014-2017, and implemented subsequent end-user tariff increases in 2014 and 2015, which were supported under an Energy Sector Development Policy Operation (DPO) and a Governance and Competitiveness DPO. As a result, between December 2014 and April 2015, residential and non-residential tariffs for heat and hot water were increased between 59% and 89%.[9] The impact of this sizeable increase on household expenditures remained relatively modest, as assessed through a quantitative Poverty and Social Impact Assessment (PSIA) conducted in 2016: households in the Kyrgyz Republic spend on average 2.5% of their monthly expenditures on electricity, 3.5% on DH and 2.5% on hot water (if connected to centralized supply).[10] In order to help mitigate the impact of higher energy prices on the poor and other population groups, the Government has developed several blunt mechanisms, such as increasing compensation to recipients of the so-called Monthly Benefit to Poor Families (MBPF) – a cash transfer program targeting the poor – pensioners and public servants. While the tariff increases helped to improve the sector revenue, as of 2016, end-user tariffs for heat and hot water are estimated to remain between 33% and 63% of cost recovery (see Annex 4). In addition, ahead of elections scheduled to take place in Fall 2017, the continued implementation of end-user tariffs as per the MTTP has been suspended and is expected to be resumed only in 2018.

7. **Given the limited access to DH and lack of viable alternatives, the majority of Kyrgyz households, especially among lower income segments, rely on traditional solid fuel-fired stoves as their primary heating source.** Among households without access to DH, close to two thirds in urban and rural areas and one fifth of households in Bishkek use a traditional coal-fired stove[11] as their primary heating source (totaling about 532,000 households). The second most common heating system in use are simple coal-fired low pressure boilers (LPBs),[12] installed in 37% of households in Bishkek and around 10% in urban and rural areas, respectively (see Figure 2). Viable alternatives to traditional solid fuel-based heating systems remain limited in the short-to medium-term, in particular for low income households: (i) given the recurrent winter power shortages and the already strained capacity of the electricity network, increasing the use of electricity for heating purposes is not a viable alternative – rough estimates indicate that a switch to electricity by households currently using solid fuel would increase winter peak load by about 50%; (ii) access to gas remains limited to wealthier households in Bishkek and select cities as no significant expansion of the gas network and supply to new residential customers

[7] The majority of heat metered customers are non-residential buildings (e.g. public and industrial buildings).
[8] Cost-recovery refers to annual cash requirements only, including debt service on capital expenditures (CAPEX) but excluding depreciation and other non-cash items.
[9] Specifically, in 2014-2015, residential heat tariffs were increased by 59% (from KGS 715/GCal to KGS 1,134/Gcal), and for other consumers groups by 82% (from KGS 929/Gcal to KGS 1,695/Gcal); and domestic hot water tariffs for residential consumers were increased by 89% (from KGS 518/Gcal to KGS 981/Gcal), and for other consumers by 82% (from KGS 929/Gcal to KGS 1,696/Gcal).
[10] The shares are estimated relative to total household consumption expenditures. In terms of total household income, the spending on energy is higher.
[11] Traditional stoves include traditional dung- or coal-fired stoves, Burzhuika stoves and Kantromarka heating walls.
[12] Simple LPBs is used to refer to non-automated LPBs.

is planned in the next five years;[13] (iii) taking into account the daunting challenges in the DH sector and its lack of viability in low density areas, access to centralized heating will remain limited to major urban centers; and (iv) renewable energy resources for space heating applications at the household level are limited (e.g. there are no sizeable renewable biomass resources, and other renewable energy resources, such as solar or geothermal, are not yet financially viable for space heating purposes at the household level).

Figure 2: Heating systems by location and income level for households without access to DH[14]



8. **Traditional stoves and LPBs in use are highly inefficient, polluting and resulting in low comfort levels**. The thermal efficiency of stoves and simple LPBs in use by the majority of Kyrgyz households is limited to around 25%-40%. As a result, fuel consumption and related household expenditures are unnecessarily high and could be reduced by about 45%-50% (depending on the current comfort levels) by switching to more efficient models.[15] On average, households without access to DH spend between 7% and 12% of their expenditures on heating, with low income households and households using gas spending the most. In addition, the current stoves and LPBs are often polluting and emitting large amounts of carbon monoxide (CO) and fine particulate matters ($PM_{2.5}$), causing indoor and outdoor air pollution with negative health and environmental impacts. Notably, measurements conducted as part of a trial phase on efficient and clean heating stoves implemented during the 2016/2017 heating season (see Annex 5) showed that $PM_{2.5}$ emissions reach levels of up to 11.5 mg/m^3 during ignition and refueling of the stove (WHO Air Quality Guidelines for the annual mean of $PM_{2.5}$ concentration refer to 0.01 mg/m^3). In particular, women and children who spend more time at home are negatively impacted by indoor air pollution – over half of the children and adults surveyed as part of the trial phase showed signs of cough, headaches and other discomforts, especially after ignition and refueling of the stoves. Close to 90% of households surveyed confirmed that their stove/LPB causes heavy smoke during ignition and refueling with detrimental impact on their home environment and health. In addition, traditional heating stoves and LPBs currently in use often provide insufficient comfort levels, including inadequate indoor temperatures and/or reduced living space during winter months, and require frequent refueling and extensive cleaning of chimneys. Currently, there is no local market for affordable, efficient and clean heating stoves and LPBs in the Kyrgyz Republic (see Annex 1).

[13] While Gazprom continues to make improvements in select local gas networks, major reconstruction and expansion investments (planned to target industrial customers in the initial phase) have been put on hold due to the economic situation in Russia.
[14] Source: Representative household survey (Bishkek, urban and rural) on individual heating options conducted in 2016.
[15] Well-designed simple stoves and LPBs can achieve thermal efficiency levels between 70% and 85%.

9. **Women, children and elderly are impacted the most by inadequate heat supply as they spend more time at home**. In households without DH, at times when women are home alone, they report not heating it to full comfort levels in order to save energy (costs). Households also indicate limiting the heating space by occupying only one room and closing down the rest of the house for winter in order to reduce heating expenses.[16] Women are also usually responsible for cooking and refueling the stoves, which makes them more exposed to indoor air pollution caused by insufficient burning of solid fuel.

10. **High heat losses of buildings exacerbate inefficient and inadequate heat supply.** The Kyrgyz Republic ranks among the 15 most energy intensive developing countries worldwide. The buildings sector is one of the main energy consumers, particularly in terms of electricity consumption, which continues to grow at a fast pace, partially driven by the low energy efficiency of the Kyrgyz building stock. The public sector accounted for about 10% of total electricity consumption in 2014 with an upward pressure that is partially controlled by the enforcement of power consumption limits for public buildings. The majority of the public buildings stock was constructed 25-60 years ago during the Soviet period without any energy efficiency considerations. Accentuated by insufficient resources for maintenance, public buildings are characterized by high heat losses due to the dilapidated condition of the building envelope and the heating system, and are poorly maintained. In addition, an urban heating assessment completed in 2015[17] confirmed that, on average, around 20-30% of the heat demand in public buildings in urban areas remains unmet every year due to the high heat loss of buildings combined with insufficient and unreliable heat and electricity supply. As a result, many public buildings are severely under-heated with negative impacts on public service delivery, comfort levels and well-being of students, toddlers and staff. In addition, while the territory of the Kyrgyz Republic is subject to high seismic hazards,[18] according to a recent study, about 80% of schools and kindergartens in the country have low seismic safety ratings and are likely not compliant with the local seismic safety regulation.

11. **A mix of investment and policy measures is needed to help address key challenges in the heating sector and meet heat demand in a sustainable manner.** The above referenced urban heating assessment identified the following key policy and priority investments to improve the heating situation in residential and public buildings, and help the country address its winter energy shortages: (i) consistent implementation of tariff and social assistance reforms; (ii) rehabilitation of the DH network in Bishkek to help improve the reliability and efficiency of the largest DH system in the country, and reduce the need for back-up electric heating; (iii) implementation of a program to incentivize the replacement of inefficient coal-fired stoves and LPBs at the household level with more efficient models; and (iv) implementation of energy efficiency investments in public buildings to help reduce heat losses, improve comfort levels and demonstrate the benefits of energy efficiency improvements. Other investment areas recommended in the heating sector, such as the gradual replacement of small electric and coal-fired heat-only-boilers with efficient gas-fired models, remain subject to increased availability of gas in the Kyrgyz Republic. The investment priorities were identified based on a multi-criteria assessment, which combined a levelised cost assessment of heat supply options with technical, institutional, environmental and social considerations.

[16] World Bank, 2014, Poverty and Social Impacts of Energy Reforms in the Kyrgyz Republic: Summary of Qualitative Assessment.
[17] World Bank, 2015, Keeping Warm: Urban Heating Options in the Kyrgyz Republic. The assessment was supported by the Energy Sector Management Assistance Program (ESMAP) and the Central Asia Energy Water Development Program (CAEWDP).
[18] The seismic map of the country classifies settlements based on expected seismic intensity according to the Medvedev-Sponheuer-Karnik scale; the majority of the territory of the country is classified at the 6-9 or higher macro-seismic intensity scale.

12. **The Government recognizes the importance of improving the efficiency and quality of heating**. Reducing the reliance on electricity for heating purposes during winter months, cutting technical and commercial losses in the DH sector and improving access to reliable and efficient heating services for the population figure among the key priorities of the Government in the heating sector, as reflected in the NSDS and the long-term Strategy for Heat Supply (2004-2015). In recent years, the Government initiated a number of actions to help improve the operational and financial performance in the overall energy sector: (i) establishing the State Regulatory Agency for the Fuel and Energy Complex as the single economic regulator for the energy sector; (ii) adopting the MTTP for heat, hot water and electricity (2014-2017), and implementing related end-user tariff increases in 2014-2015 (see paragraph 6); (iii) revising and adopting the tariff setting methodology for power and heating companies; (iv) approving and implementing a performance reporting and monitoring framework, which includes monitoring and publishing of quarterly service quality indicators for power and heating companies; (v) ongoing modernization of the CHP plant in Bishkek to improve heat generation reliability and efficiency (expected to be completed by the end of 2017); and (vi) adopting action plans to help reduce the electric load from public buildings, including options such as installation of solar panels, solar water heating, consumption limits and fuel switching of heating systems.

13. **The proposed Heat Supply Improvement Project (HSIP) supports the Government's objectives in the heating sector and helps to address recurrent winter energy shortages**. Specifically, improving the efficiency and quality of heating supports the Government's sector strategy in the following ways: (i) helping to mitigate a further increase in electricity consumption for heating by improving DH services in Bishkek and by reducing the electricity consumption in selected public buildings through energy efficiency improvements; (ii) complementing the ongoing modernization of the CHP plant by network improvements of the DH system to ensure that the expected benefits of the investment reach end-users; (iii) ensuring that current and future heat and hot water tariff increases are accompanied by improvements in heat supply quality and reliability as well as by introducing the concept of consumption-based billing; and (iv) reducing fuel consumption, expenditures and health costs associated with the use of inefficient and polluting heating technologies for vulnerable households.

14. **The HSIP builds on the Bank's strong engagement in the energy sector**. The Project builds on and complements other World Bank-supported activities in the Kyrgyz Republic, including: (i) results and key recommendation of the urban heating assessment completed in 2015; (ii) priority investments identified as part of a technical and economic assessment of BTS' network; (iii) an Energy Sector DPO and a subsequent Governance and Competitiveness DPO, which, inter alia, supported the adoption of the MTTP for 2014-2017 and related end-user tariff increases in 2014 and 2015 (see paragraph 12); going forward, the World Bank is planning to resume support for critical energy policy reforms after the elections through DPOs and/or other instruments; (iv) a comprehensive technical assistance program in the energy sector since 2014, which helped to inform policy reforms supported under the aforementioned DPOs and that will continue providing support for the development of a new MTTP for 2018-2023, public outreach campaigns and PSIA analysis; (v) the Urban Development Project, which pilots the integration of seismic and energy efficiency retrofits in six public buildings; (vi) technical assistance to support the Government in developing a Roadmap for improving energy efficiency in public buildings; and (vii) an ongoing technical assistance program on efficient heating solutions, which included a detailed supply- and demand-side market assessment for households without access to DH, a trial phase supporting the development and testing of solid fuel-based efficient and clean heating stoves and LPBs in 51 low income households in four Oblasts (Jalalabad, Osh, Naryn and Chui) as well as extensive capacity building to local manufacturers, stove designers, installers and policy makers. Further details on the trial phase are presented in Annex 5 of this PAD.

C. Higher Level Objectives to which the Project Contributes

15. **The proposed Project is aligned with and supports the Country Partnership Strategy (CPS) for 2013-2017**. The current CPS highlights public service delivery as well as maintenance of scarce natural resources and physical infrastructure, including energy, as one of the three areas of focus in 2013-2017. While the new CPS is under preparation, the underlying draft Systematic Country Diagnostic emphasizes challenges and opportunities in the energy sector as a continued focus area going forward.

16. **Link to the Bank's twin goals.** Poor efficiency and quality of heating during cold winter months has significant economic costs and negatively impacts the living conditions of the poor, who have: (i) less access to affordable back-up solutions in case of DH supply interruptions; (ii) rely more on low-end heating technologies that are inefficient and polluting (see Section I.B, Figure 2); and (iii) suffer from lower comfort levels in their homes during winter months due to under-heating and the need to save energy costs. In particular, Component 2 (piloting efficient and clean heating stoves) has a strong poverty reduction impact given its focus on low income households: it reduces fuel costs for poor households, thus freeing-up limited resources for other essential needs, while also improving the quality of life in terms of better indoor comfort levels and reduced negative health impacts associated with indoor air pollution. In addition, using more efficient and cleaner stoves and LPBs will also help to reduce carbon emissions and ambient air pollution.

17. **Link to Sustainable Energy for All (SE4All).** By improving the efficiency of the DH system in Bishkek, providing access to affordable, efficient and clean individual heating solutions for low income households and improving energy efficiency in selected public buildings, the Project contributes to the SE4All initiative, which calls for a doubling of the global rate of improvement in energy efficiency and universal access to modern energy services.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

18. The Project Development Objective (PDO) is to improve the efficiency and quality of heating in selected Project areas.

19. This will be achieved through: (i) improving supply efficiency and quality of the DH system in Bishkek; (ii) piloting efficient and clean heating stoves; and (iii) demonstrating the benefits of energy efficiency improvements in public buildings.

B. Project Beneficiaries

20. The proposed Project is expected to have a broad range of stakeholders and beneficiaries, including the following:

- *Beneficiaries of Component 1:* The main beneficiaries of improved supply efficiency and quality of the DH system in Bishkek are residential, public and commercial customers served by BTS. In addition, BTS and the Energy Holding Company will benefit from enhanced operational performance and related capacity building activities supported under the Project;

- *Beneficiaries of Component 2:* About 14,000 low income households without access to DH (located in selected pilot rayons outside of Bishkek) are expected to directly benefit from affordable, efficient and clean heating stoves and LPBs promoted under Component 2. Another important beneficiary group are local stove manufacturers and service providers (e.g. designer and installers), who will benefit from expanded business opportunities and targeted capacity building provided under the Project;
- *Beneficiaries of Component 3:* Improved comfort levels, higher resilience and better functionality of public buildings selected under Component 3 (e.g. schools, hospitals, kindergartens, clinic centers, etc.) will primarily benefit patients, students/ toddlers, medical staff and teachers working and spending most of their days in these facilities. Local governments are also expected to benefit from reduced recurrent energy costs and an enhanced public service delivery environment. In addition, local companies (e.g. energy auditors, design institutes, construction and supervision companies) will benefit from increased demand for energy efficiency services and civil works as well as improved capacity and experience in identifying, preparing and implementing energy efficiency and seismic investments.

21. **Gender considerations.** In particular, women, the elderly, and children are expected to benefit from improved efficiency and quality of heating given that they spend more time at home, are disproportionally impacted by supply interruptions as well as low comfort levels (e.g. under-or over-heating, indoor air pollution), and are responsible for heating and cooking in most households.

C. PDO-Level Results Indicators

22. The proposed key results indicators for the Project include: (i) projected lifetime fuel savings (MJ), which is a corporate results indicator to capture energy efficiency improvements; and (ii) percentage of Project beneficiaries reporting an improvement in quality of heating.

III. PROJECT DESCRIPTION

A. Project Components

23. The Project consists of three components: (1) Improving supply efficiency and quality of the DH system in Bishkek; (2) Piloting efficient and clean heating stoves; and (3) Demonstrating the benefits of energy efficiency improvements in public buildings.

24. **COMPONENT 1: Improving supply efficiency and quality of the DH system in Bishkek (estimated USD 31 million IDA financing).** This Component will support priority investments and capacity building activities aimed at improving the supply efficiency and quality of the DH system in Bishkek. The Component will be implemented by BTS and consists of two Subcomponents.

25. **Subcomponent 1.1: Priority investment program for DH rehabilitation (estimated USD 30 million IDA financing)**. This Subcomponent will support the preparation and implementation of a priority investment program for the DH system operated by BTS, including related goods, works and consulting/ non-consulting services. The investment packages were selected based on a comprehensive technical and economic assessment of BTS' DH system completed in 2015, using the following criteria for prioritization: (i) impact on heat and hot water loss reduction as measured by the economic rate of return; (ii) impact on supply reliability

and quality assessed based on the technical condition of the DH network (e.g. age and condition of assets, breakdown statistics and number of customers connected); and (iii) complementarity with planned investments financed by BTS and other development partners (see Section IV.D). Accordingly, the two priority investment packages supported under Subcomponent 1.1 include:

- *Package 1: Modernization of individual heat substations (IHS) at building-level.* This package will support: (i) installation of new IHS in about 231 residential multi-apartment buildings; (ii) reparation and upgrade of existing IHS in about 1,700 residential multi-apartment buildings; (iii) installation of about 4,000 building-level heat and hot water meters with remote reading functions ('smart meters'); and (iv) installation of a preventive maintenance information system for substations.
- *Package 2: Replacement and reconstruction of the 'Vostok' transmission network*. This package will finance the replacement, rerouting and reconstruction of about 1.87 km (trench length) of the most dilapidated sections of one of the five main transmission pipelines ('Vostok' transmission pipeline) with pre-insulated underground and above-ground pipes.

26. The design and bidding documents for the selected investment packages will be prepared with the support of preparation grants provided by the ECA Regional Capacity Development Trust Fund (ECAPDEV)[19] and are expected to be finalized in late 2017/ early 2018. Thereafter, BTS will launch the procurement of related goods and civil works prior to Project effectiveness in accordance with the agreed Procurement Plan.

27. The following benefits are expected as a result of the two priority investment packages: (i) saving heat and hot water by decreasing technical and commercial network losses and reducing end-user consumption; (ii) improving the quality of heat supply through better temperature and flow control at building-level; (iii) enhancing supply reliability by preventing further dilapidation of sections along an essential transmission pipeline, which provides heat to about 31% of BTS' customers; (iv) increasing heat and hot water transmission capacity to end-consumers; (v) introducing consumption-based billing for about 56% of BTS' customers through the installation of building-level heat and hot water meters; and (vi) improving BTS' maintenance practices and reducing emergency interventions through the installation of a preventive maintenance information system and implementation of the proposed investment packages.

28. **Subcomponent 1.2: Operational capacity strengthening and Project implementation support for BTS (estimated USD 1 million IDA financing).** This Subcomponent will finance activities aimed at strengthening BTS' technical, operational, fiduciary, customer orientation and corporate resource management functions, and ensuring effective Project implementation. Specific activities to be supported include: (i) supporting the upgrade of BTS' billing system to facilitate the transition to consumption-based billing and ensure proper revenue accounting; (ii) assisting BTS in improving the management of its corporate resources by assessing and identifying changes in its corporate strategy and developing specific actions to help strengthen corporate processes and activities (e.g. through reduction of manual entry points or integration of additional information management tools); (iii) conducting information and awareness campaigns to households to strengthen customer support and understanding of planned investments in a transparent way; (iv) supporting the optimization of BTS' operating regime through improvements of temperature and variable flow parameters applied in BTS' network; (v) enhancing BTS' technical and operational capacity – including fiduciary, technical, operational and customer orientation functions – through targeted training and technical assistance activities;

[19] The ECAPDEV supports critical preparation activities of the HSIP. The Grant Agreement was signed on June 7 and became effective on September 21, 2017. The procurement of qualified design companies is ongoing.

and (vi) providing Project implementation support, including strengthening of the Project Implementation Unit (PIU) with qualified fiduciary and safeguards consultants, conducting Project monitoring and evaluation activities (e.g. customer satisfaction surveys), supporting Project and entity audits by qualified companies acceptable to the World Bank, and covering Project incremental operating expenses.

29. **COMPONENT 2: Piloting efficient and clean heating stoves (estimated USD 5 million IDA financing).** This Component aims to pilot efficient and clean heating solutions for households that don't have access to DH and are relying on traditional, inefficient and polluting solid fuel-fired heating stoves and LPBs. This Component will be implemented by the Community Development and Investment Agency (ARIS) and consists of two Subcomponents.

30. **Subcomponent 2.1: Incentive program for low income households (estimated USD 4.4 million IDA financing)**. This Subcomponent will support an incentive program targeting eligible low income households in selected pilot rayons in order to help: (i) promote the development of a local market for efficient and clean heating technologies by fostering demand and facilitating quick market penetration; and (ii) improve the heating situation for poor households by providing access to affordable, efficient and clean solutions. The Subcomponent will finance incentive payments towards the cost of eligible stoves and LPBs (equaling about 70% of the estimated market price for eligible stoves and 60% of the estimated market price for eligible LPBs),[20] their installation and the recycling of old stoves/ LPB as well as related implementation structures. Key program features will be detailed in the Operational Manual (OM)[21] and are summarized below and in Annex 1.

31. ***Selection of pilot rayons and eligibility criteria for households***: The incentive program is designed as a pilot, which will be tested in the four poorest rayons in two selected Oblasts (Naryn and Osh). The two Oblasts were selected based on poverty considerations, synergies in terms of existing awareness and capacity that were built as part of the ongoing trial phase (see Annex 5) and climatic aspects that influence heating patterns in the Kyrgyz Republic and are relevant to enhance the replication potential of the pilot. Depending on implementation progress, additional rayons may be added in later Project years. Poor households living in pilot rayons will have access to efficient and clean heating stoves and LPBs at a subsidized price, provided they meet the following eligibility criteria: (i) low income status as confirmed through the social passport issued to households with an average monthly income of KGS 2,631 per person (USD 36 per person); (ii) no access to DH or centralized gas supply, and reliance on solid fuel-fired stoves or LPBs as primary source for heating; and (iii) detached house in reasonable condition, i.e. without apparent sources of major heat losses (e.g. broken windows). Eligible households are expected to contribute 30%-40% towards the cost of eligible models in order to ensure ownership and enhance program sustainability.

32. ***Eligibility criteria for efficient and clean heating stoves and LPBs***: Eligible households will have the choice between different heating models that meet a number of minimum eligibility criteria. These will be further detailed as part of the OM and include: (i) minimum thermal efficiency of 70%; (ii) maximum emission of particulate matter ($PM_{2.5}$) of 70 mg/MJ and CO emissions of 7 g/MJ heat delivered, or demonstrated reduction of indoor air pollution by at least 90%; and (iii) other eligibility criteria related to the durability and

[20] The proposed incentive levels were informed by affordability and willingness to pay considerations as assessed through representative household surveys, consultations with trial/ control group households and local communities, data related to fuel expenditures and the average annual income of poor households.
[21] The adoption of two OMs (one prepared by BTS and one by ARIS, respectively), satisfactory to the Bank, is a Project effectiveness condition.

safety of eligible products. The process and criteria for stoves and producers is further detailed in Annex 1.

33. For the first year of the Project, two models developed as part of the ongoing trial phase (see Annex 5) are expected to be eligible under the program: a biomass-fired space heating stove and a coal-fired space heating stove. Both models integrate cooking functions, have thermal efficiencies above 70% and have been field tested in low income households as part of the trial phase with high satisfaction rates. Their technical performance is also being verified at a reputable stove testing laboratory in China to ensure compliance with the eligibility criteria.[22] Their designs are open-sourced and extensive capacity building is being provided (with the support of Trust Fund resources) to train local manufacturers on their production and service providers on their installation. In addition, detailed producer, installer and user manuals are currently being developed. In outer Project years, additional eligible heating models are expected to be developed and offered to households.

34. ***Local Demonstration Centers and community-based implementation:*** In each pilot rayon, the program will be implemented in close collaboration with local communities, including women and community women groups. To provide information and advice on the program, facilitate community outreach and coordinate household registration, local Demonstration Centers will be established, to be operated by local technical and social mobilization facilitators from ARIS with the support of pilot rayons.

35. ***Estimated coverage and expected benefits:*** With the available funds allocated to Component 2 and estimated program costs, it is expected that around 14,000 efficient and clean heating stoves and LPBs will be installed in eligible low income households in the selected pilot rayons. Based on the results of the trial phase and experience from similar projects in other countries, switching from traditional, inefficient and often polluting heating technologies to efficient and clean models is expected to generate multiple benefits for households, the economy and the environment, including: (i) reducing solid fuel consumption and related household expenditures by 45%-50% through an improvement of the thermal efficiency to at least 70%; (ii) decreasing $PM_{2.5}$ and CO emissions, which will help to reduce households' exposure to indoor air pollution and related health costs, in particular for women, children and pensioners who spend more time at home; (iii) improving comfort levels by enabling households to heat their homes to more adequate temperature levels; and (iv) enhancing user convenience by extending the stove burning duration (and reducing the related need for constant refueling) from currently 1-3 hours to up to 12-15 hours.

36. **Subcomponent 2.2: Stimulation of production and use of efficient and clean stoves (estimated USD 0.6 million IDA financing).** This Subcomponent aims to stimulate the production and use of efficient and clean heating technologies in a sustainable manner through capacity building and awareness raising for suppliers, households and other stakeholders. Subcomponent 2.2 will build on ongoing technical assistance and awareness raising activities implemented with the support of Trust Fund resources provided by the Energy Sector Management Assistance Program (ESMAP) and the Central Asia Energy Water Development Program (CAEWDP), and is expected to include: (i) a Stove Development Center to provide technical assistance, training and capacity building to local stove designers, manufacturers and installers to develop, produce and install safe, efficient and clean products of high quality, and to conduct thermal efficiency pre-screening and monitoring of eligible/ installed stoves; and (ii) capacity building, training, awareness raising and information campaigns targeting Government entities, local administrations and communities, households, producers, and other

[22] Testing results are expected to be available in November 2017. Thermal efficiency of the stoves has already been tested as part of the trial phase, confirming efficiencies above 70%.

stakeholders on the benefits of switching to efficient and clean heating technologies.

37. **COMPONENT 3: Demonstrating the benefits of energy efficiency improvements in public buildings (estimated USD 10 million IDA financing).** Given the high energy intensity of the country (with buildings being the main energy consumer) and the impact of electric heating on recurrent winter power shortages, reducing electricity consumption in public buildings is a priority for the Government. This Component will support the Government's Action Plan on reducing electricity consumption in public buildings by improving their energy efficiency and will help to build local market capacity in preparing and implementing energy efficient and seismic building retrofits. The Component will be implemented by ARIS and consists of two Subcomponents.

38. **SUBCOMPONENT 3.1: Energy efficiency investments in public buildings (estimated USD 9 million IDA financing).** This Subcomponent will finance energy efficiency and seismic investments in selected public buildings mainly in the education and health sectors (e.g. schools, kindergartens, hospitals and clinic centers) as well as related capacity buildings activities. The Subcomponent aims to demonstrate the multiple benefits of energy efficiency by building on the social outreach capacity of public facilities and focusing on buildings that use electric-based heating in order to maximize electricity savings. Expected benefits to be demonstrated include: electricity and cost savings, improved comfort levels (e.g. in terms of temperature, indoor climate and lighting), enhanced building resilience and improved building functionality for public service delivery.

39. **Activity 1: Energy efficiency investments in selected buildings (estimated USD 8.8 million IDA financing).** This activity will finance energy efficiency and seismic investment measures in selected public buildings as well as related consulting services. Detailed implementation aspects of this activity, including selection of buildings, will be further described in the OM and are summarized below and in Annex 1.

40. ***Buildings eligibility criteria and selection process**:* To be eligible, buildings have to meet the following basic criteria: (i) confirmation of public ownership; (ii) structural soundness of the building; (iii) absence of plans for closure, downsizing, or privatization of the facility; and (iv) use of electricity-based heating system to maximize electricity savings. Buildings will be selected based on 3-4 regionally-focused call for nominations to local administrations. Nominated buildings will then be ranked and selected based on their energy efficiency potential as assessed by the specific energy consumption per heated area (kWh/m^2) and their social impact in terms of number of beneficiaries (e.g. number of pupils, patients, staff, etc.). Upon confirmed selection of the highest-ranking buildings, ARIS will conclude a tripartite Memorandum of Understanding (MoU) with the local administration and the building administration. The first call for nominations is expected to be issued shortly after approval of the Project by the World Bank's Board of Directors. The selection criteria and process will be reviewed annually and any adjustments will be reflected in the OM.

41. ***Buildings renovations**:* In each of the selected buildings, energy audits and seismic assessments will be conducted to identify the economically most viable energy efficiency measures and seismic reinforcements needed to comply with the local regulation. Eligible measures will include: building envelope measures; heating and cooling system upgrades; lighting; other viable energy saving measures; and seismic reinforcement measures. A limited amount of funds (up to 15% of total investment costs) may be made available for additional works to ensure reasonably full renovation or longevity of investments (e.g. painting, replacement of old gutters and down sprouts to avoid water damages).

42. Once energy audits and seismic assessments are completed, ARIS will discuss recommended priority

measures with the responsible local administration and the building administration, and prepare designs. Before and after implementation of energy efficiency renovation works, social surveys will be conducted on a sample basis to assess end-user satisfaction levels, including improved comfort levels and working conditions, as well as any changes in behavior and awareness on energy efficiency. With the available funds allocated to Activity 1 and cost estimates based on feasibility studies conducted as part of the Urban Development Project, it is expected that around 21 buildings will be rehabilitated by the end of the Project.

43. **Activity 2: Capacity Building on energy efficiency (estimated USD 0.2 million IDA financing).** This activity aims to strengthen local capacity and awareness on energy efficiency and build on ongoing technical assistance provided with the support of ESMAP resources. Specific areas for support will include:

a) *Training to local firms:* Targeted capacity building and training activities for local energy audit companies, design firms, construction companies and other energy service providers will be conducted to enhance their technical capacities in preparing and implementing energy efficiency projects.

b) *Public awareness campaign on energy efficiency:* In order to enhance awareness and understanding of energy efficiency, targeted awareness and information campaigns will be conducted, including dissemination of achieved Project results for demonstration purposes.

c) *Support implementation of a Roadmap on energy efficiency:* Follow-up support will be provided for the implementation of a Roadmap on improving energy efficiency in the public buildings sector, which the Government plans to develop with the support of the World Bank and ESMAP in 2017/2018.

44. **SUBCOMPONENT 3.2: Project implementation support for ARIS (estimated USD 1 million IDA financing).** This Subcomponent will provide support for effective implementation and management of Components 2 and 3, including: (i) PIU staff/ consultants (see details in Annex 2) and contribution towards the cost of backstopping assistance by ARIS staff (the so-called administrative pool of ARIS); (ii) Project-related operating costs; and (iii) annual audits of ARIS' Project accounts.

B. Project Cost and Financing

45. The total cost of the Project is USD 46 million, to be financed through a USD 23 million equivalent IDA Credit and a USD 23 million equivalent IDA Grant. Project preparation is supported by a USD 0.39 million Project preparation grant provided by the ECAPDEV Trust Fund extended to the Government of the Kyrgyz Republic[23] as well as Bank-executed Trust Fund resources provided by ESMAP and CAEWDP. In addition, it is likely that additional support of around USD 4 million grant financing (including a Bank-executed and a Recipient-executed part) will be provided by the Swiss State Secretariat for Economic Affairs (SECO) to leverage IDA funds allocated to Component 3.

[23] The ECAPDEV grant agreement was signed on June 7, 2017 and includes a retroactive financing provision.

Table 1: Estimated Project Costs and Indicative Financing (in USD millions equivalent)

Project Components	Project cost	IDA Credit	IDA Grant	Counterpart Funding
Component 1: Improving supply efficiency and quality of the DH system in Bishkek	**31**	**23**	**8**	**-**
Subcomponent 1.1: Priority investment program for DH rehabilitation	30	23	7	
Subcomponent 1.2: Operational capacity strengthening and Project implementation support for BTS	1		1	
Component 2: Piloting efficient and clean heating stoves	**5**		**5**	
Subcomponent 2.1: Incentive program for low income households	4.4		4.4	
Subcomponent 2.2: Stimulation of production and use of efficient and clean stoves	0.6		0.6	
Component 3: Demonstrating the benefits of energy efficiency improvements in public buildings	**10**		**10**	
Subcomponent 3.1: Energy efficiency investments in public buildings	9		9	
Subcomponent 3.2: Project implementation support for ARIS	1		1	
Total Costs	**46**	**23**	**23**	
Total Financing Required	**46**	**23**	**23**	

C. Lessons Learned and Reflected in the Project Design

46. The proposed Project reflects lessons learned from other World Bank-financed investment lending operations and technical assistance activities in the energy and heating sectors, both in the Kyrgyz Republic and outside.[24] Specific lessons learned reflected in the Project design include the following:

[24] For instance: Electricity Supply Accountability and Reliability Improvement Project (P133446); Power and District Heating Rehabilitation Project (P008519); Mongolia Ulaanbaatar Clean Air Project (P122320); China Hebei Air Pollution Prevention and Control Program (P154672); Kyrgyz Urban Development Project (P151416); Toward Universal Access to Clean Cooking and Heating: Early

a) *Detailed and advanced preparation is important for effective implementation of DH projects.* Lessons from the earlier Power and District Heating Rehabilitation Project as well as other infrastructure projects implemented in the Kyrgyz Republic highlight the importance of advanced project preparation, including detailed budgeting and implementation planning. It is also important to start the procurement of goods and works prior to Project effectiveness in order to mitigate the risk of significant implementation and disbursement delays during project implementation.

b) *Strong customer focus and public outreach campaigns are essential for generating consumer support.* Findings of a 2014 customer survey in the Kyrgyz Republic highlighted the growing dissatisfaction by consumers with the low quality of energy services and emphasized the low level of trust in sector companies; specifically, many focus group participants voiced their doubts that tariff increases would result in improved operational performance due to prevailing corruption in the sector. This and earlier experience highlight the importance of conducting targeted and gender-focused awareness and communication campaigns, aimed at informing the public about planned reforms and investments, and disseminating the achieved improvements in terms of supply reliability and quality. Integrating gender-sensitive approaches in communication campaigns further allow to reach men and women as they tend to rely on different sources of information and varying messages resonate differently with men and women.

c) *Well-targeted subsidies are needed to stimulate supply and demand for clean and efficient heating technologies*. Subsidies are important to target poor households who face affordability and other constraints that cannot be addressed by the market alone. However, stove giveaways should be avoided in order not to crowd-out private initiatives and generate unsustainable expectations by users. While results-based approaches have been successfully implemented in several countries as an effective way of using public resources to incentivize market development, it also requires strong interest and capacity from suppliers. The detailed design of a household-level program has to balance the risk tolerance of the private sector with transaction costs of the program.

d) *Building local capacity and awareness is critical for market transformation.* While participation in an efficient and clean stove program should be open to both domestic and imported products, providing extensive capacity building to local suppliers is important for fostering affordability and long-term sustainability of the program. Household behavior and preferences have a significant impact on the level of fuel consumption and emissions. Therefore, proposed solutions need to consider user behavior, preferences as well as stove and fuel types. Proper user manuals and trainings should be part of a successful promotion program.

e) *Establishing program credibility early on is important for the success of energy efficiency projects.* Early successes and well-documented case studies are needed to establish program credibility and help demonstrate the benefits of energy efficiency. To ensure timely implementation and technical credibility, strong energy diagnoses, clear and transparent eligibility and selection criteria, quality of technical standards and construction supervision, sound measurement and verification procedures and a strong initial pipeline are critical.

f) *Starting with simple financing and implementation models in the public sector.* In countries with limited awareness and market capacity on energy efficiency, it is advisable to start with simple (grant-based) financing and implementation approaches before transitioning to more innovative models, such as revolving funds or performance-based schemes. Focusing initial efforts on the public sector to develop

Lessons from the East Asia and Pacific Clean Stove Initiative.

implementation mechanisms, demonstrate the benefits of energy efficiency and strengthen/ develop supply-side capacity and experience can help raise public awareness and catalyze markets before moving to more difficult sectors.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

47. **Overall implementation structure**. The Financing Agreement for the HSIP was negotiated and concluded between the Ministry of Finance on behalf of the Kyrgyz Republic and the World Bank. The Ministry of Finance will provide the proceeds of the IDA credit and grant, respectively, to the two Project implementing entities through Subsidiary Agreements: (i) BTS as the implementing entity of Component 1; and (ii) ARIS as the implementing entity of Components 2 and 3. The World Bank will conclude Project Agreements with each of the two implementing entities. The State Committee for Industry, Energy and Mining ('the State Committee for Energy') assumes the overall policy responsibility for the preparation and implementation of the Project. A Project Advisory Committee (PAC), chaired by the State Committee for Energy and involving key stakeholders, shall be established no later than 6 months after Project effectiveness to facilitate coordination and provide strategic advice during implementation. Details of the Project's institutional and implementation arrangements are provided in Annex 2 and will be further described in the OM for Component 1 and the OM for Components 2 and 3, respectively. The adoption of two OMs, satisfactory to the World Bank, is a condition for Project effectiveness.

48. **BTS – Implementing entity for Component 1**. Day-to-day preparation and implementation of Component 1 will be done by the existing PIU within BTS. BTS and its PIU have adequate technical implementation capacity, including staff with solid professional qualifications, but only limited experience in implementing World Bank-financed projects. To strengthen the PIU's implementation capacity, BTS has hired additional consultants based on Terms of References (ToRs) satisfactory to the World Bank, including a Financial Management (FM) Consultant, a Procurement Consultant and a (part-time) Safeguard Consultant. To complement BTS' existing technical expertise with international know-how, the PIU will also engage a Senior DH consultant(s) on an 'as-needed basis'. Throughout Project implementation, the PIU will further draw upon the technical expertise of other relevant units and staff within BTS, including in particular technical units, the Procurement and Logistics Unit and the Accounting Unit.

49. **ARIS – Implementing entity for Components 2 and 3.** A PIU within ARIS is responsible for implementing all activities related to Components 2 and 3. ARIS has adequate capacity and experience in managing and implementing World Bank-financed projects. For the purpose of the HSIP, ARIS has designated a PIU that will be strengthened so as to comprise the following staff/consultants: Project Manager; coordinator for Component 2; coordinator for Component 3; technical energy efficiency and stove experts; Disbursement Specialist; Procurement Specialist; Monitoring and Evaluation Specialist; Database Specialist; Translator; and a part-time Safeguard Specialist. The PIU will work under the management of ARIS' Executive Director, and ARIS' administrative pool will provide backstopping support, as needed. To support implementation of Component 2 in selected pilot rayons, ARIS will further hire local technical and social mobilization facilitators. For targeted advice on technical key issues related Components 2 and 3, ARIS will also engage on an 'as-needed basis' a senior stove expert and a senior energy efficiency expert, respectively, both with international experience.

50. **Fiduciary arrangements.** BTS will be responsible for the fiduciary function for Component 1, and ARIS for Components 2 and 3. This fiduciary function includes procurement and financial management and are further described in Section VI.C and D.

B. Results Monitoring and Evaluation

51. **Overall Monitoring and Evaluation (M&E) arrangements.** The PIUs within BTS and ARIS will be responsible for M&E of results achieved under Component 1 and Components 2 and 3, respectively. For this purpose, the PIUs will set-up a simple management information system to track implementation progress on Project activities and key results indicators (including those specified in Section VII). During preparation and initial Project years, close implementation support will be provided by the World Bank team to assist the PIUs in refining their M&E system. The PIUs will submit biannual progress reports to the PAC and the Bank for review. A mid-term review will be carried out to assess the overall Project progress, identify critical implementation issues and make any necessary adjustments to the Project design, its components or implementation schedule. Detailed M&E arrangements for each Component are further described in Annex 3.

C. Sustainability

52. **Sustainability of Component 1**. The technical, economic and environmental viability of rehabilitating the existing DH system operated by BTS was confirmed as part of the aforementioned urban heating assessment completed in 2015, which included a multi-criteria assessment comparing different heating options (e.g. DH with CHP or large and small heat-only-boilers; individual heating options, such as electric oil radiators, heat pumps, gas heaters, coal stoves; and energy efficiency improvements in buildings).

53. Ultimately, the long-term sustainability of the priority investments supported under Component 1 will depend on the overall operational and financial sustainability of the energy sector, including progress towards cost-recovery tariffs. The Government started initiating important steps to gradually improve the financial and operational viability of the energy sector since 2014 (see Section I.B, paragraph 12), supported by the World Bank through DPOs and a comprehensive technical assistance program. Notable progress included: the operationalization of the Regulatory Agency for the Fuel and Energy Complex; the adoption of the MTTP and implementation of related end-user tariff increases in 2014-2015; the establishment of a tariff setting methodology for energy companies; as well as the establishment of a performance monitoring and reporting framework for sector entities. Going forward, the World Bank plans to continue providing support to further improve the financial viability of the power and heating sectors through policy dialogue, technical assistance (including for the preparation of a new MTTP for 2018-2023 and related public outreach efforts), investment lending operations as well as DPOs and/or other policy instruments. These activities will help to further improve the overall operational and financial sustainability of the energy sector and enable companies, including BTS, to recover reasonable recurrent and capital expenses.

54. At the Project level, sustainability will be ensured by: (i) using modern technologies for planned pipeline replacements (i.e. pre-insulated pipe technology) and substation upgrades (including smart heat and hot water meters), which will help to extend their service life and enable better targeting of future efficiency investments; (ii) supporting the optimization of BTS' temperature and variable flow regime through planned investments and capacity building activities; (iii) improving the accuracy, transparency and accountability of BTS' billing system and enhancing consumer incentives to use energy more efficiently by supporting the introduction of

consumption-based billing practices at the building-level; (iv) strengthening BTS' maintenance practice by installing an information management system for preventive maintenance and providing related training; (v) including a financial covenant requiring BTS not to incur additional debt unless it is able to maintain an adequate debt service coverage ratio of at least one so as to ensure that BTS will be able to service its debts and meet its liabilities going forward; and (vi) enhancing BTS' technical and operational capacity, including through technical assistance targeting improvements of BTS' technical capacity as well as accounting and customer-relation functions. In addition, combining the investments supported under Component 1 with improvements of BTS' pumping stations (supported by the European Bank for Reconstruction and Development, EBRD, as described in Section IV.D) will also help to strengthen the overall sustainability and operation of the DH system in Bishkek.

55. **Sustainability of Component 2**. The Component is designed to help promote the development of an efficient and clean heating stove market in the Kyrgyz Republic by introducing improved and affordable heating technologies, building local production capacity, enhancing supply- and demand-side awareness on related benefits, and building on and engaging local communities. This is expected to help sustain continued supply and demand for efficient and clean heating stoves after Project completion. Early experience from the trial phase also indicates the potential for a strong spill-over effect to other households through demonstrating and increasing awareness about the benefits of efficient and clean heating stoves and LPBs. In addition, the Bank will continue working with the Government throughout Project implementation to further develop the strategy on scaling-up the switch to efficient and clean heating solutions by households currently relying on traditional solid fuel-fired heating technologies.

56. The pilot complements the EBRD-supported Kyrgyzstan Sustainable Energy Financing Facility (KYRSEFF) credit-line, which will also help to enhance Project sustainability. KYRSEFF provides credits and grants for energy efficient retrofits in residential buildings and industries, including heating system upgrades with efficiencies above 70% (same minimum performance requirement as under the HSIP). The credit-line currently includes only imported and higher priced LPBs in its positive list of eligible heating systems,[25] and mainly targets creditworthy middle and higher income households. By supporting the development of locally manufactured efficient, clean and affordable heating stoves and by targeting low income segments, Component 2 not only complements KYRSEFF but offers synergies in terms of diversification of products and enhanced business opportunities for local suppliers. These synergies will be further explored during implementation of the Project with the aim to include eligible products under the HSIP as part of the KYRSEFF positive list, thereby enhancing sustainability and scale of the efficient and clean heating stove program.

57. **Sustainability of Component 3.** Sustainability of Component 3 will be promoted through the following aspects: (i) improving awareness and understanding about how energy efficiency can help to save electricity and contribute to address winter power shortages at the country and local level; (ii) demonstrating other important energy efficiency co-benefits, such as improved building performance, higher comfort levels and energy cost savings; (iii) building basic local market capacity to identify, prepare and implement energy efficiency investments in buildings; and (iv) integrating seismic and energy efficient building retrofits. Sustainability of Component 3 is further enhanced by its complementarity to the above referenced EBRD-financed KYRSEFF credit-line (focusing on residential and industrial sector). In addition, the World Bank – with assistance from ESMAP – is currently supporting the Government in preparing a Roadmap for scaling-up energy

[25] Reasons for this include the lack of locally manufactured products that meet the 70% thermal efficiency criteria and the requirement for products to be certified by an acceptable testing laboratory.

efficiency improvements in the public sector, including options on how to move from grant-financed investments to scalable financing schemes. Eventually, scalable and sustainable financing options for energy efficiency will also depend on continued progress on tariff reforms.

D. Role of Partners

58. **EBRD.** EBRD is expected to provide financing (USD 10 million) to BTS in the form of a sovereign loan to support the modernization of BTS' DH pumping stations, including the replacement of select pumps with energy efficient pumps and variable speed drives (VSD), construction of a new pumping station, and installation of a new supervisory control and data acquisition (SCADA) system. Given that BTS' network is only supplied by the CHP plant without additional generation sources and due to the large size and layout of its pipeline network, efficient and reliable booster pumps are critical to ensure adequate and reliable heat supply to all parts of the city, including in particular customers located at the outskirts of the DH system. Upgrading BTS' pumping stations with VSD pumps and SCADA are also important for efficient building-level substations with flow control, which will be supported under Component 1 of the HSIP.

59. **KyrSEFF.** KyrSEFF is an EBRD-supported credit-line (USD 20 million in phase I and USD 35 million in phase II) supporting energy efficiency improvements of residential buildings and industrial enterprises. Eligible projects receive up to 35% grants provided by the EU-supported Investment Facility for Central Asia. As of early 2017, about 600 households and 60 businesses have benefitted from KyrSEFF funding and grants. The credit-line is implemented through local partner banks and mainly targets creditworthy middle and higher income households. The list of eligible products includes heat-only-boilers, heat pumps, solar water heaters as well as building envelope measures. Investments in heating system upgrades accounted for about 17% of disbursed loans. During implementation of the HSIP, close cooperation with KyrSEFF will be sought in order to use synergies between the programs in terms of eligible heating products, awareness raising on energy efficiency and market capacity building.

60. **Russian-Kyrgyz Development Fund (RKDF).** RKDF approved in June 2017 financing (around USD 5.5 million) to BTS in the form of a non-sovereign loan to finance the reconstruction of an additional section (about 1 km trench length) of the 'Vostok' transmission pipeline, which will be connected to sections that will be rehabilitated under the HSIP. The loan is expected to enable BTS to synchronize civil works required for the installation of the re-routed pipeline section financed by RKDF with the construction of a new municipal road, which is scheduled for 2017.

61. **SECO**. SECO is considering to provide Bank- and Recipient-executed grant funds towards Component 3 (up to USD 4 million) to support energy efficiency improvements in public buildings. This would help to leverage IDA funds, pilot innovative energy efficiency technologies to enhance load reduction benefits and strengthen Project impact. The draft scope of activities proposed for financing by SECO is integrated in Annex 1.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

62. The overall risk of the proposed operation is *high* given the key risk factors described below.

63. **Political and governance risks.** The political environment in the Kyrgyz Republic has stabilized over the past years. However, the country still faces challenges as a young democracy and frequent changes/reshuffling of the Government, including in the energy sector, are continuing. Elections planned for Fall 2017 accentuate political and governance risks that may impact the Project, and are therefore considered to be high. Related risks cannot be mitigated at the Project level directly but will be continuously assessed and the Project design will be adjusted, if necessary.

64. **Sector strategies and policy risks**. Risks associated with the Government's continued commitment to bring end-user tariffs for heat and hot water closer to cost recovery-levels are considered to be high. Cost-recovery tariffs, however, will be important for the financial and operational sustainability of the DH sector in general and Component 1 in particular. The main mitigation instrument to help address this risk is the Bank's ongoing policy dialogue and engagement in the energy sector, including through DPOs and targeted technical assistance activities (see Section I.B, paragraph 14). To further mitigate the risk at the Project level, a financial covenant will be included in the Financing Agreement to ensure maintenance of an adequate debt service coverage ratio of at least one in case BTS plans to incur additional debt.

65. In addition, given the frequent reshuffling of the Government and line ministries combined with capacity constraints, risks related to decreasing ownership and commitment for promoting the use of efficient and clean heating stoves and improving energy efficiency in the public buildings sector in a sustainable manner are also substantial. The main mitigation measures to help address related risks include the strong emphasis on demonstration and awareness raising aspects, close involvement of policy-makers during preparation and implementation of the Project, and support for the development of long-term strategies to scale-up energy efficiency improvements for household heating technologies and in public buildings, which will take into account experience and lessons learned from the Project.

66. **Technical design of the Project.** The overall design of the Project with three components and several subcomponents is complex and involves substantial technical design risks. With regards to Component 1, the main design risks relate to the timely implementation of investments financed by RKDF, which is important for the sustainability and effectiveness of the investment packages supported under the HSIP. To mitigate these risks, the preparation and implementation progress of the RKDF-financed investments is closely monitored and technical documentations will be reviewed by the Bank team, as relevant (e.g. design and bidding documents for the transmission pipeline section supported by the RKDF). Key technical design and implementation risks for Components 2 and 3 relate to the dispersed and small-scale nature of investments, limited market capacity on the supply-side (e.g. stove manufacturers, energy service providers, construction companies) and relatively complex implementation mechanisms, especially for Component 2. To help mitigate these design risks, the following measures are used: (i) the design of Components 2 and 3 builds on existing operational experience combined with detailed market assessments, including in particular the trial phase for Component 2 and the Urban Development Project for Component 3; (ii) Component 2 is limited to four adjacent pilot rayons in two Oblasts, using a community-based implementation approach with centralized procurement by the PIU; (iii) Component 3 will be implemented in a geographically-phased manner; (iv) strong implementation support will be provided by the World Bank team; (v) Trust Fund resources from ESMAP and CAEWDP were mobilized to support technical assistance and South-South knowledge exchange on efficient heating stoves and building energy efficiency; and (vi) use of an experienced implementing entity for Components 2 and 3, ARIS, which has strong experience in implementing dispersed projects in various local communities, including implementation

of seismic and energy efficient building renovations under the Urban Development Project.

67. **Institutional Capacity for Implementation and Sustainability.** Given the use of two implementing entities, the lack of experience of BTS in implementing World Bank-financed projects, dispersed activities under Components 2 and 3, and limited experience in the Kyrgyz Republic with professional supervision companies for civil works, the institutional capacity risk is considered to be high. To help mitigate associated risks, the following measures will be used: (i) staffing of BTS' PIU with qualified fiduciary and safeguards consultants and targeted training, including with the support of ECAPDEV preparation grants; (ii) use of professional companies for the supervision of civil works under Components 1 and 3; (iii) hiring of senior experts on an 'as needed basis' for DH, stoves and energy efficiency with international experience; (iv) use of four adjacent pilot rayons for Component 2; (v) implementation of energy efficient retrofits in public buildings in geographically concentrated annual batches of buildings; and (vi) adequate staffing of and training to ARIS' PIU, including the use of local facilitators and Component Coordinators.

68. **Fiduciary Risks**. The overall integrated fiduciary risk for the Project is assessed to be high given the complex implementation arrangements involving two implementing entities, one of which (BTS) has no relevant knowledge and experience in World Bank procurement, FM/disbursement policies and procedures and in implementing World Bank-financed projects. In addition, the heating stove component arrangements will involve a high level of small value transactions. Mitigation measures are detailed in Sections VI.C and D as well as Annex 3.

69. **Environmental, Social and Stakeholders risks**. The social risks under this Project are two-fold. Firstly, there is a continued mistrust on the part of the population whether reforms will improve services delivery and whether resources will be used as intended.[26] Social tensions in the country (tied to regional and ethnic divides), coupled with insufficient transparency and accountability in the sector, and limited information about priority investments significantly increase the risks of the Project, including social and stakeholder risks. Secondly, BTS has limited knowledge of safeguards requirements and institutional capacity is low, putting the risk at substantial level. The first set of risks will be mitigated by the careful targeting of beneficiaries,[27] broad information campaigns and citizen engagement activities to improve transparency and accountability of the Project, strengthening of client-customer relations and community engagement. Feedback received from beneficiaries will highlight Project aspects that perform well or need improvement. The second set of risks will be mitigated by hiring of an experienced safeguards consultant and capacity building activities of BTS in safeguards and World Bank reporting.

[26] Overall, trust in the energy sector has improved in the last couple of years as documented by a series of energy consumer surveys (carried out in 2014, 2015, and 2016). Specifically, in the 2016 survey, 62% of respondents evaluated the work quality and efficiency of the sector as positive (either "positive" or "positive rather than negative"), an increase from 42% in 2014. In addition, those who have heard about recent energy sector reforms undertaken by the Government primarily expressed their approval – 80% strongly or somewhat approve. This percentage is double that of the 2015 survey.

[27] Specifically, for Component 2, ARIS will periodically review the demographic and social-economic composition of registered households to ensure inclusive and purposeful targeting and to mitigate potential socials risks associated with perception of unequal distribution of Project benefits.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

a) Economic analysis of Component 1

70. **Modernization of individual building-level heat substations**. Overall, the proposed investment is economically viable with an economic internal rate of return (EIRR) of 10.1% and a net present value (NPV) of USD 5.22 million, exclusive of social costs of CO_2 emissions, and an EIRR of 22.7% and an economic NPV of USD 27.47 million, inclusive of social costs of CO_2 emissions. The main economic benefits of modernizing IHS are: (i) reduction in technical losses and non-demanded heat and hot water; (ii) more efficient use of heat and hot water; and (iii) pumping energy savings in BTS' network and at the CHP plant. The reduction in technical losses and non-demanded heat and hot water was quantified as avoided cost of heat energy and make-up water supply, and estimated at USD 13.4/Gcal and USD 0.18/t, respectively. The introduction of metering and better control at building-level is estimated to result in a 10% reduction in heat energy and water consumption. Pumping energy consumption in BTS' network is assumed to decrease in proportion to the reduction in heat energy supply, i.e. by 6.2%. A 50% correlation between savings in pumping energy and heat supply has been assumed for the Bishkek CHP plant, hence a decrease in power consumption at the CHP plant by 3.1%. Pumping energy savings are quantified as avoided cost of power generation, evaluated at long-run average incremental cost of USD 0.14/kWh.

71. **Replacement and reconstruction of the 'Vostok' transmission network**. The replacement and reconstruction of the 'Vostok' transmission pipeline and related network parts is economically viable with an economic NPV of USD 13.72 million and an EIRR of 14.5%, exclusive of social costs of CO_2 emission, and an NPV of USD 12.89 million and an EIRR of 14.1%, inclusive of social costs of CO_2 emission. The main economic benefits are: (i) reduction in heat losses and water leakage; (ii) reduction in unserved energy; (iii) savings on water treatment and operating and maintenance (O&M) costs; and (iv) pumping energy saving in BTS' network and at the CHP plant.

72. Replacement of the worn-out pipes with pre-insulated pipes will result in an annual reduction of 3,116 Gcal of heat losses and 24,247 tons of water leakages, evaluated at their marginal cost of supply. Over the past 5 years, the 'Vostok' transmission pipeline experienced an average of one major failure per year resulting in the disruption of heat and HW supply to end-users, which can take up to 24 hours to fix. It is assumed that underspending on maintenance will cause further deterioration of the already severely dilapidated transmission network and increase the annual frequency of such disruptions to five by 2020. Replacement of a 2.87 km section of the 'Vostok' transmission pipeline (including World Bank- and RKDF-financed sections) is expected to eliminate major breakdowns. This will reduce required O&M expenses and make-up water treatment costs. Reduced heat and water losses will also decrease pumping energy requirements in BTS's network and at the CHP plant by 0.16% and 0.08%, respectively, evaluated at long-run average incremental cost of electricity.

73. **CO_2 emission reduction Component 1**. Over the economic life of the upgraded substations and replaced transmission pipeline, CO_2 emissions will be reduced by 942,630 t.

b) Financial analysis of Component 1

74. **Modernization of individual building-level heat substations.** The financial viability of the Project was assessed based on the incremental cash inflows and outflows from the perspective of BTS. The financial benefits for BTS are: (i) savings on purchase of heat energy and make-up water from Bishkek CHP because of reduced technical losses and more efficient use of energy; (ii) net changes in revenue due to introduction of building-level meters; and (iii) pumping energy savings. The investment in IHS upgrades has a negative financial NPV of USD (6.75) million and a Financial Internal Rate of Return (FIRR) of -1.8 %, which is due to the assumed 10% reduction in end-user consumption after introduction of building-level meters, as well as the assumption that only half of the reduced commercial losses will translate to billable energy given that heat and hot water supply more accurately matches the demand. As a result, end-users will consume overall less heat and hot water.

75. It is worth highlighting that besides the direct financial impacts quantified in the financial analysis, the IHS upgrade generates other indirect system-level benefits which will improve the long-term financial viability and sustainability of BTS' DH system, which were not quantified in the analysis. Specifically, the ability to better control heat consumption at building-level and related bills for customers is an important factor in moving towards cost-recovery tariffs, thus, enabling BTS to ensure its financial sustainability in the long-term. Modernized substations will also enable BTS to better optimize its operational regime in terms of variable flow and temperature, which would help to improve the overall efficiency of the DH system. In addition, higher flow temperatures would increase the transmission and distribution capacity of the network, which can help to meet additional heating demand from under-served customers (e.g. under-heated buildings) and potentially connect new customers in the medium-term without requiring additional pumping capacity or larger pipe dimensions.

76. **Replacement and reconstruction of 'Vostok' transmission network**. The replacement and reconstruction of the targeted transmission pipeline sections has a financial NPV of USD 7.02 million and FIRR of 4.6%. The financial benefits for BTS are: (i) savings on purchase cost of heat energy and make-up water from Bishkek CHP because of reduced heat loss and make-up water leakage in 'Vostok' transmission pipeline; (ii) increased sales because of reduction in unserved heat energy; (iii) savings of water treatment and O&M costs; and (iv) pumping energy savings.

c) Analysis and forecast of financial performance of BTS (Component 1)

77. **Current financial performance of BTS**. BTS is a financially viable company with a low level of indebtedness and high liquidity to meet its current liabilities. In 2016, the current ratio was 1.8, and the cash conversion cycle was 57 days. In 2013-2016, bill collection rates averaged 99%. As of December 31, 2016, the outstanding debt was KGS 249 million (USD 3.6 million), which equaled 12% of the company's assets. The debt service coverage ratio (DSCR) was 3.2 times the debt service requirement.

78. In 2016, the net profit margin of BTS was 4%. At least 25% of the annual net income is paid out as dividends, and the retained earnings are reinvested in the company. On average 67% of the company's earnings before interest and tax (EBIT) were reinvested in 2014-2015.

79. **Project financial performance of BTS**. During the forecast period of 2017-2022, the operating profit of the company is expected to remain in the range of 2014-2016 margins. Debt of the company will grow more than tenfold over the next five years to 59% of total assets (combined EBRD, RKDF and World Bank-supported investments to improve supply efficiency and service quality). In 2021-2022, following the point of maximum

indebtedness, current assets will make up 240% and 266% of current liabilities respectively, and the debt service coverage ratios will be at 2.5 in 2022, an indication of the company's ability to meet its short-term and long-term liabilities.

Table 2: Financial ratios

	2014A	2015A	2016A	2017F	2018F	2019F	2020F	2021F	2022F
EBITDA margin	13%	11%	4%	17%	17%	17%	18%	19%	19%
Current ratio	2.10	2.31	1.81	2.09	2.02	1.92	2.11	2.40	2.66
Quick ratio	1.68	1.80	1.39	1.65	1.63	1.56	1.74	2.03	2.28
Debt-to-equity*	0.26	0.28	0.23	0.38	1.20	1.79	2.13	1.98	1.80
DSCR	5.08	3.62	3.23	21.82	10.58	3.30	2.14	2.40	2.53

** includes only interest-bearing debt*

d) Cost effectiveness analysis for Component 2

80. A cost-effectiveness analysis was conducted to compare more efficient coal-fired stoves/LPBs with traditional solid fuel-based heating systems in terms of their efficiency in meeting heat energy demand. The levelised cost of heat per unit of energy output (GJ) for the compared heating systems was assessed, where capital costs associated with the purchase and installation of existing inefficient stoves/LPBs proposed for replacement under this activity are considered sunk. The results of the comparative analysis demonstrate that the fuel costs for low income households to heat their homes can be reduced by around 45%. Switching to more efficient stoves/LPBs will also have health benefits due to decreased exposure to indoor air pollution, which are not included in the analysis.

Table 3: Summary of cost-effectiveness analysis for efficient and clean heating stoves/ LPBs

Heating system	Thermal efficiency	Useful life	Capital cost (KGS/GJ)	Fuel cost (KGS/GJ)	Carbon cost (KGS/GJ)	Levelised cost without carbon cost (KGS/GJ)	Levelised cost with carbon cost (KGS/GJ)
Existing inefficient heating systems							
Traditional stove	40%	8	-	366	382	366	748
Inefficient coal-fired LPB	40%	8	-	366	382	366	748
Proposed eligible heating systems							
Efficient coal-fired stove	75%	12	38	195	216	233	450
Efficient LPB	70%	12	72	209	232	281	513

e) Economic and financial analysis for Component 3

81. Economic and financial appraisal was conducted for representative types of public facilities to be financed under the Project. The Project will primarily finance energy efficiency improvements of the building envelope, heating and cooling systems, lighting, and other typical energy efficiency measures. The investment costs of energy efficiency measures and energy saving estimates are drawn from the pre-feasibility studies

prepared under the Urban Development Project for selected schools and kindergartens in the cities of Balykchy and Toktogul.

82. The main economic benefits from energy efficiency investments in public facilities is the economic value of electricity savings for heating and other purposes, increased comfort level for occupants of the social and public facilities and O&M cost savings.

83. The main financial benefits of the energy efficiency investments are the reduction in energy bills of public buildings and O&M cost savings, which are valued at the prevailing tariffs for electricity. It is worth highlighting that financial returns are impacted by tariffs and under-heating of buildings, which reduces achievable energy costs savings under the assumption that part of the energy savings will be used to increase comfort levels in buildings. If 'normative' consumption (and costs) are considered, the financial NPV and FIRR would improve.

84. A cost-benefit analysis was conducted to assess the economic and financial viability of energy efficiency investments in each of the audited public facilities. The results of the economic and financial appraisal for Component 3 are presented in the table below.

Table 4: Summary of cost-benefit analysis for energy efficiency investments in public buildings

Public facility	Economic NPV (USD)	EIRR (%)	Payback period	Financial NPV (USD)	FIRR (%)	Payback period
Balykchy – Kindergarten No: 8 "Ak-Tilek"	122,254	16%	8 years	$377	1.3%	20 years
Balykchy – School #5 "Aitmatova"	209,313	12%	11 years	($125,268)	-1.1%	Longer than 20 years
Toktogul – Kindergarten No: 2 "Archa-Beshik"	146,419	18%	7 years	$9,860	1.8%	20 years
Toktogula – School #1 "Toktogula"	551,742	25%	5 years	$107,191	3.4%	17 years
Toktogul – School #2 "Bokombaeva"	241,150	13%	10 years	($111,100)	-0.9%	Longer than 20 years

B. Technical

85. **Technical appraisal Component 1**. In 2014/2015, the World Bank, together with BTS, conducted a comprehensive assessment of BTS' network, which analyzed the overall technical and financial investment needs, and included a comparison of different technical options for all major investment areas (e.g. transition to closed DH system, building-level versus apartment-level metering, use of pre-insulated pipes). On the basis of this assessment, a prioritized investment plan was developed (based on criteria described in Section III, paragraph 25), which informed the design of Component 1.

86. The proposed technologies for implementation are commercially proven, have been widely used by utilities in developed and developing countries, and will be implemented according to internationally accepted technical standards and practices. This refers in particular to the use of pre-insulated pipelines at larger dimension and installation of modern substations with smart heat and hot water meters. On the latter, based on the results of the technical and economic assessment of BTS' network, the Project will focus on introducing

metering and consumption-based billing at building-level rather than apartment-level metering. The following considerations informed the decision to adopt a gradual approach in the introduction of consumption-based billing (with the first phase concentrating on the building level): institutional aspects, such as ownership and access issues;[28] funding constraints; and technical considerations, e.g. vertical building-internal pipes and DH water quality in terms of scaling and corrosion due to the open system design (see below).

87. The current DH system in Bishkek is of the open system type where the DH distribution network and building-internal heating systems are not hydraulically separated. Furthermore, consumer hot water demand is supplied by tapping directly from the DH network. The hydraulically separated (closed) system is generally considered to be more efficient and financially sustainable. However, the technical assessment of BTS' network concluded that the conversion to a closed system is not viable due to the large size and layout of BTS' system, and taking into account available funds as well as urban planning aspects, including in particular the significant limitations in cold water supply capacity (e.g. deteriorated water supply infrastructure, limited capacity). Accordingly, the HSIP is targeted to address the most urgent and viable efficiency improvement needs within the existing open system.

88. Technical soundness of the selected investment packages was assessed and investment costs (based on local and international market prices) were estimated by international DH consultants. Detailed designs and technical specifications for the priority investments (substation and transmission pipeline upgrades) will be developed by qualified companies with international experience, as reflected in the agreed ToRs. Adequate supervision of installation/ civil works will be ensured through: (i) hiring of a qualified supervision company for civil works related to the rehabilitation of the 'Vostok' transmission network; and (ii) targeted training to BTS staff on assembling and installation of substations combined with sample verification (by the supplier of IHS) and targeted site supervision by the design company. Smart meters will be installed as part of a turnkey contract (supply and install).

89. **Technical appraisal Component 2.** The technical design and soundness of Component 2 was informed by: (i) representative household surveys for urban, rural and Bishkek area; (ii) supply-side assessments and review of international experience from similar programs; (iii) technical assistance to develop and locally produce prototypes that meet Kyrgyz consumption patterns and household preferences; and (iv) field testing of four prototypes in 51 low income households during the 2016/2017 heating season, including satisfaction, health and efficiency monitoring in trial and control group households. In addition, the technical eligibility criteria for stoves and LPBs promoted under Component 2 (namely overall thermal efficiency greater than 70% and reduction of $PM_{2.5}$ and CO emissions) are in line with international standards for small-scale heating equipment and the requirements used in similar programs in other countries.

90. The technically sound production, installation and operation of stoves/ LPBs will be ensured through extensive technical assistance and capacity building supported by Trust Fund resources and as part of the Project (Subcomponent 2.2). Technical soundness will also be maintained by: (i) providing the designs and production manuals for open-sourced eligible stoves/ LPBs,[29] conducting compliance checks of each model

[28] Current experience of BTS with apartment-level hot water metering confirms institutional complexities related to apartment-level equipment - out of 80,000 apartment-level hot water meters installed, more than one third are no longer in use for invoicing due to pending calibration.

[29] The design of stove/ LPB models will be open-sourced for prototypes developed as part of the trial phase and the HSIP. There may be additional models developed by private suppliers that are eligible under Component 2 – these will not be open-sourced.

produced by selected manufacturers (with potential retention of a performance guarantee during the first year) and requiring a producer warranty; (ii) providing detailed installation manuals and hiring qualified service providers (including a potential retention of a performance guarantee); (iii) involving a regional technical expert in each pilot rayon to verify proper installation and conducting selective post-installation M&E; and (iv) providing a detailed user manual to households and related training (to be done by the installer).

91. **Technical appraisal Component 3.** Investments in selected public buildings supported under Component 3 build on the experience of the Urban Development Project and involve internationally well proven technologies for energy efficiency and seismic reinforcements with demonstrable energy savings and enhanced building resilience, respectively. In order to help reduce winter power shortages, eligible buildings will be electrically heated. The Project will primarily finance energy efficiency improvements of the building envelope, heating and cooling systems, lighting, other typical energy efficiency measures, and seismic reinforcement measures. The selection of energy efficiency and seismic reinforcement measures for each building will be determined based on the results of detailed energy audits and seismic assessments, conducted by companies with adequate experience, to ensure the technical viability of the supported investment packages.

92. Targeted capacity building and training will be provided to local energy service providers during implementation to address limited local experience and capacity in conducting high quality energy audits and seismic assessments, preparing designs and technical specifications for energy efficient retrofits in line with international standards, and ensuring adequate technical site supervision of civil works.

C. Financial Management

93. The FM arrangements in place at both BTS and ARIS have been reviewed in March 2017, also as part of the FM assessment at BTS for the ECAPDEV Project preparation grant, and implementation support and supervision for active projects (last conducted in September 2017) at ARIS. FM arrangements have been assessed to be adequate for the Project's implementation. Currently, ARIS successfully implements a number of World Bank and other donor-financed projects, and the HSIP will partially built on the strong implementation experience and structure of ARIS.

94. It was agreed that ARIS will implement the following capacity building actions: (i) no later than 30 days from Project effectiveness, hiring an additional FM/accounting staff specifically assigned to the Project; (ii) updating its accounting software to include the functionality for automatic generation of Project financial reports as well as SOEs; and (iii) no later than two months from Project effectiveness, developing a Project cycle database for Component 2 in order to track the implementation status and progress with regards to registered eligible households and respective household contributions, selected stove suppliers/products and related payments as well as stove installation progress and related payments.

95. BTS staff has no relevant experience and knowledge in World Bank FM/disbursement policies and procedures. Therefore, it has hired a FM consultant with relevant experience and knowledge in World Bank FM/disbursement policies and procedures, as well as in state budget processes and procedures. The FM consultant will provide support on the Project's FM arrangements to BTS until the latter builds necessary experience and knowledge in World Bank FM/Disbursement policies and procedures. It was agreed that no later than 30 days of Project effectiveness, BTS will also install an accounting software specifically for Project accounting, which will have a functionality for automatic generation of Project financial reports as well as SOEs.

96. The development and adoption of the OM for Component 1 and the OM for Components 2 and 3, acceptable to the Bank and including a description of the Project's FM and disbursements arrangements, funds flow as well as controls (including the funds flow and controls related to Component 2), will be an effectiveness condition.

97. Two separate sets (one for Component 1 and one for Components 2 and 3) of Project management-oriented Interim Un-audited Financial Reports (IFRs) will be used for Project monitoring and supervision. These financial reports will be submitted by BTS and ARIS, respectively, to the Bank within 45 days of the end of each calendar quarter.

98. ARIS will be responsible for the consolidation of annual financial statements of the Project based on inputs received from BTS for its part of the Project activities. The audit of the Project annual financial statements will be conducted (i) by independent private auditors acceptable to the Bank, on ToR acceptable to the Bank and procured by ARIS, and (ii) according to the International Standards on Auditing (ISA) issued by the International Auditing and Assurance Standards Board of the International Federation of Accountants (IFAC). The annual audits of the Project financial statements will be provided to the Bank within six months since the end of each fiscal year, and at Project closing. The cost of the Project audit will be financed from the proceeds of the Project, and shared between BTS and ARIS.

99. The audit of the entity[30] (BTS) financial statements will be conducted (i) by independent private auditors acceptable to the Bank, on ToR acceptable to the Bank and procured by BTS, and (ii) according to the ISA issued by the International Auditing and Assurance Standards Board of the IFAC. The annual audits of the entity financial statements will be provided to the Bank within six months since the end of each fiscal year.

100. According to the latest Doing Business Survey 2017,[31] the Kyrgyz Republic ranked among the bottom-rated countries of the Commonwealth of Independent States (CIS) and scored modestly vis-à-vis many other developed and developing countries (75th out of 190) on the ease of doing business. According to the 2016 Transparency International's Corruption Perception Index,[32] the Kyrgyz Republic was ranked 136th in the list of 176 countries. The latest Public Expenditure and Financial Accountability (PEFA) report (conducted in 2014) found that several critical Public Financial Management (PFM) elements, including internal controls, external audit (Supreme Audit Institution, SAI), and financial reporting remain weak. While some elements of the country PFM, such as the country's budget system, will be used for the Project, for other PFM elements (accounting, financial reporting, internal controls, funds flow under the Project), BTS's and ARIS's respective systems will be used for this Project. The Project's Designated Accounts[33] (DAs) will be opened in a commercial bank(s) acceptable to the World Bank.

D. Procurement

[30] The audits of the entity (BTS) financial statements are required to monitor the implementing entity's financial results and stability, which are critical for Project implementation.
[31] http://www.doingbusiness.org/data/exploreeconomies/kyrgyz-republic
[32] http://www.transparency.org/news/feature/corruption_perceptions_index_2016
[33] BTS will open and manage two DAs (one for IDA Credit funds and the other one for IDA Grant funds), while ARIS will open and manage one DA (for IDA Grant funds) under the Project.

101. Overall, the public procurement environment in the country is improving as the Public Procurement Department (PPD) under the Ministry of Finance has revised the Public Procurement Law (PPL). The new PPL created an independent complaint review commission and the PPD under the Ministry of Finance became a regulatory body for public procurement. The World Bank is supporting the institutional development of the PPD and the complaint review commission, and is providing capacity building to all stakeholders. The Government has developed electronic Government Procurement (e-GP) with financing provided by the Asia Development Bank (ADB) and World Bank technical assistance.

102. The Bank team conducted a procurement capacity and risks assessment using the Procurement Risk Assessment and Management System (PRAMS). Procurement activities will be carried out by BTS and ARIS, respectively. The review identified a number of risks related to procurement policy and institutional arrangements which need to be mitigated.

103. **Summary of Risks and Risk Mitigation Measures:** The Procurement Capacity Assessment Report, including the risks and risk mitigation plan, has been filed in the PRAMS. The key issues and risks concerning procurement for implementation of the Project include: (i) BTS officials, who would be involved in some Project procurements through tender committees, may not be familiar with Bank procurement procedures; political developments may lead to the frequent turnover of tender committee members; (ii) potential procurement delays: experience with past and ongoing projects in the country show frequent procurement delays due to poor procurement planning; (iii) low level of competition: past experience indicates that procurement in the country has not attracted adequate competition; (iv) inadequate contract management and lower-than-required quality of procured equipment and construction; and (v) perceived high level of corruption as measured by Transparency International. Given the findings of the assessments, the initial overall procurement risk under the Project is assessed as high.

104. Procurement for the proposed Project will be carried out in accordance with the World Bank's "Guidelines: Procurement of Goods, Works and non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011 and revised July 2014 (Procurement Guidelines); and "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011 and revised July 2014 (Consultant Guidelines) and provisions stipulated in the Financing Agreement. The Project will also follow "Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants dated October 15, 2006 and revised in January 2011 and as of July 1, 2016".

E. Social (including Safeguards)

105. The Project is expected to have positive impacts on beneficiaries. Improved heat supply in homes with DH and individual heating systems will have a positive impact on the quality of life of households as the need to decrease living spaces in homes and to change family routines during the heating season will be eliminated or at least reduced. Efficient heating and related reduction in fuel consumption as well as the ability to better control heating bills and consumption, accompanied by more transparent billing practices, will help to reduce the financial burden on households, particularly the most vulnerable. In addition, improved comfort levels in public educational and health facilities will have a positive impact on the working, learning and recovery environment, including for children and sick people, respectively.

106. **Gender**. Women are expected to be the key beneficiaries of the Project, as improved heating services will impact them directly. Women spend more time at home and carry primary responsibility for household chores. In many households, women are also responsible for keeping the home warm and refueling the stoves/boilers, and tend to be the ones paying bills and managing family budgets. Women will also benefit from improved comfort levels as well as safer and better working environments in renovated public buildings under Component 3. The Project will include gender-disaggregated measures for Project beneficiaries and track participation of men and women in the results framework for all three Components. Specifically, during implementation of Component 1, the Project will disaggregate customer satisfaction data collected by the BTS by gender to ensure the voices of women are reflected and help to inform the company's strategy to improve service provision. As part of Component 2, the Project will monitor female beneficiaries of efficient and clean heating technologies installed in households, and women will also be engaged in community monitoring activities. Similarly, for Component 3, satisfaction data in retrofitted public buildings will be disaggregated by gender. Information campaigns conducted as part of the Project will formulate gender-targeted messages and utilize varying tools to reach out to both men and women. In order to support the PIUs on the integration of gender aspects, the Project will receive technical assistance provided under an ESMAP-supported programmatic activity on Energy and Gender in the ECA Region.

107. **Citizen Engagement activities**. In order to effectively engage direct and indirect Project beneficiaries, the following activities will be adopted by the Project:

(a) *Customer Satisfaction Surveys* will evaluate BTS' heat supply service performance with regards to a range of aspects including: reliability and quality of heating and billing services, customer relations, transparency of bills, and ease of payment. Customer feedback will be collected and evaluated on a sample basis at least once a year, and aggregated into an annual report. This will not only help to monitor progress in terms of Project beneficiary's satisfaction rates but also help BTS to reflect and integrate the findings in its company strategy on how to improve performance and customer orientation. The results of the surveys and any steps adopted by BTS to address identified shortcomings will be made available in a manner and places accessible to customers.

(b) *Community monitoring* will be used to ensure that the heating stove program under Component 2 reaches the targeted households and achieves intended results. To this end, the communities through neighborhood groups, associations of Aksakals (elders) and women groups, will be closely involved in Project implementation in order to share information on the Project activities, reach out to target households, and help monitor and evaluate Project results and user satisfaction. The findings will be shared during regular community meetings and through reports by ARIS.

(c) *Information campaigns* on Project activities, including improved DH services, efficient and clean heating technologies and building energy efficiency improvements will be conducted for both Project beneficiaries and broader audiences. This will help raise public awareness about the benefits of energy efficiency investments and switching to efficient and clean individual heating technologies for households without access to DH. Targeted information campaigns conducted by BTS will also inform the population about priority investments in the DH sector and expected benefits, aiming to help improve transparency and trust of the population in the sector.

(d) *The Grievance Redress Mechanism (GRM)* will build on the mechanism required by the World Bank's Operational Policy (OP) 4.12 on Involuntary Resettlement to address grievances related to the process of land acquisition and resettlement. The GRM will be extended to encompass the range of issues related to overall Project implementation, including a customer complaint center

integrated in ARIS' existing GRM to collect, categorize and transmit household complaints related to the performance of installed stoves/ LPBs. This comprehensive Project level GRM is further detailed in the Resettlement Policy Framework (RPF) and will be included in the OMs.

108. **Involuntary Resettlement**. The Project has triggered the OP on Involuntary Resettlement (OP 4.12). Resettlement impact in the form of temporary land acquisition, access restriction and/or direction of livelihoods, is expected under Component 1 due to civil works to replace and reconstruct part of the 'Vostok' transmission network. No physical displacement or permanent land acquisition is expected. While the corridor for the transmission pipeline is known, the exact siting alignment of the transmission pipeline and the scale of civil works is not known at the time of Project approval and as such the scope and extent of resettlement impact under the Project has not yet been identified. Consequently, a RPF has been prepared and was publicly consulted in accordance with the OP/BP 4.12. During public consultations, questions and answers provided to beneficiaries and stakeholders focused on the proposed Project design and timing. The RPF was disclosed in-country and on the World Bank external website on March 27, 2017. The RPF provides guidelines for resettlement-related activities and for preparation of site-specific Resettlement Action Plans (RAPs), if deemed necessary during Project implementation. The RPF details a range of potential impact and includes an entitlement matrix. Once the Project design is finalized, the exact alignment is known and resettlement impact is confirmed, site-specific RAPs pursuant to the RPF will be prepared.

109. As described in Section IV.D, RKDF is expected to provide parallel financing to BTS to reconstruct an additional section of the 'Vostok' transmission pipeline (with a trench length of about 1 km). As this activity is (i) directly and significantly related to the Bank-assisted Project; and (ii) may be carried out contemporaneously with the Project, it is considered an associated facility of the Project and World Bank safeguards policies, including OP 4.12 on Involuntary Resettlement, apply to it. No temporary or permanent land acquisition, restriction of access or economic impact is expected as a result of civil works related to the reconstruction of the section proposed for parallel financing by RKDF. A social due diligence review of the section to be financed by RKDF will be conducted between World Bank Board approval and Project effectiveness. Civil works to carry out this reconstruction of the transmission pipeline (financed by RKDF) will be timed to coincide with the road expansion project that is planned and financed by Bishkek municipality in order to minimize impacts and disruptions for the population and economic activity. While the planned road construction is contemporaneous with the reconstruction of the pipeline section to be financed by RKDF, it is unrelated to the HSIP and there is no mutual dependency between the road expansion and the Project. The civil works on the transmission pipeline section financed by RKDF benefits from the road construction, and in that way social and environmental impacts are reduced. Therefore, any impacts due to the road expansion do not fall under the scope of the World Bank safeguards policies and OP 4.12 will not apply in this case. No resettlement instruments for the activities financed by the RKDF have been prepared.

110. **Conflict Filter** analysis undertaken during Project preparation identified a number of conflict stressors. These stressors include: low citizen trust in energy sector reforms, prior social upheavals related to energy tariff increases, perception of unequal distribution of Project benefits and unresolved regional and ethnic tensions, as well as a perception of socio-economic and political ties between the energy sector and political decision-makers in the country. Demographic shifts and rural-to-urban migration increase the number of people in urban centers, which in turn adds additional pressure on services, including heating. To mitigate these stressors, the Project will ensure that Project targeting does not prioritize any ethnic group. The selection criteria of beneficiaries will be widely publicized and ascertained by the communities. Community monitoring

will facilitate and monitor the implementation of the efficient and clean stove program, including reporting on issues with regards to the continued use of the stoves (e.g. so that intended results are achieved and subsidized products are not re-sold by the beneficiaries at the markets). Community groups will also be engaged in awareness raising activities. The information campaign will ensure public awareness of Project activities and the Government's priority investments in the sector. Improved transparency and accountability of the services provided by BTS (including through improved billing system) will help to enhance the trust of consumers and foster sustainability of investments.

F. Environment (including Safeguards)

111. Because the exact alignment of the 'Vostok' transmission pipeline under Component 1 will be finalized as part of its detailed design, and given that Components 2 and 3 are demand-based, the exact locations of activities supported under the Project are not yet known and an Environmental and Social Management Framework (ESMF) has been chosen as the environmental safeguards instrument. The ESMF was prepared and publicly consulted in accordance with OP/BP 4.01. The ESMF was disclosed in-country on April 18, 2017, and on the World Bank external website on April 25, 2017.

112. The Project will have overall positive environmental impacts and benefits at the selected Project locations, including: (i) improving the efficiency of heat and hot water supply services (Component 1), thereby reducing related fuel consumption and CO_2 emissions; (ii) reducing consumption of solid fuel (coal, fire wood, dung, etc.) by households without access to DH and lowering related CO_2, CO and $PM_{2.5}$ emissions (Component 2); (iii) reducing the consumption of electricity by selected public facilities (Component 3) and lowering related CO_2 emissions; and (iv) decreasing public health risks associated with indoor air pollution (Component 2) and low comfort levels in schools, kindergartens and health facilities.

113. The Project, especially during civil works under Component 1 and to a lesser extent under Component 3, is expected to cause some short-term negative impacts on air, soil, water, and acoustic environment. Environmental issues likely to be associated with the two Components include: noise generation; impact on soil and on water by the construction works; disturbance of traffic during construction and rehabilitation works; construction dust and wastes; finding and handling of hazardous materials (e.g. asbestos insulation, mercury containing light bulbs); and workers' safety. However, these adverse impacts will be temporary and site specific and can be easily mitigated through implementing adequate avoidance and/or mitigation measures identified in the ESMF and template Environmental and Social Management Plan (ESMP). Adverse impacts on natural environment, protected areas and physical cultural resources are not expected because of the location of the Project in urbanized areas.

114. Given that the Kyrgyz territory is located in zones of high seismic activity, Project activities under Components 1 and 3 will be required to comply with seismic regulations.

115. As described above (paragraph 109), an additional section along the 'Vostok' transmission pipeline is expected to be reconstructed with the support of parallel financing expected to be provided by RKDF. As this section will be connected to sections financed as part of the HSIP, it is considered as ancillary aspect of the Project, and all environmental safeguards requirements stipulated to other sections of the pipeline according to World Bank safeguard policies (OP 4.01 Environmental Assessment) will be equally applied to this section financed by RKDF. It is expected that the section funded by RKDF will be carried out before the commencement

of civil works of World Bank-financed sections of the pipeline. Accordingly, an environmental audit of the section to be financed by RKDF will be conducted between Board approval and Project effectiveness. However, for reasons outlined in paragraph 109 above, any impacts due to the municipal road expansion do not fall under the scope of the World Bank safeguards policies and OP 4.01 will not apply in this case.

116. No adverse or irreversible environmental impacts are anticipated from activities funded under Component 2, provided that stove designs and stove producers meet the eligibility criteria (as included in the OM and listed in the ESMF) and follow the relevant provisions to mitigate any possible environmental risks. In order to ensure the sustainable dismantling and the disposal of old stoves in compliance with the ESMF, relevant arrangements will be described in the Project OM[34] and relevant provisions included in respective service contracts. For activities related to Component 2, safety checklists will be included in the compliance protocol to be developed for delivered stoves (based on which the PIU will accept produced stoves for payment) and the manual for stove installers (which outlines detailed instructions for service providers on the proper and safe installation of stoves and LPBs). The checklist and the manuals will be developed together with the Project OM before Project effectiveness and will be approved by the World Bank.

117. **Climate Change**. The Project will contribute to climate change mitigation by improving the energy efficiency of the DH system, individual heating stoves/LPBs and selected public buildings. By enhancing the seismic resilience of public buildings, the Project will also contribute to climate change adaptation and resilient development. This scale up of pro-climate action in the Kyrgyz Republic is closely aligned with the World Bank Group's and ECA's Climate Change Action Plan 2017-2020.

G. Other Safeguard Policies

118. No other safeguard policies are applicable to the Project.

H. World Bank Grievance Redress

Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit *http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service*. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

[34] The OM will set out the detailed environmental and social institutional safeguard arrangements for the implementation of the Project.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework
COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

Project Development Objectives

The Project Development Objective is to improve the efficiency and quality of heating in selected Project areas.

Project Development Objective Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: Projected lifetime fuel savings		Mega Joules (MJ)	0.00	12212674005.00	Semi-annual	PIU progress reports	BTS and ARIS
Projected lifetime fuel savings of Component 1		Mega Joules (MJ)	0.00	7871875994.00	Semi-annual	BTS energy balance (with agreed adjustment factors) and CHP fuel consumption per heat energy unit	BTS
Projected lifetime fuel savings of Component 2		Mega Joules (MJ)	0.00	4191600000.00	Semi-annual	Laboratory test results	ARIS
Projected lifetime fuel savings of Component 3		Mega Joules (MJ)	0.00	149198011.00	Semi-annual	Energy audit and commissioning reports	ARIS

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: This indicator projects lifetime fuel use that is avoided by energy efficiency measures. The baseline value for this indicator should be zero.							
Name: Percentage of Project beneficiaries reporting an improvement in quality of heating		Percentage	0.00	70.00	Annual	PIU progress reports	BTS and ARIS
Percentage of Project beneficiaries reporting an improvement in quality of heating for Component 1		Percentage	0.00	70.00	Annual	Household survey conducted on a sample basis in buildings with upgraded substations	BTS
Percentage of Project beneficiaries reporting an improvement in quality of heating for Component 2		Percentage	0.00	70.00	Annual	Household survey conducted on a sample basis	ARIS
Percentage of Project beneficiaries reporting an improvement in quality of heating for Component 3		Percentage	0.00	70.00	Annual	Beneficiary surveys conducted in retrofitted buildings on a sample basis	ARIS
Description: This indicator projects the share of Project beneficiaries that perceive an improvement in quality of heating due to the Project.							

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection

Intermediate Results Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: Projected lifetime energy savings		Megawatt hour(MWh)	0.00	3374302.00	Semi-annual	PIU progress reports	BTS and ARIS
Projected lifetime energy savings (cummulative) of Component 1		Megawatt hour(MWh)	0.00	2168525.00	Semi-annual	BTS energy balance (with agreed adjustment factors)	BTS
Projected lifetime energy savings (cummulative) of Component 2		Megawatt hour(MWh)	0.00	1164333.00	Semi-annual	Laboratory test results	ARIS
Projected lifetime energy savings (cummulative) of Component 3		Megawatt hour(MWh)	0.00	41444.00	Semi-annual	Energy audits and commissioning reports	ARIS
Description: This indicator projects lifetime energy savings directly attributable to the project, converted to MWh. The baseline value is expected to be zero.							
Name: Projected lifetime		Tones/year	0.00	1051942.0	Semi-annual	PIU progress reports	BTS and ARIS

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
CO2 savings (cummulative)				0			
Projected lifetime CO2 savings (cummulative) of Component 1		Tones/year	0.00	777081.00	Semi-annual	BTS energy balance and CO2 content of fuel used at CHP	BTS
Projected lifetime CO2 savings (cummulative) of Component 2		Tones/year	0.00	272789.00	Semi-annual	Laboratory test results	ARIS
Projected lifetime CO2 savings (cummulative) of Component 3		Tones/year	0.00	2072.00	Semi-annual	Energy audit reports	ARIS
Description: This indicator projects lifetime reduction in CO2 emissions assessed on a cumulative basis and directly attributable to the project.							
Name: Direct project beneficiaries		Number	0.00	215598.00	Semi-annual	PIU progress reports	BTS and ARIS
Female beneficiaries		Percentage	0.00	50.00	Semi-annual	PIU progress reports	BTS and ARIS
Direct project beneficiaries of Component 1		Number	0.00	150148.00	Semi-annual	BTS customer database	BTS

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Direct project beneficiaries of Component 2		Number	0.00	56000.00	Semi-annual	ARIS Project cycle database	ARIS
Direct project beneficiaries of Component 3		Number	0.00	9450.00	Semi-annual	Energy audit reports	ARIS
Description: Direct beneficiaries are people or groups who directly derive benefits from an intervention (i.e., children who benefit from an immunization program; families that have a new piped water connection). Please note that this indicator requires supplemental information. Supplemental Value: Female beneficiaries (percentage). Based on the assessment and definition of direct project beneficiaries, specify what proportion of the direct project beneficiaries are female. This indicator is calculated as a percentage.							
Name: Number of individual substations installed/ rehabilitated (cummulated)		Number	0.00	1931.00	Semi-annual	Commissioning reports	BTS
Description: This indicator measures implementation progress on the modernization of IHS.							
Name: Number of installed heat and hot water meters (cummulative)		Number	0.00	4020.00	Semi-annual	Commissioning reports	BTS
Description: This indicator measures progress towards installation of heat and hot water meters.							
Name: Lenth (trench) of DH pipeline installed		Meter(m)	0.00	1870.00	Semi-annual	Construction supervision and commissioning reports	BTS

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: This indicator measures implementation progress on the rehabilitation and reconstruction of the Vostok transmission pipeline.							
Name: Number of stoves/ LPBs installed		Number	0.00	14000.00	Semi-annual	Project cycle database	ARIS
Description: This indicator measures implementation progress on the delivery/ installation of eligible stoves/ LPBs in households.							
Name: Number of public buildings retrofitted		Number	0.00	21.00	Semi-annual	Commissioning reports	ARIS
Description: This indicator measures progress on the implementation of energy efficient renovations in selected public buildings.							

Target Values

Project Development Objective Indicators

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Projected lifetime fuel savings	0.00	2106967556.00	6208284936.00	10316808665.00	11863541335.00	12212674005.00	12212674005.00
Projected lifetime fuel savings of Component 1	0.00	1807567555.00	5160384936.00	7871875994.00	7871875994.00	7871875994.00	7871875994.00
Projected lifetime fuel savings of Component 2	0.00	299400000.00	1047900000.00	2395200000.00	3892200000.00	4191600000.00	4191600000.00
Projected lifetime fuel savings of Component 3	0.00			49732670.00	99465341.00	149198011.00	149198011.00
Percentage of Project beneficiaries reporting an improvement in quality of heating	0.00	41.00	47.00	54.00	63.00	70.00	70.00
Percentage of Project beneficiaries reporting an improvement in quality of heating for Component 1	0.00	40.00	45.00	50.00	60.00	70.00	70.00
Percentage of Project beneficiaries reporting an improvement in quality of heating for Component 2	0.00	50.00	60.00	70.00	70.00	70.00	70.00
Percentage of Project beneficiaries reporting an improvement in quality of	0.00	0.00	50.00	60.00	70.00	70.00	70.00

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
heating for Component 3							

Intermediate Results Indicators

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Projected lifetime energy savings	0.00	581111.00	1712653.00	2847673.00	3277321.00	3374302.00	3374302.00
Projected lifetime energy savings (cummulative) of Component 1	0.00	497944.00	1421570.00	2168525.00	2168525.00	2168525.00	2168525.00
Projected lifetime energy savings (cummulative) of Component 2	0.00	83167.00	291083.00	665333.00	1081166.00	1164333.00	1164333.00
Projected lifetime energy savings (cummulative) of Component 3	0.00	0.00	0.00	13815.00	27629.00	41444.00	41444.00
Projected lifetime CO2 savings (cummulative)	0.00	197921.00	577611.00	933651.00	1031767.00	1051943.00	1051942.00
Projected lifetime CO2 savings (cummulative) of Component 1	0.00	178436.00	509413.00	777081.00	777081.00	777081.00	777081.00
Projected lifetime CO2 savings (cummulative) of Component 2	0.00	19484.00	68197.00	155880.00	253304.00	272789.00	272789.00
Projected lifetime CO2 savings (cummulative) of Component 3	0.00	0.00	0.00	691.00	1381.00	2072.00	2072.00

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Direct project beneficiaries	0.00	35880.00	108164.00	188448.00	211598.00	215598.00	215598.00
Female beneficiaries	0.00	50.00	50.00	50.00	50.00	50.00	50.00
Direct project beneficiaries of Component 1	0.00	31880.00	91014.00	150148.00	150148.00	150148.00	150148.00
Direct project beneficiaries of Component 2	0.00	4000.00	14000.00	32000.00	52000.00	56000.00	56000.00
Direct project beneficiaries of Component 3	0.00	0.00	3150.00	6300.00	9450.00	9450.00	9450.00
Number of individual substations installed/ rehabilitated (cummulated)	0.00	410.00	1171.00	1931.00	1931.00	1931.00	1931.00
Number of installed heat and hot water meters (cummulative)	0.00	1340.00	2680.00	4020.00	4020.00	4020.00	4020.00
Lenth (trench) of DH pipeline installed	0.00	680.00	1060.00	1870.00	1870.00	1870.00	1870.00
Number of stoves/ LPBs installed	0.00	1000.00	3500.00	8000.00	13000.00	14000.00	14000.00
Number of public buildings retrofitted	0.00	0.00	7.00	14.00	21.00	21.00	21.00

ANNEX 1: DETAILED PROJECT DESCRIPTION

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

1. The Project aims to improve the efficiency and quality of heating in selected Project areas. To this end, the Project includes three components: (1) Improving supply efficiency and quality of the DH system in Bishkek; (2) Piloting efficient and clean heating stoves; and (3) Demonstrating the benefits of energy efficiency improvements in public buildings.

b

2. **COMPONENT 1: Improving supply efficiency and quality of the DH system in Bishkek (estimated USD 31 million IDA financing).** This Component will support priority investments and capacity building activities aimed at improving the supply efficiency and quality of the DH system in Bishkek. The Component will be implemented by BTS and consists of two Subcomponents: (1) Priority investment program for DH rehabilitation; and (2) Operational capacity strengthening and Project implementation support for BTS.

3. **BTS operates the largest DH system in the Kyrgyz Republic**. Thermal energy generated at the CHP plant in Bishkek (owned and operated by EPP) accounts for around 70% of total thermal energy generated by DH systems in the Kyrgyz Republic. The plant was commissioned in 1961 and is currently being modernized, which will increase its electrical power capacity from 666 MW to 812 MW and decrease thermal energy capacity from 1,444 Gcal/hour to 1,294 Gcal/hour. The modernization is expected to be completed by the end of 2017. BTS operates a city-wide transmission and distribution network with a total length of 429 km to deliver heat and hot water dispatched at the CHP plant to about 103,000 end-consumers. In 2016, BTS supplied a total of 1.3 million Gcal of heat and 9.2 million tons of hot water to about 5,000 buildings, including 2,256 multi-apartment buildings, 1,122 detached family houses, 783 public buildings and 932 industrial/ other facilities. BTS's customer base covers about 80%-85% of all residential multi-apartment buildings in Bishkek. In terms of energy supplied, the key customer categories served by BTS are multi-apartment buildings (62%) and public buildings (35%).

4. **The DH system is dated and characterized by high losses**. The DH system operated by BTS consists of 19 booster pumping stations, consumer heat interface units as well as 388 km of DH water and 41 km of steam/condensate pipelines. The transmission network (DN 300-1020mm) includes 28 km above-ground and 112 km underground pipelines (mostly in non-accessible reinforced concrete ducts). The distribution network is comprised of 9 km above-ground and 239 km underground pipelines. About 70% of the DH network has been commissioned more than 25 years ago, and DH pipe technologies from that time remained to be the prevailing method for gradual extension, replacement and repairs of the network. The above-ground pipes are insulated with mineral wool, ruberoid (roofing felt) or asbestos plaster. In many places, the insulation is damaged or completely lacking due to wear and tear, theft and vandalism.[35] Mineral wool insulation is used for underground pipes as well, installed in concrete channels. Due to lack of water tight outer casing (as in pre-

[35] In recent years, BTS replaced on average about 7-8 km/year of its most dilapidated pipes based on annual replacement plans prepared with the input of the four operating districts. In addition, about 2,000-2,500 m^2 of the thermal insulation (for above-ground pipes/ pipelines in accessible ducts) are repaired each year. Outside the heating season, when only domestic hot water is supplied, BTS is using a one pipe system so that the other pipe can be (pressure) tested and repaired, if needed. However, pipeline wear-out rates surpass the rate of renovation works.

insulated pipes) the steel pipes are heavily exposed to external corrosion.[36] As a result of the old age and deteriorated condition of the network, inefficient controls at (open system) substations and mostly unmetered consumption, the technical and commercial losses are high: thermal energy losses in BTS' network are estimated to account for 29% of the heat dispatched from the CHP plant, and water losses for about 42% of the water dispatched (normalized average in 2013-2016).

5. **The system's operating regime impacts its overall efficiency**. The DH system is of the open system design, i.e. there are no heat exchangers at building- or apartment-level which would hydraulically separate the DH circulation water, the building-internal heating circuits (radiators) and the domestic hot water. As a result, customers are directly tapping hot DH circulation water for domestic use (e.g. washing and showering). Furthermore, BTS' DH system was originally designed to operate at variable temperature with 150^{o}C as the maximum. However, the current operation guidelines set a maximum of 110^{o}C, and at present, the DH system is operated practically with constant water flow and constant flow temperature. The only variation is between winter time (heating season) and summer time (hot water supply only). According to operation statistics from 2013, the average hourly flow temperature is about 65^{o}C, both during and outside the heating season; 70-80^{o}C is used only during the coldest days, for about three weeks per year. The low flow temperature and the resulting low delta-T of about 15-20^{o}C (difference between flow and return temperature) are detrimental to the DH system because it reduces the capacity of the transmission and distribution network and increases the pumping costs. The main reason for the low flow temperature is the open system design and lack of efficient domestic hot water temperature controls at building-level. Variable temperature (with higher temperature at peak periods) could be applied in the primary network if building-level substations are upgraded. Implementing more efficient control systems at consumer substations together with the ongoing plans to install variable speed booster pumps would further facilitate variable flow operation.

6. **SUBCOMPONENT 1.1: Priority investment program for DH rehabilitation (estimated USD 30 million IDA financing).** This Subcomponent will support the implementation of a priority investment program for the DH system operated by BTS, including related works, goods and consulting services (e.g. designs, technical specifications, supervision). The priority investment packages were identified based on a comprehensive technical and economic assessment of BTS' DH system completed in 2015 with the support of ESMAP and CAEWDP Trust Fund resources. The investment measures were prioritized and selected in accordance with the following criteria: (i) impact on heat and hot water loss reduction as measured by the economic internal rate of return for select investments; (ii) impact on supply reliability and quality as quantitatively and qualitatively assessed based on the technical condition of the DH network (e.g. age and condition of assets, breakdown statistics and number of customers connected to different sections of the network); and (iii) complementarity with planned investment measures financed by BTS and other development partners (see Section IV.D). Based on these criteria, Subcomponent 1.1 will support the preparation and implementation of two priority investment packages.

7. **Package 1: Modernization of individual (building-level) heat substations (estimated USD 21 million IDA financing)**. This package will support: (i) installation of new IHS in about 231 residential multi-apartment buildings, which currently use old hydro-elevators; (ii) reparation and upgrade of existing IHS in about 1,700 residential multi-apartment buildings; (iii) installation of about 4,000 building-level heat and hot water meters with remote reading functions ('smart meters') in all multi-apartment building-level substations without meters; and (iv) installation of a preventive maintenance information system.

[36] In the last couple of years, BTS started using pre-insulated pipes in small quantities and for small to medium dimensions.

8. ***Installation and upgrade of IHS and building-level meters in multi-apartment buildings (estimated USD 20.6 million IDA financing).*** Currently, two types of open system substations are used in buildings served by BTS: (i) substations equipped with mixing pumps and control valves for regulating the heating circuit and hot water temperature, used in about 90% of the residential multi-apartment buildings served by BTS; and (ii) old Soviet-type hydro elevator connections,[37] installed in the remaining 10% of multi-apartment buildings. In 2016, about 25% of heat energy and 34% of hot water was invoiced based on metering and the rest based on normative consumption.[38] This means that the majority of customers served by BTS are billed for heat and hot water based on norms, rather than actual consumption.

9. *Expected benefits*. The IHS investment package – involving the modernization of around 1,931 IHS and installation of 4,000 smart heat and hot water meters – is expected to benefit an estimated 89,496 households (covering about 95% of all multi-apartment buildings served by BTS and equaling approximately 56% of BTS' heat and hot water supply) and to help generate the following benefits: (i) reducing heat and hot water losses through installation of controllable IHS and meters, which would help decrease commercial losses (so-called non-demanded heat and unaccounted hot water) by introducing consumption-based billing for heat and hot water at building-level, and reducing leakages and heat losses at building connections; the estimated heat and hot water savings are equal to 6% (107,808 Gcal per year) of the total heat and 13% (1,257,178 tons per year) of the water dispatched from the CHP plant, respectively; (ii) facilitating a more accurate assessment of technical and commercial network losses and better targeting of future efficiency investments; (iii) improving the quality of heat supply through better temperature and flow control at building-level, which would help to reduce under- and/or over-heating of apartments, and decrease risks associated with excess temperature at consumer applications (e.g. shower and tap water); (iv) providing better incentives to end-consumers to use energy more efficiently by introducing consumption-based billing after the installation of building-level heat and hot water meters; and (v) increasing transmission and distribution capacity by facilitating the use of better optimized operation temperatures and pressures in the overall network (through better control at IHS); as a result, smaller pipe dimensions may be used at replacement[39] and/or more customers connected without network investments (other than the connection).

10. ***Installation of a preventive maintenance information system (estimated USD 0.4 million IDA financing).*** As part of investment package 1, the installation of a preventive maintenance information system will be supported, including necessary software, mobile maintenance devices, computer and training. Lessons learned from the earlier World Bank-financed Power and District Heating Rehabilitation Project (P008519) highlight the importance of adequate maintenance of rehabilitated assets to ensure their sustainability. The preventive maintenance information system will help improve the maintenance and management of IHS by facilitating better planning and supervision of maintenance works and optimizing the spare part inventory. Improved maintenance practices may not only reduce the risk of asset failures but also extend the equipment service life. While the maintenance information system would initially target BTS' substations, the company plans to gradually expand the system to also cover other assets and eventually integrate it with other

[37] A hydro-elevator is a pumping device in building-level substations utilizing the pressure difference between DH flow and return pipes to elevate the DH water to building-internal systems. In modern DH systems, the common approach is to use electrically driven pumps, which are easier to control, and more flexible and efficient from the operational point of view for the overall DH distribution system.
[38] The majority of heat metered customers are non-residential buildings (e.g. public and industrial buildings).
[39] Increasing the flow temperature (at peak periods) and decreasing the return temperature (due to better control at the upgraded IHS) will increase the transmission and distribution capacity.

information management tools.

11. The draft designs and bidding documents for the IHS investment package will be prepared with the support of ECAPDEV preparation grants. Once the bidding documents are finalized (expected in late 2017), BTS will launch related procurements prior to Project effectiveness in accordance with the agreed draft Procurement Plan.

12. **Package 2: Replacement and reconstruction of the 'Vostok' transmission network (estimated costs of USD 9 million IDA financing).** As part of this investment package, the most critical sections of one of the five main transmission pipelines and associated network parts ('Vostok' transmission pipeline) with a total length of about 1.87 km (trench length) will be replaced with pre-insulated pipes (up to DN 900 mm) and partly re-routed. This involves replacing about 0.18 km of existing above-ground pipelines and 1.01 km of existing underground pipelines, and constructing 0.68 km of new underground pipelines, new concrete valve chambers as well as related accessories. The selected sections are dated (with a service life between 30-50 years) and worn-out due to extensive corrosion and loss of insulation. During the last five years, the frequency and extent of maintenance needs to ensure continued reliability of supply have significantly increased along the target sections.

13. *Expected benefits.* Overall, the 'Vostok' transmission pipeline provides heat to about 31% of BTS' customers, including 450 apartment buildings (or 70,000 residents) and 29 community facilities (schools, kindergartens, hospitals) located in the South of Bishkek. In addition, the pipeline also provides peak and back-up capacity to other parts of the city. Replacing and reconstructing the targeted sections of the 'Vostok' transmission pipeline is expected to generate the following benefits: (i) help improve heat supply reliability to customers served by the pipeline; (ii) reduce technical heat and water losses by using pre-insulated pipes; (iii) improve safety of informal settlements built in close vicinity of one of the sections by re-routing and constructing a new underground pipeline; (iv) increase the transmission capacity, which may allow to connect new customers to the DH network that currently either rely on electricity or coal for heating; and (v) reduce 'emergency' maintenance costs and interventions for BTS.

14. The procurement of a qualified design company responsible for preparing the detailed design, bidding documents, technical specifications and supervision support for investment package 2 is currently ongoing and will be supported by ECAPDEV preparation grants. Once the bidding documents are finalized (expected in early 2018), BTS will launch related procurements prior to Project effectiveness in accordance with the agreed draft Procurement Plan.

15. **SUBCOMPONENT 1.2: Operational capacity strengthening and Project implementation support for BTS (estimated USD 1 million IDA financing)**. This Subcomponent will finance activities aimed at strengthening BTS' technical, operational, fiduciary, customer orientation and corporate resource management functions, and ensure effective Project implementation. The following activities will be supported as part of the HSIP:

a) *Upgrading of BTS' billing system:* BTS is currently improving its customer management database and started automating the billing system. This is an important step in modernizing the company's operations by eliminating manual entry points and increasing the effectiveness of data processing in accounting for revenues. Upgrading and automating the customer management and billing system is also expected to improve transparency and accuracy of bills for customers. Building on this ongoing

effort, the Project will support the completion of the automated billing system (e.g. updating the existing accounting software and integrating it with the billing system) in order to ensure proper revenue accounting, facilitate the transition to consumption-based billing and help strengthen customer orientation of the company.

b) *Supporting improved management of corporate resources*: While the company's existing information management system covers the main corporate functions (accounting, finance, human resources, procurement, warehouses and logistics, IT, corporate planning), several of the related processes and activities are carried out manually (e.g. data are recorded on paper and manually transferred). In order to strengthen the transparency, accountability and efficiency of corporate processes and activities, the Project will support an assessment of BTS' existing system (e.g. processes and activities executed, existing functionalities of supporting information management tools, and effective use of these tools), a 'gap analysis' to compare the current situation with good practices in management of corporate resources, and the development of an action plan to improve current practices (e.g. reengineering of processes and activities, eventual adjustments in the organizational structure, upgrades of existing information systems and/or implementation of new Enterprise Resource Planning system). It may also provide support for an update of BTS' long-term Corporate Strategy.

c) *Information and awareness campaigns to households:* BTS will conduct targeted information and awareness campaigns to affected households and other key stakeholders to inform about the planned investments and the transition to consumption-based billing, build understanding about the expected benefits for customers and facilitate implementation of the planned modernization plans.

d) *Optimization of BTS' operating regime:* The planned rehabilitation of BTS' pumping stations (parallel financing by EBRD), the modernization of IHS and the reconstruction of selected sections along the 'Vostok' transmission pipeline will enable BTS to improve its operating regime in terms of temperature and variable flow, which would further help in reducing losses and improving the overall efficiency of the system. To this end, the Project will support knowledge exchanges with other DH companies and an assessment of options to improve BTS' operating regime.

e) *Strengthening of BTS' technical and operational capacity*: The Project, including through the use of ECAPDEV preparation grants,[40] will also provide support to enhance the technical and operational capacity of key staff, including: (i) strengthening of BTS' accounting functions; (ii) enhancing the company's customer orientation; and (iii) improving the overall performance of the company through other targeted technical and operational trainings and capacity building activities, as needed.

f) *Implementation support for Project management*: This will include: (i) covering of Project M&E activities (e.g. customer satisfaction surveys); (ii) strengthening of the PIU, including by hiring a qualified FM Specialist (full-time), a Procurement Specialist (full-time), a Safeguards Consultant (part-time) and a translator, and by providing targeted training on relevant World Bank rules and procedures; (iii) carrying out the Project and entity audits by qualified companies acceptable to the Bank; and (iv) covering incremental operating expenses needed for effective Project implementation.

16. **COMPONENT 2: Piloting efficient and clean heating solutions (estimated USD 5 million IDA financing).** This Component aims to promote access to affordable, efficient and clean heating solutions for households that are not connected to DH and are relying on traditional, inefficient and polluting solid fuel-fired heating stoves

[40] ECAPDEV grants are available until up to effectiveness of the IDA Project. Some of the activities will be launched during the preparation process and continue to be supported under the IDA Project.

and LPBs. The Component will be implemented by ARIS and involves two Subcomponents: (1) Incentive program for low income households; and (2) Stimulation of production and use of efficient and clean heating stoves.

17. **Affordable, efficient and clean heating stoves and LPBs on local markets are lacking.** The majority of Kyrgyz households, especially among lower income segments use inefficient and polluting traditional solid fuel-fired stoves or simple LPBs to keep their homes warm during winter (see Section I.B). Based on the findings of two market surveys conducted in 2016 and 2017, the market price for these locally produced models ranges between USD 30 (biomass heating stove) and USD 250 (non-automated LPB). While there are currently no locally produced efficient and clean solid fuel-fired stoves available on the Kyrgyz market, some retailers offer certified state-of-the-art LPBs. However, these are usually imported and with costs of USD 500-USD 1,500 are not affordable to low income households. The largest stove market is located in Bishkek and traditional stoves/ LPBs are mainly manufactured by specialized boiler producers or metal welding and artisanal workshops. The production capacity of manufacturers varies between 100 and 1,000 stoves/ LPBs per year with flexibility for scale-up (especially outside of the heating season) should there be additional demand.

18. **The lack of viable alternatives forces households without access to DH to continue relying on solid fuel-fired heating technologies in the short- to medium-term**. The urban heating assessment completed in 2015 confirms that viable alternatives for households without access to DH are limited, especially for low income groups: (i) access to gas in the short- to medium-term will remain restricted mainly to wealthier households in Bishkek and select cities due to the limited coverage of the gas network, absence of significant expansion plans to residential consumers in the foreseeable future and affordability constraints; (ii) given the dilapidated condition and limited capacity of existing DH systems as well as the lack of viability to build new DH systems in low density areas, access to DH will also remain restricted to Bishkek and other major urban centers; (iii) switching to electricity-based heating by households currently relying on individual solid fuel-fired technologies is not considered to be a viable alternative in the short- to medium-term given the already strained capacity of the electricity network and recurrent winter power shortages;[41] and (iv) renewable energy sources for space heating are limited, taking into account natural resource limitations in the Kyrgyz Republic in terms of woody biomass as well as affordability and viability constraints associated with solar or geothermal energy for space heating purposes at household level. As a result, the multi-criteria analysis conducted as part of the aforementioned heating assessment – combining a levelised cost analysis with technical, institutional, environmental and social considerations – identified the switch to more efficient heating technologies for households without access to DH and currently relying on individual solid fuel-fired options as the most viable solution to help improve the heating situation for the majority of the Kyrgyz population in the short- to medium-term.

19. **Supporting the production and use of efficient and clean solid fuel-fired heating stoves will generate multiple benefits for households, local businesses and the environment**. Based on the preliminary results of the trial phase implemented during the heating season in 2016/ 2017 (see Annex 5) and experience from similar projects in other countries, switching from traditional, inefficient and often polluting heating

[41] In 2007-2016, residential electricity consumption increased by 58% and is characterized by high seasonality due to the significant use of electricity for heating. In 2016, households consumed an average of 286 kWh/month in summer but 721 kWh/month in winter. Winter demand accounts for 67% of total demand. The use of electricity for heating is a driving factor behind this seasonal consumption pattern and the additional electric load represents a major challenge to the already strained power system with recurrent power shortages occurring during winter months.

technologies to efficient and clean models is expected to generate multiple benefits, including: (i) reducing solid fuel consumption and related household expenditures by 45%-50% through an improvement of the thermal efficiency to at least 70%; (ii) decreasing $PM_{2.5}$ and CO emissions, which will help to reduce households' exposure to indoor air pollution and related health costs in particular for women, children and pensioners who spend more time at home; (iii) reducing ambient air pollution; (iv) improving comfort levels by enabling households to heat their homes to more adequate temperature levels; (v) enhancing user convenience by extending the stove burning duration (and reducing the related need for constant refueling) from currently 1-3 hours to up to 15 hours; and (vi) creating new business opportunities for local stove manufacturers.

20. **SUBCOMPONENT 2.1: Incentive program for low income households (estimated USD 4.4 million IDA financing)**. As part of this Subcomponent, an incentive program targeting eligible low income households in selected pilot rayons will be supported in order to help: (i) promote the development of a local market for efficient and clean heating technologies by fostering local demand and facilitating quick market penetration; and (ii) improve the heating situation for poor households by providing access to affordable, efficient and clean solutions. Accordingly, Subcomponent 2.1 will provide support to low income households by providing access to eligible heating solutions at a subsidized price; covering the installation costs of new models and the removal/ recycling of old equipment; and supporting required implementation structures of the incentive program (e.g. local facilitators, local demonstration centers, technical experts, M&E activities; etc.). Key program features are summarized below and will be further detailed in the OM.

21. ***Pilot rayons:*** The Component is designed as a pilot program to help promote the development and adoption of efficient and clean individual heating technologies in the Kyrgyz Republic. It will be tested in the four poorest rayons in two selected Oblasts (Naryn and Osh). The two Oblasts were selected based on poverty considerations, synergies in terms of existing awareness and capacity that were built in the two Oblasts as part of the ongoing trial phase (see Annex 5) and climatic aspects that influence heating patterns in the Kyrgyz Republic and hence the replication potential of the pilot. Based on 2016 data from the Ministry of Social Protection concerning the share of poor families in rayons, the following four rayons were selected: Naryn and Ak-Talaa in Naryn Oblast (North), and Nookat and Alay in Osh Oblast (South). Depending on implementation progress, additional rayons may be added in later Project years, with the selection of specific pilot rayons to be defined and agreed as part of an updated version of the OM.

22. ***Household eligibility criteria***: The program will use a demand-based approach, i.e. interested eligible households in the pilot rayons will have access to eligible heating models at a subsidized price. To be eligible, households have to be resident in one of the selected pilot rayons and meet the following criteria:

a) *Low income status*: Incentives will be provided to low income households as confirmed by social passports, which are issued by local administrations to households with an average monthly income below KGS 2,631 (USD 36) per person (2016). By targeting low income households, the program will help to ensure that: (i) incentives are provided to the household segment that relies the most on polluting and inefficient solid fuel-fired stoves (93% of low income households use wood, dung or coal as primary fuel for heating in traditional stoves as compared to 80% among higher income groups), and that can afford the least the higher upfront investment costs of improved technologies; and (ii) the program complements the ongoing EBRD-supported credit line (KYRSEFF) for energy efficiency, which focuses mainly on creditworthy middle and higher income households by providing commercial loans and grants for energy efficient upgrades of buildings and equipment, including heating systems (see Section IV.D).

b) *Current reliance on solid fuel-fired stoves:* The program targets households which currently use solid fuel-fired stoves or LPBs as their primary heating source. This means households with access to centralized heating/gas or primarily using electricity for heating purposes will not be eligible for incentives provided under the program.

c) *Detached houses without major heat losses:* Incentives will only be provided to households living in detached houses that are in reasonable condition, i.e. without apparent sources of major heat losses, such as broken windows or doors.

23. ***Product eligibility criteria***: The program will provide incentives for the purchase of efficient and clean heating technologies (stoves and LPBs), which meet a number of eligibility criteria as outlined in Table A1-1 and further detailed in the OM. In terms of performance, eligible models need to have an overall thermal efficiency of at least 70%, and either limit emission of particulate matter ($PM_{2.5}$) to no more than 70 mg/MJ and CO emissions to no more than 7 g/MJ heat delivered, or reduce indoor air pollution by at least 90% as demonstrated through field measurements on the $PM_{2.5}$ concentration in sample households.[42] These performance criteria are in line with standards set in other efficient and clean heating stove program (notably Mongolia and China) and takes into account Kyrgyz heating patterns and the use of various types of biomass and coal. Compliance with the agreed performance criteria will be confirmed through pre-screening at the local Stove Development Center (see Subcomponent 2.2), field measurements on $PM_{2.5}$ concentration levels and tests conducted at a reputable testing laboratory in accordance with an agreed testing protocol, which was developed with the support of ESMAP Trust Fund resources during the trial phase and reflects local heating practices.

Table A1-1: Key Eligibility Criteria for Stoves and LPBs

№	Criteria	Indicators/values
1	Fuel	All solid fuels, including coal, dung and wood; the laboratory testing results are relevant only for the selected stove-fuel combination
2	Type of heating system	Both stoves and LPBs are eligible; the system has to be designed to provide primarily heat; cooking can be included as an option
3	Heating capacity	Equal or more than 5 kW and less than 30 kW of heating power, averaged over the whole testing cycle
4	Overall thermal efficiency	>70%
5	Particulate matter emission ($PM_{2.5}$ g/MJ_{net})	Maximum $PM_{2.5}$ emissions of 70 mg/MJ following the agreed laboratory testing protocol, or 90% reduction of indoor $PM_{2.5}$ concentration following the agreed testing protocol conducted in sample households
6	CO emission (g/MJnet)	Maximum CO of 7g/MJ following the agreed laboratory testing protocol
7	Safety	Compliance with approved design and product safety checklist (to be included in the OM), including: - Pressure valves installed for LPBs - Safe and sound manufacturing (e.g. absence of cutting edges, strong components) - Use of adequate material and dimensioning (e.g. brick sizes, thickness of steel)
8	Workmanship and durability	Workmanship and materials used should ensure durability of at least 5 years or more

24. Currently, there are no local stoves available on the Kyrgyz market that meet these criteria and only a

[42] Average results from measurements conducted during the trial phase will be used as the reference baseline for this criterion.

limited number of imported high-end LPBs have thermal efficiencies of more than 70%. As part of the initial trial, four stove and one LPB prototypes have been developed, locally manufactured and tested in 51 low income households during the 2016/2017 heating season (see Annex 5). It is expected that the following two models will be eligible and promoted in the first year, given their performance and success in terms of household feedback:

a) Model 2.5 – biomass-fired space heating stoves with cooking function, an average thermal efficiency ranging between 73% (low power) and 85% (high power), and an estimated fuel saving of 45% compared to traditional biomass-fired technologies. The stove can burn dung, wood and coal, and be connected to a (regular or long) chimney or a heating wall. The average burning period of the stove is up to 8 hours.

b) Model 4 – coal-fired space heating stove with cooking function, an average thermal efficiency of 74% and an estimated fuel saving of 40% compared to traditional technologies. The stove can be connected to a chimney or a heating wall, and has an average burning period of 6-15 hours (without refueling).

25. In outer years, additional heating models will be offered to eligible households, subject to meeting the agreed performance criteria. To support product development, about 2% of the available funds allocated to Component 2 will be reserved for testing new prototypes in households and a reputable testing laboratory. For this purpose and to provide ad hoc guidance on technical aspects of the Component, ARIS will engage a stove expert with international experience on an 'as-needed' basis.

26. ***Producer eligibility criteria and selection process***: The selection of producers will follow a two-stage process: (i) *list of potential suppliers*: ARIS will issue a call for participation to potential producers, and identify those that express interest and meet the eligibility criteria described in the OM and summarized in Table A1-2 below; ARIS may sign Participation Agreements with the potential suppliers outlining the general terms and conditions for participation in the program;[43] and (ii) *batch procurement*: based on the selection of specific models by eligible households, ARIS will conduct procurements of the selected models among aforementioned list of potential suppliers following World Bank procurement rules and procedures. Taking into account current capacities of local producers, and to promote competition and facilitate mainstreaming of efficient and clean heating technologies among producers, the procurement of eligible models is likely to be done in batches of around 200-300 stoves. The eligibility criteria and procedures for products and producers will be regularly reviewed and updated, as needed, in the OM.

Table A1-2: Key Criteria for Identifying Potential Producers

№	Criteria	Parameter/values
1	Stove model	Having successfully produced a stove model as per eligible design
2	Production capacity	Being able to supply a minimum of 100 eligible stoves within a 4-month period after obtaining a purchase order
3	Quality control	Agreeing to the following quality control aspects, which will be further developed in the OM and detailed in the Participation Agreement: - Marking each stove with a unique tamper proof identification label and number, allowing the stove to be traced back to the supplier and production date - Facilitation of defined quality assurance process, including acceptance tests, quality and performance tests of installed stoves/ LPBs, and penalties for manufacturing

[43] This is expected to include provisions related to the production and delivery of eligible models, including standard delivery times, after-sales services, compliance with safeguard requirements, periodic quality and performance inspections and other program aspects.

№	Criteria	Parameter/values
		- Accepting disclosure of information, including product performance parameters, production capacity and price
4	Warranty	Providing a warranty to users, guaranteeing that the stove will be repaired or replaced during a two-year period following the purchase, if there are defects, breakage, or component malfunctions due to manufacturing defects
5	Participation	Signing a Participation Agreement with ARIS
6	Safeguards	Complying with safeguard requirements
7	Operations and maintenance manual	Providing a basic operation and maintenance manual for their product specifying how it is to be operated by the user for optimal and safe performance
8	Legal Entity	Holding a valid business license

27. ***Incentive mechanism***: Eligible households will have access to and the choice between eligible stove models at a subsidized price. While incentives provided under Component 2 will be differentiated between higher and lower priced models, eligible households have to provide a contribution towards the cost of eligible models in order to ensure ownership and enhance program sustainability. The household contribution is expected to remain unchanged throughout the Project, be defined at an absolute value (to avoid unequal treatment due to price fluctuations) and be set at around 30% of the initial estimated market price of eligible stove models and 40% of eligible LPBs.[44] The level of household contribution will be reviewed after the first pilot year in order to ensure its adequacy and affordability, taking into account household and community feedback, achieved results and lessons learned. The proposed household contribution was informed by the following considerations:

- Lessons learned from similar programs indicate that well-targeted incentives are needed to stimulate supply and demand for efficient and clean household technologies, especially for low income households. However, stove giveaways should be avoided in order to prevent lack of ownership by households, unsustainable expectations by users and crowding-out of private initiatives;
- The estimated annual income for poor households averages around KGS 147,125 (USD 2,167). Buying a new stove is therefore a significant expenditure for poor households and may require investments up to 12% of their annual income. Accordingly, affordability of better performing heating stoves represents a challenge for poor households;
- A recently completed representative survey for households without access to DH showed that households spend on average about KGS 1,500/month (USD 21/month) per household for heating fuels or around USD 100 over the heating season. With a more efficient stove, households may be able to save up to USD 40 per heating season depending on the current comfort level and efficiency of the stove in use;
- Stakeholder consultations conducted during Project preparation, including in particular feedback from local communities and low income households monitored as part of the initial trial phase (control and trial households), indicate an ability and willingness to pay around USD 40-150 per household[45] for more efficient and clean heating stoves.

28. ARIS will be responsible for the procurement of and payment (including incentive payment and

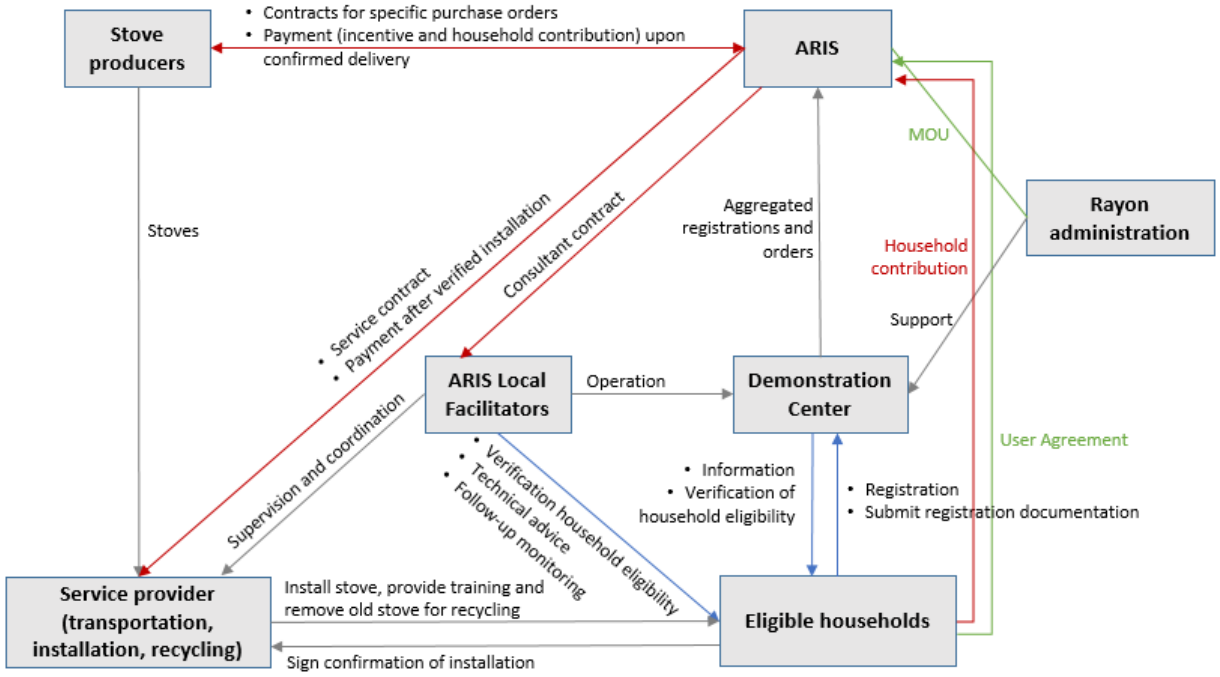
[44] For models likely to be promoted in the first year, household contribution would correspond to around USD 48.
[45] Trial households usually indicated a much higher willingness to pay compared to control group households.

household contribution) to selected producers upon accepted delivery of the stoves (a performance guarantee may be retained). In addition, the program will also cover costs related to testing of eligible models at a reputable laboratory as well as costs of transportation, installation (including basic improvements of the connecting parts, such as heating walls or chimneys, to ensure safe operation of the stove), and recycling of the old stoves. With the available funds allocated to Component 2 and estimated program costs, it is expected that around 14,000 efficient and clean heating stoves/ LPB will be installed in eligible low income households located in the pilot rayons.

29. ***Community-based implementation mechanism:*** In each pilot rayon, the program will be implemented in close collaboration with local communities, including local administrations, associations of Aksakals (elders), neighborhood and women groups. To this end, ARIS will conclude tripartite MoUs with each pilot rayon administration outlining the terms and conditions of the pilot cooperation. Specifically, pilot rayons (with the support of village councils and ARIS' local facilitators) will be responsible for supporting: (i) information and awareness raising campaigns to households; (ii) verification of household eligibility criteria; (iii) monitoring of the program to ensure that that the program is implemented as intended and achieves targeted results; (iv) information to eligible households about payment options and collection of registration documents (including household baseline questionnaires, confirmation of household contributions and signed User Agreements between ARIS and eligible households); and (v) aggregation and transfer of orders for eligible models to ARIS on a regular basis. Local Demonstration Centers will be established in each pilot rayon so that interested households can obtain detailed information on the program, inspect eligible models (displayed in brochures and/or showrooms, depending on availability of space), and register to the program. The detailed implementation process and related responsibilities will be further described in the Project OM.

30. In each of the pilot rayons, local facilitators from ARIS (a technical expert and a social mobilization specialist) will closely work with the local administration to coordinate and facilitate implementation. Specific functions of the local facilitators will include: coordinating information and awareness campaigns to households; supporting the operation of the Demonstration Center; verifying household eligibility criteria in terms of housing condition (based on a checklist template to be developed as part of the OM) and current fuel use; coordinating installation of stoves between eligible households and selected service providers; verifying quality of installation and training provided to households; confirming trade-in of the old stove; conducting follow-up monitoring activities; and following-up on household complaints. An overview of the implementation mechanism is provided in Figure A1-1 below.

Figure A1-1: Implementation mechanism for efficient and clean heating stove program



31. **SUBCOMPONENT 2.2: Stimulation of production and use of efficient and clean stoves (estimated USD 0.6 million IDA financing).** This Subcomponent aims to stimulate the production and use of efficient and clean heating technologies through capacity building and awareness raising activities to suppliers, households and other stakeholders. Specific activities will include the following:

a) *Establishment of a Stove Development Center:* The Stove Development Center will be established as a center of expertise for efficient and clean stoves/LPB mandated to provide technical assistance, training and capacity building to local stove designers, manufacturers and installers to develop, produce and install safe, efficient and clean products of high quality. The center will also perform pre-selection screening (i.e. testing the thermal efficiency and conducing visual inspections) of new stoves/LPB models before sending them to a reputable stove testing laboratory. This activity will build on: technical assistance provided during Project preparation with the support of Trust Fund resources, including trainings organized for stove producers, designers and installers; and detailed operation manuals prepared for the production, installation and use of stoves expected to be promoted during the first Project year.

b) *Capacity building, training and awareness raising activities:* Targeted capacity building, training, awareness raising and information campaigns will be conducted for Government entities, local administrations and communities, households, and other stakeholders on the benefits of switching to efficient and clean heating technologies. Experience from similar programs implemented in other countries show that targeted outreach is critical to help generate and maintain demand for efficient and clean technologies. Information campaigns will be implemented in close collaboration with local communities, formulate gender-targeted messages and utilize varying tools to reach out to both men and women. This activity will build on capacity building, training and awareness raising that is currently being conducted as part of the trial phase with the support of Trust Fund resources.

32. **COMPONENT 3: Demonstrating the benefits of energy efficiency improvements in public buildings (estimated USD 10 million IDA financing).** This Component aims to demonstrate the benefits of energy efficiency improvements in selected public buildings, will be implemented by ARIS and consists of two Subcomponents: (1) energy efficiency investments in public buildings; and (2) Project implementation support for Components 2 and 3.

33. **Using social outreach capacity of public buildings for demonstration purposes**. Given their social outreach capacity and sizeable share in total electricity consumption, public buildings are a good starting point for demonstrating the multiple benefits of energy efficiency and its importance as a solution to help address winter energy shortages. Specifically, improving energy efficiency in public buildings will help to reduce electricity consumption and related peak loads, and decrease recurrent public energy expenditures. Reducing heat losses in public building will also help to enhance comfort levels during winter, and improve building operations. Based on available energy audits for public buildings in the Kyrgyz Republic, it is estimated that energy consumption can be reduced by 40%-80%, subject to the current comfort level in buildings as some of the savings may be used to increase temperature levels. In addition, the combination of energy efficient and seismic upgrades will not only strengthen building resilience to natural disasters but also help to start mainstreaming operational synergies between energy and resilience aspects (notably by building on the experience from the Urban Development Project and complementing the planned Project on Enhancing Resilience in the Kyrgyz Republic).

34. **Multiple barriers hamper progress on energy efficiency improvements**. While the potential for energy efficiency improvements in public buildings is significant, a number of technical, economic, institutional, legal, regulatory and financial impediments are preventing comprehensive energy efficiency investments from being undertaken: (i) low energy tariffs[46] and norm-based billing for DH; (ii) strained public sector budgets and lack of access to commercial financing by public entities, including for energy efficient retrofits; (iii) low comfort levels and public budgeting regulations that limit achievable and retainable energy cost savings; (iv) lack of local market capacity and experience (e.g. energy auditors, design institutes, construction companies, etc.) in preparing and implementing high quality energy efficiency projects; (v) lack of credible data, awareness and behavioral inertia, which hamper the demand for and investments in energy efficiency products and services; and (vi) institutional and regulatory barriers, especially on the implementation and enforcement side.

35. **SUBCOMPONENT 3.1: Energy efficiency investments in public buildings (estimated USD 9 million IDA financing).** This Subcomponent will finance energy efficiency and seismic investments in selected public buildings mostly from the education and health sectors (e.g. schools, kindergartens, hospitals and clinic centers) and related capacity buildings activities. Two main activities will be supported under the Subcomponent.

36. ***Activity 1: Energy efficiency investments in selected buildings (estimated USD 8.8 million IDA financing)***. This activity will primarily finance energy efficiency and seismic investment measures in selected public buildings as well as related consulting services. Eligibility and selection criteria for buildings and related

[46] Current heating and electricity tariffs are below cost recovery levels and one of the lowest in the ECA region. However, in recent years (2014-2015), weighted average electricity and heat tariffs for non-residential customers, including the public sector, were increased by more than 50% for electricity (to KGS 2.23/kWh or USD 0.03/kWh) and more than 80% for heating (to KGS 1,695/Gcal or USD 24.7/kWh).

implementation aspects are summarized below and will be further detailed in the OM.

37. ***Building eligibility and selection process****:* To be eligible, buildings have to meet the following basic criteria: (i) confirmation of public ownership; (ii) structural soundness of the building; (iii) absence of plans for closure, downsizing, or privatization of the facility; and (iv) use of electricity-based heating system to maximize electricity savings. Buildings will be selected based on 3-4 annual call for nominations to local administrations (with a specific geographic focus every year). Nominated buildings will then be ranked based on their energy efficiency potential as assessed by the specific energy consumption per heated area (kWh/m^2) and their social impact in terms of number of beneficiaries (e.g. number of pupils, patients, staff, etc.).

38. The first call for nominations will be issued shortly after approval of the Project by the World Bank's Board of Directors and around seven buildings be selected for the first batch of building renovations in accordance with above outlined process. The selection criteria and process will be annually reviewed and may be adjusted based on experience from the previous year. Any adjustments of the selection criteria will be reflected in the OM and have to be agreed with the World Bank. The list of nominated and selected buildings, including key information relevant for the selection process, will also be reviewed by the World Bank. Upon confirmed selection, ARIS will sign tripartite MoUs with the local administration responsible for the facility and the building administration, which stipulates the terms and conditions for energy efficiency investments in the selected public buildings.

39. ***Building renovations****:* Energy audits and seismic assessments will be conducted in each selected building to identify the economically most viable energy efficiency measures and seismic reinforcements needed to comply with local regulations. Eligible measures will include: building envelope measures (e.g. walls, basements, roof, windows, doors); heating system upgrades (e.g. boilers, valves and controls, pipes, chiller/air conditioners, heat pumps, solar water heating); lighting (e.g. light emitting diodes); other viable energy saving measures; and seismic reinforcements needed to comply with local regulations. A limited amount of funds (up to 15% of total investment costs) may be made available for additional works required to ensure reasonably full renovation or longevity of investments (e.g. painting, replacement of old gutters and down sprouts to avoid water damages).

40. Based on the completed energy audits and seismic assessments, recommended priority measures will be discussed with the responsible local administration and the building administration. On this basis, detailed designs will be prepared and buildings retrofitted. Before and after implementation of energy efficiency/ seismic measures, social surveys will be conducted for sample buildings to assess end-user satisfaction levels, including improved comfort levels and working conditions, as well as any changes in behavior and awareness on energy efficiency. ARIS will be responsible for conducting all procurement activities and making related payments, reviewing energy audits and designs, and supervising renovations and commissioning. Supervision and commissioning (to ensure energy savings are consistent with the audit reports and designs) will be supported by an experienced firm. With the available IDA funds allocated to Activity 1 and cost estimates provided in existing energy audits for public buildings conducted as part of the Urban Development Project, it is expected that around 21 buildings will be rehabilitated by the end of the Project.

41. ***Activity 2: Capacity Building on energy efficiency (estimated USD 0.2 million IDA financing).*** This activity will support targeted capacity building activities to improve the enabling environment for energy efficiency, enhance market capacity and build public awareness on energy efficiency. Specific activities are

outlined below and will be complemented by Trust Fund resources, including from ESMAP.

a) *Training to local firms:* Targeted capacity building and training activities for energy audit companies, design firms, construction companies and other energy service provides will be conducted to enhance their technical capacities in preparing and implementing energy efficiency projects. The training will also aim to capture and learn from early project lessons (e.g. quality of designs and construction weaknesses). In order to help improve market capacity before implementation start of the Project, targeted training and technical assistance to potential service providers will be offered with the support of ESMAP Trust Fund resources.

b) *Public awareness campaign on energy efficiency:* In order to enhance awareness and understanding of energy efficiency, targeted awareness and information campaigns will be conducted for Project beneficiaries in retrofitted buildings, local communities, relevant Line Ministries and other stakeholders. In addition, Project results will be captured and broadly disseminated to demonstrate the multiple benefits associated with energy efficiency, including its potential as a solution to help address winter energy shortages.

c) *Piloting of a benefit-sharing and/ or co-financing scheme:* In order to help pilot the transition to more sustainable financing schemes, the Project will aim to phase-in and pilot benefit-sharing and/or co-financing schemes in 1-2 selected Oblasts/ rayons. The benefit-sharing scheme will aim to capture and direct part of the energy cost savings achieved to finance additional energy efficiency activities in the Oblasts/rayon, such as small awareness and information campaigns or financing of additional no or low cost energy savings and other rehabilitation measures. Related provisions would be included as part of the tripartite MoU.

d) *Support implementation of a Roadmap on energy efficiency:* The Government is planning to develop a Roadmap for improving energy efficiency in the public sector with the support of the World Bank and ESMAP. The Roadmap will include priority actions and financing mechanisms to help gradually scale-up energy efficiency in the public sector. The Project may support implementation for some of the recommended priority actions identified in the Roadmap.

42. SECO plans to provide grant financing towards implementation of Component 3. The activities proposed for financing by SECO would build on and complement the IDA Project by:

- Providing innovation grants and related technical assistance to pilot innovative energy efficiency technologies in buildings selected for energy efficiency and seismic retrofits under the HSIP. The potential for integrating complementary and innovative technologies as a top-up to measures financed under the HSIP will be assessed as part of the energy audits and determined on a building-by-building basis. Examples of measures that may be financed by SECO include: hybrid heating systems, such as combined solar photovoltaic (PV) and heat pump systems, especially in regions with significant capacity shortages; combined PV/solar-thermal energy and heat pump storage systems for medical facilities with high hot water and cooling demand and need for operational resilience during power outages; solar rooftop systems and/or other energy saving/ load reducing measures.
- Supporting preparation and implementation activities for a distinct set of buildings selected for financing under the HSIP, including energy audits, seismic assessments and preparation of the technical documentation.
- In a number of selected cities/municipalities where buildings will be retrofitted as part of the HSIP, conducting broader energy efficiency assessments across different municipal sectors, such as water

supply, street lighting, district heating and public buildings.[47] On this basis, a time-bound and locally tailored energy savings action plan would be developed, including a prioritized investment pipeline, in order to inform future investments in energy efficiency funded by the local administration, SECO or other development partners.

43. **SUBCOMPONENT 3.2: Project Implementation Support for ARIS (estimated USD 1 million IDA financing).** This Subcomponent will provide support for effective implementation and management of Components 2 and 3. Given the dispersed nature of investments supported under these two Components and the importance to ensure strong implementation mechanisms to maximize benefits and demonstration effects, a strong and adequately staffed PIU combined with sufficient resource allocation is critical. Accordingly, this Subcomponent will provide support for: (i) ARIS PIU staff[48] (including Project Manager, Coordinator for Component 2, Coordinator for Component 3, Disbursement Specialist, Procurement Specialist, M&E Specialist and Interpreter) and contributions towards the cost of backstopping assistance by ARIS staff (the so-called administrative pool of ARIS); (ii) Project-related operating costs and trainings; and (iii) annual audit of Project accounts.

[47] This activity is likely to be Bank-executed.
[48] Additional consultants supporting implementation will be hired under Component 2 and Subcomponent 3.1, as agreed in the Procurement Plan.

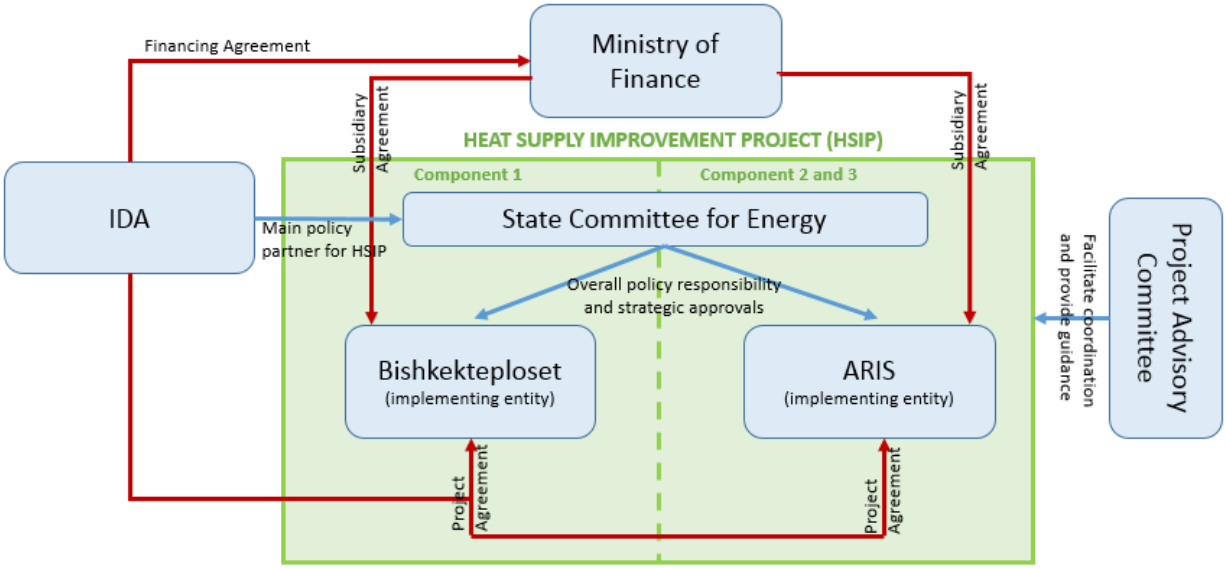
ANNEX 2: IMPLEMENTATION ARRANGEMENTS

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

Project Institutional and Implementation Arrangements

44. **Overall implementation structure**. The Financing Agreement for the HSIP will be negotiated and concluded between the Ministry of Finance on behalf of the Kyrgyz Republic and the World Bank. The Ministry of Finance will provide the proceeds of the IDA credit and grant, respectively, to the two Project implementing entities through Subsidiary Agreements: (i) BTS as the implementing entity of Component 1; and (ii) ARIS as the implementing entity of Components 2 and 3. The World Bank will conclude Project Agreements with each of the two implementing entities. The State Committee for Energy assumes the overall policy responsibility for the preparation and implementation of the Project. A PAC, chaired by the State Committee for Energy and involving key stakeholders, will facilitate coordination and provide strategic advice during implementation. Figure A2-1 provides an overview of the institutional and implementation arrangement for the HSIP, which will be further detailed in the OM. Responsibilities of different key stakeholders involved are summarized below.

Figure A2-1: Overview of the institutional and implementation arrangement for HSIP



45. **State Committee for Industry, Energy and Mining**. The State Committee for Energy has been providing policy guidance during the preparation of the Project and will continue to guide its implementation. Specifically, this will include: (i) chairing of the PAC, which includes Project key stakeholders and assumes a facilitative and advisory role; (ii) strategic decision-making on potential scaling-up of energy efficiency investments in the public sector, including through the development of a Roadmap; (iii) championing the efficient and clean heating stove agenda, including development of a scale-up plan after implementation of the Project; and (iv) facilitating coordination and outreach to key Project stakeholders. BTS and ARIS will continue to consult the State Committee for Energy on strategic issues during implementation and submit key Project

documents for information to the State Committee. It will also be involved in capacity building activities supported under all three components.

46. **Bishkekteploset JSC**. BTS – responsible for the purchase, transmission, distribution and sale of thermal energy and hot water in parts of Bishkek – will be the designated implementing entity for Component 1. It is a state-owned joint stock company, established pursuant to the Registration Certificate no.15573-3300-AO dated April 12, 2007 issued by the Ministry of Justice and functioning according to its charter approved by the shareholders' general meeting dated April 9, 2015.

47. Day-to-day preparation and implementation of Component 1 will be done by the existing PIU within BTS, which was established in 2015 for the purpose of implementing externally-financed projects (Order No. 68 of the General Director, dated April 27, 2015). Detailed responsibilities of the PIU for the purpose of the HSIP will be described in the OM and include inter alia: procurement, contracting and processing payments for all goods, works and services; FM; environmental and social safeguards; monitoring, evaluation and reporting; coordination with other relevant units within BTS; outreach and consultations with public and private stakeholders, including the Energy Holding Company, the State Committee for Energy and Project beneficiaries; preparation of PAC meetings related to Component 1; and routine communication with the World Bank.

48. BTS and its PIU have adequate technical implementation capacity, including staff with solid professional qualifications, but only limited experience in implementing World Bank-financed projects. In order to support effective Project management and strengthen fiduciary and safeguards capacity of the PIU, BTS has hired a qualified and experienced FM consultant, a Procurement consultant and a (part-time) Safeguard consultant based on ToRs agreed with the World Bank and using ECAPDEV grant and IDA resources after Project effectiveness. For targeted advice on technical key issues, BTS will also engage a senior DH expert with international experience on an 'as needed basis' (under Subcomponent 1.1). Throughout Project implementation, the PIU will further draw upon the technical expertise of other relevant units and staff within BTS (e.g. engineers, repair unit, operation and technical unit, service quality center). The Procurement and Logistics Unit and the Accounting Unit within BTS will support the PIU on fiduciary matters, and may also benefit from fiduciary capacity building activities supported by the ECAPDEV grant and the Project, respectively.

49. **Community Development and Investment Agency.** ARIS is the designated implementing entity for Components 2 and 3 of the Project. ARIS was created by a Decree of the President of the Kyrgyz Republic in October 2003 (Edict of the President of the Kyrgyz Republic No. 330, dated October 15, 2003) as a legally and operationally autonomous institution for the purpose of managing the implementation of the IDA-supported First Village Investment Project. It operates under the oversight of a Supervisory Board comprised of 21 representatives of the State administration, local government and civil society.

50. As the implementing entity for Components 2 and 3, ARIS will be responsible for carrying out all related Project preparation and implementation activities in accordance with the OM, including in particular: review of eligibility criteria and management of the selection process for eligible products and manufacturers under Component 2 and for public buildings under Component 3; liaising with key stakeholders (e.g. local communities, local and public building administrations, Project beneficiaries); procurement, FM and accounting; social and environmental safeguards; preparation of PAC meetings related to Components 2 and 3; monitoring, evaluating and reporting; as well as routine communications with the World Bank.

51. ARIS will further sign the following agreements to facilitate implementation of Components 2 and 3 (templates will be included in the OM): (i) User Agreements with eligible households under Component 2, which outline the rights and obligations of beneficiaries and the PIU; (ii) MoUs with pilot rayons governing the cooperation and implementation of Component 2; and (iii) tripartite MoUs with the local administration and public building administrations, stipulating the terms and conditions for energy efficiency investments in the selected public buildings.

52. ARIS has extensive experience in managing and implementing World Bank-financed projects.[49] Accordingly, its implementation capacity is considered to be adequate. For the purposes of the HSIP, ARIS will maintain a core team (PIU) comprised of: Project Manager, coordinator for Component 2, coordinator for Component 3, technical experts, disbursement specialist, procurement specialist, M&E Specialist, interpreter (all hired based on ToRs and qualifications agreed with the Bank) and a part-time safeguard consultant. The PIU will work under the management of ARIS' Executive Director, and ARIS' administrative pool will provide backstopping support, as needed. For targeted advice on technical key issues, ARIS will also engage a senior stove expert and an energy efficiency expert with international experience on an 'as needed basis'. To support implementation of Component 2 in pilot rayons and manage the Project cycle database, ARIS will involve local technical and social mobilization facilitators in the selected pilot rayons as well as an information management/database specialist, respectively.

53. **Project Advisory Committee.** The objective of the PAC is to facilitate coordination among key stakeholders of the HSIP and to provide strategic guidance during Project implementation, as needed. This may include advice on any issues proposed for discussion of the PAC by the Chair or any of its members. The PIUs will serve as the Secretariat of the PAC (subject to the agenda of the PAC). The PAC will meet at least annually to discuss implementation progress of the HSIP (based on progress reports prepared by the PIUs), Project experience and lessons learned, the implementation plan for the upcoming 12 months, scale-up strategies for Components 2 and 3, and any issues requiring guidance and advice by the PAC. The PAC will be chaired by the State Committee for Energy and is expected to include the following members: State Committee for Energy (chair), Ministry of Finance, Ministry of Health, Ministry of Education, Ministry of Social Protection, State Agency for Local Self-Governments, and Energy Holding Company. Additional stakeholders may be involved on an ad-hoc basis, e.g. suppliers, local administrations, civil society representatives, etc. The exact composition will be determined based on the order of the State Committee for the establishment of the PAC.

Financial Management

54. The FM arrangements in place at both BTS and ARIS have been reviewed in March 2017, also as part of the FM assessment at BTS for the ECAPDEV Project preparation grant, and as part of implementation support and supervision (including the latest conducted in September 2017) provided as part of other active Projects implemented by ARIS. FM arrangements in place at both implementing entities have been assessed as adequate for Project implementation.

55. Currently, ARIS successfully implements the Urban Development Project (P151416), Third Village Improvement Project (P146970), Sustainable Rural Water Supply Project (P154778), and Pasture Management

[49] Including as implementing entity of the First, Second and Third Village Investment Projects, the Small Town Infrastructure and Capacity Building Project, the Bishkek and Osh Urban Infrastructure Project and Additional Financing, the Third Rural Water Supply and Sanitation Project and Additional Financing, the Pasture Management Improvement Project, and the Urban Development Project.

Improvement Project (P145162) as well as a number of other donor-funded projects, and HSIP is partially building on the strong implementation experience and structure of ARIS.

56. It was agreed that ARIS will implement the following capacity buildings actions: (i) no later than 30 days from Project effectiveness, hiring an additional FM/accounting staff specifically assigned to the Project; (ii) updating its accounting software to include the functionality for automatic generation of the Project financial reports as well as SOEs; and (iii) no later than two months from Project effectiveness, developing a Project cycle database for Component 2 in order to track the implementation status and progress with regards to registered eligible households and respective household contributions, selected stove suppliers/products and related payments as well as stove installation progress and related payments.

57. BTS staff has no relevant experience and knowledge in World Bank FM/disbursement policies and procedures. Therefore, it has hired a FM consultant with relevant experience and knowledge in the Bank FM/Disbursement policies and procedures, as well as in national budget processes and procedures. The FM consultant will provide support on the Project's FM arrangements to BTS until the latter builds necessary experience and knowledge in Bank FM/disbursement policies and procedures. It was agreed that no later than 30 days of Project effectiveness, BTS will also install an accounting software specifically for Project accounting, which will have a functionality for automatic generation of the Project financial reports as well as SOEs.

58. The development and adoption of the OM for Component 1, and the OM for Components 2 and 3, acceptable to the Bank, and including a description of the Project's FM and disbursements arrangements, funds flow as well as controls (including in particular the funds flow and controls related to Component 2), will be an effectiveness condition.

59. Cash basis will be applied for Project accounting, and International Public Sector Accounting Standards (IPSAS) "Financial Reporting Under the Cash Basis of Accounting" issued by the International Public Sector Accounting Standards Board of the IFAC will be used for the Project financial reporting. For the entity (BTS) financial reporting International Financial Reporting Standards (IFRS) is adopted. The Project's chart of account will be developed by both entities.

60. There are overall adequate planning and budgeting capacity at both implementing entities. Given that the large portion of the Project funds will be utilized by BTS, it will be responsible for the Project annual budget consolidation for all components (including inputs provided by ARIS for its components), and submission for approval to the Ministry of Finance. As BTS has no experience in dealing with the state budget preparation and approval cycle, the FM consultant hired will support BTS in the state budget processes and procedures.

61. There are overall adequate internal control systems in place at both implementing entities for Project implementation. Both ARIS and BTS have internal audit functions, which are yet expected to have a greater role and involvement in the Project's internal control system. Currently, in particular, internal audit function at BTS is mostly focused on technical audits rather than on the FM/accounting systems' and procedures' review and audit, as it does not have the required capacity.

62. Two separate sets (one for Component 1 and one for Components 2 and 3) of Project management-oriented IFRs will be used for Project monitoring and supervision. The format of the IFRs have been confirmed during the assessment and will include: (i) Project Sources and Uses of Funds; (ii) Uses of Funds by Project

Activity; (iii) Designated Account Statements; (iv) A Statement of the Financial Position; and (v) SOE Withdrawal Schedule. The entities will be producing IFRs every calendar quarter throughout the life of the Project. These financial reports will be submitted by BTS and ARIS, respectively, to the Bank within 45 days of the end of each calendar quarter. The first IFR will be submitted after the end of the first full quarter following the initial disbursement.

63. Overall, there are adequate auditing arrangements at BTS and ARIS. There are no pending audits for the active projects implemented by ARIS. The auditors issued unmodified (clean) opinions on the financial statements of the projects implemented by ARIS, with no critical recommendations in the management letters. The audit of the entity's financial statements of BTS is conducted by independent private auditors, who, however, are not from the list of eligible auditors acceptable to the Bank. The auditors issued unmodified (clean) opinions on the entity's annual financial statements for the last three years, with no critical issues raised.

64. ARIS will be responsible for the consolidation of the Project annual financial statements based on inputs received from BTS for its part of the Project activities. The audit of the Project annual financial statements will be conducted (i) by independent private auditors acceptable to the Bank, ToRs acceptable to the Bank and procured by ARIS, and (ii) according to the ISA issued by the International Auditing and Assurance Standards Board of the IFAC. The annual audits of the Project financial statements will be provided to the Bank within six months since the end of each fiscal year, and at Project closing. The cost of the Project audit will be financed from the proceeds of the Project, and shared between BTS and ARIS.

65. The audit of the entity[50] (BTS) financial statements will be conducted (i) by independent private auditors acceptable to the Bank, on ToRs acceptable to the Bank and procured by BTS, and (ii) according to the ISA issued by the International Auditing and Assurance Standards Board of the IFAC. The annual audits of the entity financial statements will be provided to the Bank within six months since the end of each fiscal year.

66. The Recipient has agreed to disclose the audit reports for the Project and entity (BTS) within one month of their receipt from the auditors and acceptance by the Bank by posting the reports on the website of BTS or ARIS or other official websites of the Recipient. Following the Bank's formal receipt of these reports from the Recipient, the Bank will make them publicly available according to World Bank Policy on Access to Information.

67. The overall FM risk for the Project is assessed as substantial, with the Inherent Risk and Control Risk also assessed as substantial, given that implementation arrangements are complex, involving two implementing entities, one of which (BTS) lacks experience in implementation of the Bank-financed projects. In addition, the Project will involve large number of small value transactions under Component 2.

Disbursements

68. The FM/accounting staff at ARIS has relevant knowledge and experience in Bank disbursement policies and procedures, while BTS has no such experience and knowledge. The FM consultant hired will provide necessary support to BTS with disbursement arrangements.

[50] The audits of the entity (BTS) financial statements are required to monitor the implementing entity's financial results and stability, which are critical for Project implementation.

69. Three separate Designated Accounts (DAs) will be opened for the Project: two for Component 1 (one for IDA Credit funds and the other for IDA Grant funds), to be managed by BTS; and one for Component 2 and 3 (for IDA Grant funds), to be managed by ARIS. The DAs will be opened in USD, in a commercial bank(s) acceptable to the World Bank. The SOE based disbursement method will be applied for the Project.

70. Project funds will flow from the World Bank, either: (i) via the DA, which will be replenished on the basis of SOEs or full documentation; or (ii) on the basis of direct payment withdrawal applications and/or special commitments, received from the implementing entities. Withdrawal applications documenting funds utilized from the DAs will be sent to the Bank at least every three months. The following disbursement methods may be used under the Project: Reimbursement, Advance, Direct payment and Special Commitment. The DAs' proposed ceilings for each DA are USD 1,000,000. The detailed instructions on withdrawal of Project proceeds are provided in the Disbursement and Financial Information Letter.

71. The following table specifies the categories of Eligible Expenditures that may be financed out of the proceeds of the Credit/Grant ("Category"), the allocation of the amounts of the Credit/Grant to each Category, and the percentage of expenditures to be financed for Eligible Expenditures in each Category.

Category	Amount of the Credit Allocated (expressed in SDR)	Amount of the Grant Allocated (expressed in SDR)	Percentage of Expenditures to be financed (inclusive of Taxes)
(1) Goods, works, non-consulting services, consultants' services, including audit, Training, and Operating Costs for Component 1 of the Project.	16,300,000	5,675,000	100%
(2) Goods, works, non-consulting services, consultants' services, including audit, Training, and Operating Costs for Components 2 and 3 of the Project	0	10,625,000	100%
TOTAL AMOUNT	16,300,000	16,300,000	

Procurement

72. Overall, the public procurement environment in the country is improving as the PPD under the Ministry of Finance has revised the PPL. The new PPL created an independent complaint review commission and the PPD under the Ministry of Finance became a regulatory body for public procurement. The Bank is supporting the institutional development of the PPD and the complaint review commission and capacity building of all stakeholders. The Government has developed e-GP with ADB financing and World Bank technical assistance.

73. Procurement for the proposed Project will be carried out in accordance with "Guidelines: Procurement

of Goods, Works and Non-consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 (revised July 2014) and "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 (revised July 2014). The various items under different expenditure categories are described in general below. For each contract to be financed by the Project, the different procurement methods or consultant selection methods, estimated costs, prior review requirements, and time frame are agreed between the Recipient and the Bank in the Procurement Plan.

74. **Assessment of the implementing entities' capacity to implement procurement.** BTS and ARIS will implement the Project. The procurement capacity assessment of BTS and ARIS was carried out by the Bank using the PRAMS. The review identified a number of risks related to procurement policy and institutional arrangements which need to be mitigated. The procurement risks include: (i) BTS officials, who would be involved in some Project procurements through tender committees, may not be familiar with Bank procurement procedures; political developments may lead to the frequent turnover of tender committee members; (ii) potential procurement delays: experience with past and ongoing projects in the country show frequent procurement delays due to poor procurement planning; (iii) low level of competition: past experience indicates that procurement in the country has not attracted adequate competition; (iv) inadequate contract management and lower-than-required quality of procured equipment; and (v) perceived high level of corruption as measured by Transparency International.

75. The agreed mitigation measures are: (i) BTS will prepare an OM including a procurement chapter, to be agreed with the World Bank, which will include procurement and contract management procedures to ensure the clear division of responsibilities among staff. The contract management procedures should minimize the discretion given to public officials involved for certification of invoices, issue of completion certificates and making payments. All officials concerned should be required to fulfill their obligations within a specified period; (ii) BTS and ARIS procurement staff will receive intensive training in international procurement under the Bank Guidelines, including the regional procurement seminars that will be organized by the Bank and other events (if any); (iii) BTS and ARIS will establish ad-hoc tender committees; and (iv) each staff involved in procurement, including each member of a tender committee, will have to certify in writing that his or her involvement does not create any conflict of interest (e.g. relationship with a supplier or consultant); (v) BTS and ARIS will organize a half-day seminar for senior officials involved in procurement to make them aware of Bank procurement requirements; (vi) in addition to the publication of tender notices and contract award information as required by the Bank Procurement and Consultant Guidelines, BTS and ARIS will publish all tenders and contract award information on their respective websites; (vii) BTS and ARIS will put in place the necessary mechanisms to ensure that suppliers and consultants are paid according to their contract terms without any delays; (viii) BTS and ARIS will inform the World Bank of every complaint received from any supplier, contractor or consultant relating to the procurement process, and respond promptly to such complaints; and (ix) both entities will maintain up-to-date records and make these available to Bank staff, and auditors.

76. To mitigate the identified procurement-related risks, the following mitigation actions are suggested:

	Actions	**Deadline**
1	Training of staff involved in Project procurement activities on the Bank's Procurement and Consultant Guidelines and the public procurement	Ongoing

	Actions	Deadline
2	Preparation of Project OMs (by BTS and ARIS, respectively) with a detailed chapter on procurement, including detailed description of procurement decision making processes and accountability for procurement decisions	By effectiveness
3	Preparation of a detailed procurement plan for the first 18 months of the Project and submission of updates as required	Appraisal and agreed by negotiations
4	Preparation of the bidding documents, ToRs and draft request for proposals for the first year of project implementation to facilitate the initiation of procurement as per the agreed Procurement Plan	Negotiations/ first months of implementation
5	Ensuring quality review of the technical specifications/ ToR, Bid Evaluation Reports and the final deliverables	Ongoing
6	Putting in place an efficient contract monitoring mechanism designed to maximize overall value for money of contracting activities	Ongoing
7	Regular procurement support during Project implementation by Bank procurement staff	Ongoing

77. The overall Project risk for procurement is high. After mitigation measures implemented, the residual risk will be substantial.

78. **Procurement Arrangement.** As indicated above, it was agreed that procurement responsibilities will be entrusted to PIUs under BTS and ARIS. To assist BTS, the PIU has hired a procurement consultant based on ToR agreed with the World Bank.

79. **Methods of Procurement.** The following procurement methods shall be used under the Project. It has been agreed that if a particular invitation for bid comprises several packages, lots or slices, and invited in the same invitation for bid, then the aggregate value of the whole package determines the applicable threshold amount for procurement and also for review by the Bank.

80. **Procurement of Works, Supply and Installation**. Works procured under the Project will include supply and installation of heat and hot water meters; civil works for installation of pipelines; and civil works for energy efficient renovations of selected public buildings. The procurement will be done using appropriate Standard Bidding Documents (SBD) agreed with the Bank. The SBD shall contain draft contract and conditions of contract acceptable to the Bank. International Competitive Bidding (ICB) will be used for civil works contracts estimated to cost more than USD 5,000,000 while National Competitive Bidding (NCB) will be used for civil works contracts estimated to cost more than USD 50,000 but less than USD 5,000,000. Shopping for Minor Works will be used for civil works contracts estimated to cost USD 50,000 or less.

81. **Procurement of Goods.** Goods procured under this Project would include: supply of substations, pre-insulated pipelines and related accessories; supply as well as supply and installation of various IT-related systems (e.g. preventive maintenance system, GPS for households, FM accounting software, billing-system upgrade, etc.); eligible clean and efficient heating stoves; and limited goods for effective Project implementation. The procurement will be done using appropriate SBDs agreed with the Bank. Shopping will be used for goods contracts estimated to cost less than USD 100,000 per contract. The procurement of shopping packages will be done using appropriate form of Invitation to Quote (ITQ) agreed with the Bank. The ITQ shall contain draft contract and conditions of contract acceptable to the Bank.

82. **Procurement of non-Consulting Services**. This will include non-consulting services related to transportation and installation of new stoves as well as recycling of old stoves; and testing of stoves in laboratories.

83. **Selection of Consultants.** Consultancy services will include several contracts for feasibility studies (energy audits and seismic assessments), designs and technical site supervision; capacity building activities and awareness campaigns; technical experts; client satisfaction surveys; as well as entity and Project audits. Short lists of consultants for services estimated to cost less than USD 300,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.6 of the Consultant Guidelines.

84. **Training and Operational Costs**. The Project will finance training and operating costs of BTS and ARIS, comprising mainly salaries and fees of contractual staff, office operations, travel and subsistence expenses. These will be procured using the existing administrative procedures of BTS and ARIS which were reviewed and found acceptable to the Bank. BTS and ARIS will prepare annual operational budgets and training plans (including cost estimates) for the Bank team's review and clearance.

85. **Complaint Handling Mechanism.** To deal with procurement complaints received by BTS and ARIS, a complaint handling mechanism for the Project will be developed and documented in the procurement section of the OMs. On receipt of complaints, immediate action will be initiated to acknowledge the complaint and redress in reasonable time frame. All complaints will be dealt with at levels higher than that of the level at which the procurement process was undertaken. Any complaint received is to be forwarded to the Bank for information and the Bank will be kept informed after the complaint is redressed.

86. **Procurement Plans.** Two draft procurement plans have been developed covering the above procurement activities and agreed at negotiations. A summary of the draft Procurement Plans is attached in Annex 6. The Procurement Plans will be updated annually or as needed to: (i) reflect progress in Project implementation; (ii) accommodate changes that should be made; and (iii) add new packages necessary for the Project. Each update will be subject to the Bank's prior review. The Procurement Plan will be published on the World Bank website. Procurement under the Project will be carried out in accordance with the agreed Procurement Plan and as updated. The General Procurement Notice has been published on January 19, 2017 by BTS.

87. **Advance Procurement**. To facilitate implementation of the Project, all new procurement activities will be advanced as feasible and in line with the agreed procurement plans.

88. **Retroactive financing.** The Project provides for the use of retroactive financing up to an aggregate amount not to exceed SDR 496,000 (USD 700,000 equivalent), available for eligible expenditures procured in accordance with World Bank guidelines and implemented in accordance with other relevant operational policies for which payments have been made on or after July 30, 2017.

89. **Project OMs.** The procurement chapter of the Project OMs (two separate OMs will be prepared by BTS and ARIS, respectively) will cover all procurement aspects under the Project such as: procurement implementation arrangements, procurement plan and reporting, procurement methods and thresholds,

responsibilities of procurement staff and evaluation committees, procurement process including contract monitoring, procurement control procedures and complaints handling procedures.

90. **Additional Provisions for NCB.** The standard provisions for NCB will be applied to all the NCB contracts in the Kyrgyz Republic as per Financing Agreement.

91. **Procurement Thresholds.** The thresholds for procurement methods and Bank's prior review thresholds are noted below.

Expenditure Category	Contract Value (USD)	Procurement Method	Bank Prior Review
Civil Works, S&I of Plant & Equipment	>= 5, 000 000	ICB	All ICB contracts
	< 5, 000,000	NCB	NA
	<50 000	Shopping	NA
	NA	DC	All contracts >= USD 5,000,000
Goods, IT and Non-Consultant Services	>= 1, 000 000	ICB	All contracts >= USD 1,500,000
	<1, 000 000	NCB	NA
	<100 000	Shopping	NA
	NA	DC	All contracts >= USD 1,500,000
Consultant Services	NA	QCBS, QBS, FBS, LCS and CQS*	All contracts >= USD 500,000 for firms; all contracts >= USD 200,000 for individuals;
	NA	SSS	
	NA	IC	

Notes:
ICB – International Competitive Bidding
NCB – National Competitive Bidding
DC – Direct Contracting
QCBS – Quality and Cost Based Selection
QBS – Quality Based Selection
FBS – Fixed Budget Selection
LCS – Least Cost Selection
*CQS – Selection Based on Consultants' Qualification below $300,000 depending on the nature of assignment
SSS – Single (or Sole) Source Selection
IC – Individual Consultant selection procedure
NA – Not Applicable

92. **Procurement Supervision.** The procurement post review will be carried out on a sample basis (20% in terms of number of contracts) by the procurement specialist based in the region/country office and one ex-post review report will be prepared per fiscal year, including findings of physical inspections for not less than 10% of the contracts awarded during the review period. In addition, two supervision missions are expected to take

place per year.

93. **Disclosure.** The following documents shall be disclosed on BTS and ARIS website: (i) procurement plan and updates; (ii) invitation for bids for goods and works for all ICB and NCB contracts; (iii) request for expression of interest for selection/hiring of consulting services (firms); (iv) contract awards of goods and works procured following ICB/NCB procedures; (v) short list of consultants (firms) for QCBS and LCS; (vi) contract award of all consultancy services (firms); and (vii) list of contracts following DC, CQS or SSS on a quarterly basis.

94. The following details will be sent to the Bank for publishing on the Bank's external website and UNDB: (i) invitation for bids for procurement of goods and works using ICB procedures; (ii) request for expression of interest for consulting services with estimated cost above USD 300,000; (iii) contract award details of all procurement of goods and works using ICB procedure; (iv) contract award details of all consultancy services with estimated costs above USD 300,000; and (v) list of contracts/purchase orders placed following SSS, CQS or DC procedures on a quarterly basis.

Environmental and Social (including safeguards)

95. The Project is expected to have positive impacts on beneficiaries. Improved heat supply in homes with DH and individual heating systems will have a positive impact on the quality of life of households as the need to decrease living spaces in homes and to change family routines during the heating season will be eliminated or at least reduced. Efficient heating and related reduction in fuel consumption as well as the ability to better control heating bills and consumption, accompanied by more transparent billing practices, will help to reduce the financial burden on households, particularly the most vulnerable. In addition, improved comfort levels in public educational and health facilities will have a positive impact on the working, learning and recovery environment, including for children and sick people, respectively.

96. **Gender**. Women are expected to be the key beneficiaries of the Project, as improved heating services will impact them directly. Women spend more time at home and carry primary responsibility for household chores. In many households, women are also responsible for keeping the home warm and refueling the stoves/boilers, and tend to be the ones paying bills and managing family budgets. Women will also benefit from improved comfort levels as well as safer and better working environments in renovated public buildings under Component 3. The Project will include gender-disaggregated measures for Project beneficiaries and track participation of men and women in the results framework for all three Components. Specifically, during implementation of Component 1, the Project will disaggregate customer satisfaction data collected by the BTS by gender to ensure the voices of women are reflected and help to inform the company's strategy to improve service provision. As part of Component 2, the Project will monitor female beneficiaries of efficient and clean heating technologies installed in households, and women will also be engaged in community monitoring activities. Similarly for Component 3, satisfaction data in retrofitted public buildings will be disaggregated by gender. Information campaigns conducted as part of the Project will formulate gender-targeted messages and utilize varying tools to reach out to both men and women. In order to support the PIUs on the integration of gender aspects, the Project will receive technical assistance provided under an ESMAP-supported programmatic activity on Energy and Gender in the ECA Region.

97. **Citizen Engagement activities**. In order to effectively engage direct and indirect Project beneficiaries, the following activities will be adopted by the Project:

(a) *Customer Satisfaction Surveys* will evaluate BTS' heat supply service performance with regards to a range of aspects including: reliability and quality of heating and billing services, customer relations, transparency of bills, and ease of payment. Customer feedback will be collected and evaluated on a sample basis at least once a year. This will not only help to monitor progress in terms of Project beneficiary's satisfaction rates, but also help BTS to reflect and integrate the findings in its company strategy on how to improve performance and customer orientation. The results of the surveys and any steps adopted by BTS to address identified shortcomings will be made available in a manner and places accessible to customers.

(b) *Community monitoring* will be used to ensure that the heating stove program under Component 2 reaches the targeted households and achieves intended results. To this end, the communities through neighborhood groups, associations of Aksakals (elders) and women groups, will be closely involved in Project implementation in order to share information on the Project activities, reach out to target households, and help monitor and evaluate Project results and user satisfaction. The findings will be shared during regular community meetings and through reports by ARIS.

(c) *Information campaigns* on Project activities, including improved DH services, efficient and clean heating technologies and building energy efficiency improvements will be conducted for both Project beneficiaries and broader audiences. This will help raise public awareness about the benefits of energy efficiency investments and switching to efficient and clean individual heating technologies for households without access to DH. Targeted information campaigns conducted by BTS will also inform the population about priority investments in the DH sector and expected benefits, aiming to help improve transparency and trust of the population in the sector.

(d) *The GRM* will build on the mechanism required by the World Bank's OP 4.12 on Involuntary Resettlement to address grievances related to the process of land acquisition and resettlement. The GRM will be extended to encompass the range of issues related to overall Project implementation, including a customer complaint center integrated in ARIS' existing GRM to collect, categorize and transmit household complaints related to the performance of installed stoves/ LPBs. This comprehensive Project level GRM will be further detailed in the OM and the RPF.

98. **Involuntary Resettlement**. The Project has triggered the OP on Involuntary Resettlement (OP 4.12). Resettlement impact in the form of temporary land acquisition, access restriction and/or direction of livelihoods, is expected under Component 1 due to civil works to replace and reconstruct part of the 'Vostok' transmission pipeline. No physical displacement or permanent land acquisition is expected. While the corridor for the transmission pipeline is known, the exact siting alignment of the transmission pipeline and the scale of civil works is not known at the time of Project approval and as such the scope and extent of resettlement impact under the Project has not yet been identified. Consequently, a RPF has been prepared and was publicly consulted in accordance with the OP/BP 4.12. During public consultations, questions and answers provided to beneficiaries and stakeholders focused on the proposed Project design and timing. The RPF was disclosed in-country and on the World Bank external website on March 27, 2017. The RPF provides guidelines for resettlement-related activities and for preparation of site-specific RAPs, if deemed necessary during Project implementation. The RPF details a range of potential impact and includes an entitlement matrix. Once the Project design is finalized, the exact alignment is known and resettlement impact is confirmed, site-specific RAPs pursuant to the RPF will be prepared.

99. As described in Section IV.D, RKDF is expected to provide parallel financing to BTS to reconstruct an additional section of the 'Vostok' transmission pipeline (with a trench length of about 1 km). As this activity is:

(i) directly and significantly related to the Bank-assisted Project; and (ii) may be carried out contemporaneously with the Project, it is considered an associated facility of the Project and World Bank safeguards policies, including OP 4.12 on Involuntary Resettlement, apply to it. No temporary or permanent land acquisition, restriction of access or economic impact is expected as a result of civil works related to the reconstruction of the section proposed for parallel financing by RKDF. A social due diligence review of the section to be financed by RKDF will be conducted between Board approval and Project effectiveness. Civil works to carry out this reconstruction of the transmission pipeline (financed by RKDF) will be timed to coincide with the road expansion project that is planned and financed by Bishkek municipality in order to minimize impacts and disruptions for the population and economic activity. While the planned road construction is contemporaneous with the reconstruction of the pipeline section to be financed by RKDF, it is unrelated to the HSIP and there is no mutual dependency between the road expansion and the Project. The civil works on the transmission pipeline section financed by RKDF benefit from the road construction, and in that way social and environmental impacts are reduced. Therefore, any impacts due to the road expansion do not fall under the scope of the World Bank safeguards policies and OP 4.12 will not apply in this case. No resettlement instruments for the activities financed by the RKDF have been prepared.

100. **Conflict Filter** analysis undertaken during Project preparation identified a number of conflict stressors. These stressors include: low citizen trust in energy sector reforms, prior social upheavals related to energy tariff increases, perception of unequal distribution of Project benefits and unresolved regional and ethnic tensions, as well as a perception of socio-economic and political ties between the energy sector and political decision-makers in the country. Demographic shifts and rural-to-urban migration increase the number of people in urban centers, which in turn adds additional pressure on services, including heating. To mitigate these stressors, the Project will ensure that Project targeting does not prioritize any ethnic group. The selection criteria of beneficiaries will be widely publicized and ascertained by the communities. Community monitoring will facilitate and monitor the implementation of the efficient and clean stove program, including reporting on issues with regards to the continued use of the stoves (e.g. so that intended results are achieved and subsidized products are not re-sold by the beneficiaries at the markets). Community groups will also be engaged in awareness raising activities. The information campaign will ensure public awareness of Project activities and the Government's priority investments in the sector. Improved transparency and accountability of the services provided by BTS (including through improved billing system) will help to enhance the trust of consumers and foster sustainability of investments.

101. **Environment.** Because the exact alignment of the 'Vostok' transmission pipeline under Component 1 will be finalized as part of its detailed design, and given that Components 2 and 3 are demand-based, the exact locations of activities supported under the Project are not yet known and an ESMF has been chosen as the environmental safeguards instrument. The ESMF was prepared and publicly consulted in accordance with OP/BP 4.01. The ESMF was disclosed in-country on April 18, 2017, and on the World Bank external website on April 25, 2017.

102. The Project will have overall positive environmental impacts and benefits at the selected Project locations, including: (i) improving the efficiency of heat and hot water supply services (Component 1), thereby reducing related fuel consumption and CO_2 emissions; (ii) reducing consumption of solid fuel (coal, fire wood, dung, etc.) by households without access to DH and lowering related CO_2, CO and $PM_{2.5}$ emissions (Component 2); (iii) reducing the consumption of electricity by selected public facilities (Component 3) and lowering related CO_2 emissions; and (iv) decreasing public health risks associated with indoor air pollution (Component 2) and

low comfort levels in schools, kindergartens and health facilities.

103. The Project, especially during civil works under Component 1 and to a lesser extend under Component 3, is expected to cause some short-term negative impacts on air, soil, water, and acoustic environment. Environmental issues likely to be associated with the two Components include: noise generation; impact on soil and on water by the construction works; disturbance of traffic during construction and rehabilitation works; construction dust and wastes; finding and handling of hazardous materials (e.g. asbestos insulation, mercury containing light bulbs); and workers' safety. However, these adverse impacts will be temporary and site specific and can be easily mitigated through implementing adequate avoidance and/or mitigation measures identified in the ESMF and template ESMP. Adverse impacts on natural environment, protected areas and physical cultural resources are not expected because of the location of the Project in urbanized areas.

104. Given that the Kyrgyz territory is located in zones of high seismic activity, Project activities under Components 1 and 3 will be required to comply with seismic regulations.

105. As described above (paragraph 99), an additional section along the 'Vostok' transmission pipeline is expected to be reconstructed with the support of parallel financing expected to be provided by RKDF. As this section will be connected to sections financed as part of the HSIP, it is considered as ancillary aspect of the Project, and all environmental safeguards requirements stipulated to other sections of the pipeline according to World Bank safeguard policies (OP 4.01 Environmental Assessment) will be equally applied to this section financed by RKDF. It is expected that the section funded by RKDF will be carried out before commencement of civil works of World Bank-financed sections of the pipeline. Accordingly, an environmental audit of the section to be financed by RKDF will be conducted between Board approval and Project effectiveness. However, for reasons outlined in paragraph 99 above, any impacts due to the municipal road expansion do not fall under the scope of the World Bank safeguards policies and OP 4.01 will not apply in this case.

106. No adverse or irreversible environmental impacts are anticipated from activities funded under Component 2, provided that stove designs and stove producers meet the eligibility criteria (as included in the OM and listed in the ESMF) and follow the relevant provisions to mitigate any possible environmental risks. In order to ensure the sustainable dismantling and the disposal of old stoves in compliance with the ESMF, relevant arrangements will be described in the Project OM[51] and relevant provisions included in respective service contracts. For activities related to Component 2, safety checklists will be included in the compliance protocol to be developed for delivered stoves (based on which the PIU will accept produced stoves for payment) and the manual for stove installers (which outlines detailed instructions for service providers on the proper and safe installation of stoves and LPBs). The checklist and the manuals will be developed together with the Project OM before Project effectiveness and will be approved by the World Bank.

107. **Climate Change**. The Project will contribute to climate change mitigation by improving the energy efficiency of the DH system, individual heating stoves/LPBs and selected public buildings. By enhancing the seismic resilience of public buildings, the Project will also contribute to climate change adaptation and resilient development. This scale up of pro-climate action in the Kyrgyz Republic is closely aligned with the World Bank Group's and ECA's Climate Change Action Plan 2017-2020.

Monitoring and Evaluation

[51] The OM will set out the detailed environmental and social institutional safeguard arrangements for the implementation of the Project.

108. **Overall M&E arrangements.** The PIUs within BTS and ARIS will be responsible for M&E of results achieved under Component 1 and Components 2 and 3, respectively. For this purpose, the PIUs will set-up a simple management information system to track implementation progress on project activities and key results indicators (including those specified in Section VII). During preparation and initial project years, close implementation support will be provided by the Bank team to assist the PIUs in refining their M&E system. The PIUs will submit biannual progress reports to the PAC and the Bank for review in accordance with an outline to be developed and included in the Component's OMs. A mid-term review will be carried out to assess the overall Project progress, identify critical implementation issues and make any necessary adjustments to the Project designs, its components or implementation schedule.

109. **M&E system for Component 1.** For data on heat and hot water losses, the PIU will use the existing company system. Specifically, BTS' heat and hot water balance will be used to report energy savings achieved (adjusted for external factors, such as degree days, length of heating season and changes in customer base) and to calculate related fuel and CO_2 savings (taking into account the fuel mix used at the CHP and related standard emission factors). However, at the absence of adequate heat and hot water metering, baseline and target data are based on meter reading at the CHP plant and theoretical estimates and may need to be revised during implementation. The installation of heat and hot water meters in more than 2,000 residential multi-apartment buildings will help to improve reliability of target data. The baseline and target data on customer satisfaction levels in terms of improved quality of heat supply will be assessed through sample household surveys; this will include comprehensive baseline surveys conducted at the beginning of the Project and periodic household surveys conducted on a sample basis during implementation. To assess perceived improvements in terms of quality of heat supply, the survey will include questions related to adequacy of indoor temperature and comfort levels, temperature and warm-up time for hot water, reliability of heat and hot water supply, including number of service interruptions experienced, and other relevant aspects. Data for intermediate results indicators will be based on progress and commissioning reports for installed substations, meters and rehabilitated sections of the 'Vostok' transmission pipeline.

110. In addition to the results indicators included in Section VII, additional indicators will be monitored and evaluated, as agreed in the OM, and may include: water savings (m^3); technical and commercial heat and hot water losses; share of heat and hot water consumption billed based on meter readings; reduced breakdown and repair needs for 'Vostok' transmission pipeline; increased system-wide transmission and distribution capacity (higher delta-T); and number of complaints recorded related to Project activities.

111. **M&E system for Component 2.** Relevant data for M&E of Component 2 will be based on the following input: (i) laboratory test results on thermal efficiency for eligible stoves/ LPBs to calculate deemed energy, fuel and CO_2 savings (ii) household surveys among Project beneficiaries to be conducted on a sample basis (e.g. 5%-10%) to monitor satisfaction levels in terms of improved quality of heat supply; aspects to be included in the survey involve: adequacy of indoor temperature and comfort levels, smoke emitted when refueling or igniting the stove, number of refueling required per day, fuel consumption, and other relevant aspects; and (iii) the Project cycle database, which tracks the full program cycle, including registered eligible households and related number of household members, eligible products, suppliers, submitted purchase orders, installed products and completed incentive payment transfers.

112. Besides the indicators outlined in Section VII, additional aspects will be monitored and evaluated, as

agreed in the OM. These may include: reduced indoor air pollution based on measurements that are expected to be conducted in collaboration with the EU-funded Fresh Air Program led by the Ministry of Health (see Annex 5); improved cooking convenience as assessed through household surveys; extended burning time of the stove without refueling; reduced chimney cleaning needs; achieved energy cost savings; number of complaints recorded in the Project GRM; number of stove suppliers; number of eligible models; increased awareness in pilot communities as qualitatively assessed, etc.

113. Community monitoring will be used to ensure that the heating stove program reaches the targeted households and achieves the intended results. To this end, the communities through neighborhood groups, associations of Aksakals (elders) and women groups, will be closely involved in Project implementation in order to share information on Project activities, reach out to target households, and help monitor and evaluate Project results. The findings will be shared during regular community meetings and through reports by ARIS.

114. **M&E system for Component 3.** Data for M&E of Component 3 will be based on: (i) energy audit reports to determine pre-Project energy use and comfort levels, as well as estimated energy, fuel and CO_2 savings; (ii) post-Project monitoring of results (e.g. in the form of commissioning reports); and (iii) social surveys conducted before and after implementation of energy efficiency measures in selected public buildings on a sample basis, including aspects related to improved quality of heat supply, such as: adequacy of indoor temperature and comfort levels, temperature and warm-up time for hot water, improved functionality/operation of the building, etc.

115. Additional indicators will be tracked (besides those outlined in Section VII) as agreed in the OM. This may include: energy cost savings achieved; reduced electric load of the buildings; improved indoor temperature; number of trainings organized to service providers and other stakeholders; etc.

Role of Partners (if applicable)

116. **EBRD.** EBRD is providing financing (USD 10 million) to BTS in the form of a sovereign loan to support the modernization of BTS' DH pumping stations, including the replacement of select pumps with energy efficient pumps and VSD, construction of a new pumping station, and installation of a new SCADA system. Given that BTS' network is only supplied by the CHP plant without additional generation sources and due to the large size and layout of its pipeline network, efficient and reliable booster pumps are critical to ensure adequate and reliable heat supply to all parts of the city, including in particular customers located at the outskirts of the DH system. Upgrading BTS' pumping stations with VSD pumps and SCADA are also important for efficient building-level substations with flow control, which will be supported under Component 1 of the HSIP.

117. **KyrSEFF.** KyrSEFF is an EBRD-supported credit-line (USD 20 million in phase I and USD 35 million in phase II) supporting energy efficiency improvements of residential buildings and industrial enterprises. Eligible projects receive up to 35% grants provided by the EU-supported Investment Facility for Central Asia. As of early 2017, about 600 households and 60 businesses have benefitted from KyrSEFF funding and grants. The credit-line is implemented through local partner banks and mainly targets creditworthy middle and higher income households. The list of eligible products includes heat-only-boilers, heat pumps, solar water heaters as well as building envelope measures. Investments in heating system upgrades accounted for about 17% of disbursed loans. During implementation of the HSIP, close cooperation with KyrSEFF will be sought in order to use synergies between the programs in terms of eligible heating products, awareness raising on energy efficiency

and market capacity building.

118. **RKDF.** RKDF is expected to provide parallel financing (around USD 5.5 million) to BTS in the form of a non-sovereign loan to finance the reconstruction of one of the sections of the 'Vostok' transmission pipeline, which will be connected to sections that will be rehabilitated under the HSIP. The loan was approved by RKDF in July 2017 and is expected to enable BTS to synchronize civil works required for the installation of a re-routed pipeline section with the construction of a new municipal road, which is scheduled for 2017.

119. **SECO**. SECO plans to provide Bank- and Recipient-executed grant funds towards Component 3 (up to USD 4 million) to support energy efficiency improvements in public buildings. This would help to leverage IDA funds, pilot innovative energy efficiency technologies to enhance load reduction benefits and strengthen Project impact. The draft scope of activities proposed for financing by SECO is integrated in Annex 1.

ANNEX 3: IMPLEMENTATION SUPPORT PLAN

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

Strategy and Approach for Implementation Support

120. The Implementation Support Plan (ISP) describes how the World Bank will assist the client in achieving the PDO of the Project. The ISP is based on the risks and mitigation measures identified in the Systematic Operations Risk-Rating Tool (SORT) and aims to provide flexible and effective implementation support to both BTS and ARIS, which ensures that: (i) the necessary technical advice is provided, including with regards to international experience, good practices and technical sustainability of investments; and (ii) the required fiduciary, social and environmental safeguards are put in place and implemented per the Financing and Project Agreements and in accordance with other Project documents.

121. The Project team will provide timely and effective implementation support through regular missions (i.e. within six months from the Project effectiveness date, and at appropriate intervals thereafter), recurrent M&E of Project results, facilitating implementation of risk mitigation measures identified in the SORT and providing technical advice to BTS and ARIS on fiduciary requirements, safeguards, operations and technical aspects to support Project implementation. The Project team consists of both headquarter- and regionally-based staff to ensure an appropriate mix of sectoral, operational, country and fiduciary experts. The team will conduct an extensive mid-term review and provide the following implementation support through a combination of field visits and regular exchanges using different communication channels, including video- and audio-conferences as well as regular email exchange.

Implementation Support Plan and Resource Requirements

122. **Technical support.** Technical implementation support will be provided by the task team leaders, DH experts, specialists on individual heating technologies as well as an energy efficiency specialist, and will focus on providing technical guidance and support on the following: (i) for Component 1: preparation of ToRs for key assignments; review of bidding documents, including technical specifications for priority investment packages; advice on key outputs produced by consultants; guidance on implementation issues during installation and civil works; sharing of international experience on transition to consumption-based billing and optimization of operating regimes in DH systems; and adequate tracking of results indicators under Component 1; (ii) for Component 2: technical and operational advice on Project cycle processes and related templates (e.g. Participation and User Agreements, acceptance checklists, safety checklists, etc.) based on experience from similar projects; preparation of ToRs for key assignments and review of related outputs; guidance on operationalization of the agreed implementation and quality assurance mechanisms; input on capacity building and outreach strategies to suppliers, local communities and households; review of laboratory testing results; support strategy for scaling-up the efficient and clean heating stove program; etc. and (iii) for Component 3: preparation of ToRs for key assignments and review of related outputs; operationalization and review of selection processes and criteria for public buildings; review of bidding documents, including technical specifications of proposed energy efficiency measures; guidance on implementation issues and commissioning tests; sharing of international experience on energy efficiency in public buildings, including sharing of relevant

tool-kits, etc. Technical experts on the Bank team will also carry out regular site visits during implementation support missions, targeting sites where works are ongoing or were recently completed.

123. **FM support.** As part of its Project implementation support and supervision missions, the Bank will conduct risk-based FM implementation support and supervision within a year from the Project effectiveness, and then at appropriate intervals. During Project implementation, the Bank will supervise the Project's FM arrangements in the following ways: (a) review the Project's quarterly IFRs as well as the Project's and the entity's annual audited financial statements and auditor's management letters and remedial actions recommended in the auditor's management letters; and (b) during the Bank's on-site missions, review the following key areas: (i) Project accounting and internal control systems; (ii) budgeting and financial planning arrangements; (iii) disbursement arrangements and financial flows, including counterpart funds/ beneficiary contributions, as applicable; and (iv) any incidences of corrupt practices involving Project resources. As required, a Bank-accredited FM Specialist will participate in the implementation support and supervision process.

124. **Procurement Implementation Support.** The Project team will conduct risk-based implementation support and supervise procurement arrangements in the following ways: (i) providing detailed guidance on the Bank's Procurement Guidelines to BTS and ARIS; (ii) providing training to relevant agency staff, as well as its consultants; (iii) prior and/or post-review of procurement documents, including timely comments and suggestions for improvements; and (iv) monitoring procurement progresses against the procurement plan.

125. **Environmental Safeguards Implementation Support**. The capacity of BTS in implementation and monitoring of environmental protection and labor safety measures is sufficient for regular operations, but is expected to require implementation support during the preparation of ESMPs and the reconstruction of the 'Vostok' transmission pipeline. The environmental specialist will provide necessary guidance during preparation of ESMPs, will review BTS reports on ESMP implementation with the aim of building BTS' capacity in implementing environmental safeguards measures and monitoring. If training events for firms participating in Components 2 or 3 are organized, a special module on environmental safeguards will be prepared and delivered.

126. **Social Safeguards Implementation Support.** The capacity of BTS in social safeguards and World Bank requirements is limited. ARIS has extensive experience in implementing World Bank-financed project and demonstrates familiarity with World Bank requirements. ECADEV grant funds have been secured to assist with the preparation of the environmental, social and resettlement instruments. A Bank Social Development Specialist has worked closely with the BTS to build capacity on the Bank's social development and safeguards requirements and reporting. The specialist will continue providing technical support and guidance to BTS to ensure compliance with the Bank's requirements. Safeguards consultants working on Project implementation will also be invited to World Bank-supported safeguards trainings. The Bank's Social Safeguards Specialist will review the implementation of the Project's RAP(s) and provide guidance on compliance with the requirements outlined in the RPF and with OP/BP 4.12 on Involuntary Resettlement. The Social Specialist will also review Citizen Engagement activities under the Project, including the commitment to gender representation. Implementation support to ARIS

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First twelve months	Key procurement packages; selection process for products, households and public buildings; operationalization of implementation mechanism for Component 2; preparation of ESMPs and RAP; implementation of civil works (Component 1 and 3) and installation of stoves; transition consumption-based billing	Technical, fiduciary and safeguards	USD 150,000	SECO for parallel co-financing under Component 3 Coordination with EBRD and RKDF for investments under Component 1 Local administrations and communities under Component 2 Local administrations under Component 3
12-48 months	Implementation support related to civil works and commissioning tests (Components 1 and 3); selection process for products, households and public buildings; M&E; installation and monitoring of stoves; technical assistance	Technical, fiduciary, safeguards	USD 120,000	Same as above
Other				

Skills Mix Required

Skills Needed	Number of Staff Weeks/year	Number of Trips/year	Comments
Task team leaders	30	2-3	Headquarters
Energy Specialist	10		Local

Operations Officer	10	2	Headquarters
DH experts	8	2-3	Mixed: field and non-field based
Individual heating technology expert	10	2-3	International
Energy efficiency specialist	10	2	International
FM Specialist	3	2	Regional
Procurement Specialist	5		Local
Environmental specialist	3	2	Regional
Social specialist	4	2	Regional

Partners

Name	Institution/Country	Role

ANNEX 4: ECONOMIC AND FINANCIAL ANALYSIS

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

127. This section presents the economic and financial analyses of the Project, which includes: (a) the Project economic analysis; (b) the Project financial analysis; and (c) the analysis and forecast of the financial performance of BTS.

a) Project Economic Analysis

128. **Rationale for public sector financing.** Public sector financing of the Project is justified because: (a) low cost private sector financing for investments supported under Components 1 and 3 with relatively long payback periods is not available in the local financial market; (b) the heating and public buildings sector remains unattractive for private sector participation due to (i) inconsistent implementation of the MTTP adopted by the Government of Kyrgyz Republic, which is critical to restoring the financial viability of the heating sector, (ii) below cost-recovery electricity, heat and hot water tariffs, which limit financial returns for investments in DH and energy efficiency; and (iii) insufficient data on the operational performance of the DH sector due to the lack of adequate metering; as well as (c) the dispersed nature and small transaction value of individual efficient and clean heating solutions, combined with affordability constraints of low income households.

129. **Value added of the World Bank's support.** The World Bank has an established track record with similar projects in the region. The HSIP will draw on the experience and lessons learned from these projects to provide technical, fiduciary, and safeguards support to BTS and ARIS during implementation of the Project.

130. **Approaches to economic analysis of the Project.** The economic analyses related to the two priority investment packages supported under Component 1 (i.e. modernization of IHS, and replacement and reconstruction of the 'Vostok' transmission network) were conducted based on the incremental benefits and costs. Their economic viability was determined through the assessment of the expected economic returns, evaluated with regard to the NPV and EIRR. The economic costs and benefits are expressed in USD 2016 real price terms that are based on end-of-year exchange rate for 2016 and are exclusive of taxes and duties. No explicit or implicit subsidies affect the economic costs and prices.

131. The economic analysis for eligible efficient and clean heating solutions for low-income household was conducted using a cost-effectiveness analysis. The switch to efficient and clean heating options will help to reduce fuel consumption, raise the comfort level in homes and reduce harmful indoor air pollution. The chosen approach will compare the costs of achieving those objectives.

132. The economic analysis of energy efficiency investments in public buildings was conducted for representative types of facilities to be financed under the Project. The investment costs of energy efficiency measures and energy saving estimates are drawn from the pre-feasibility studies prepared under Urban Development Project for selected schools and kindergartens in the cities of Balykchy and Toktogul.

133. The stream of economic costs and benefits was discounted at the social opportunity cost of the capital, which was assumed to equal 6%.[52] The choice of the discount rate is driven by the assumption that the average real GDP per capita will grow at an average annual rate of 3% during the useful economic life of the Project using the Ramsey formula for discount rate.

134. **Key assumptions.** The key assumptions underlying the economic analysis of the project under the base case scenario are presented in Table A4-11.

Subcomponent 1.1 – Package 1: Modernization of individual (building-level) heat substations

135. **Economic benefits.** The main economic benefits of modernizing IHS are: (i) reduction in technical losses and non-demanded heat and make-up water; (ii) more efficient use of heat and hot water; and (iii) pumping energy savings in BTS' network and at the CHP plant. The proposed repair and replacement investment would cover 1,931 building connections with new or upgraded controllable mixing pump substations. Currently, there are 3,326 building-level substations, group substations and hydro-elevators, excluding individual houses (2% of consumption). Taking the number of substations as a proxy for consumption, the proposed investments are estimated to cover 56.1% of the total heat consumption by BTS customers. Accordingly, the savings have been calculated based on the assumption that the proposed substation investments impact 56.1% of consumption.

136. *Reduction of technical losses*. Installing new and upgrading existing IHS will reduce heat losses and water leakage at building connections, quantified as avoided cost of heat energy and make-up water supply. It is assumed that technical losses at building connections will be reduced by 3%. The marginal cost of heat supply is estimated at USD 13.4/Gcal. It is adjusted for the change in the forecasted real price of coal during the lifetime of the Project, where Australian coal was used as reference price. The cost of make-up water supply is estimated at USD 0.18/ton.

137. *Reduction of non-demanded heat and hot water.* The non-demanded heat and hot water is caused by commercial losses, especially due to non-registered occupants using hot water. It is assumed that 95% of those commercial losses can be reduced by upgrading the consumer connections with controllable substations and building-level heat and hot water metering. It is assumed that 50% of the reduced commercial losses will translate to reduced consumption and 50% to increased billing. The reduced consumption is estimated as avoided cost of heat generation and make-up water supply, evaluated using their respective marginal costs of supply indicated above.

138. *Impact of building-level metering on actual consumption (consumer behavior change)*. The introduction of metering and better control at building level is estimated to result in a 10% reduction in heat energy and water consumption.

139. *Pumping energy savings*. Pumping energy consumption in BTS' network is assumed to decrease in proportion to the reduction in heat energy supply, i.e. by 5.8%. In 2014-2015, the CHP plant consumed on average 45,820 MWh of electrical energy for DH supply purposes, including power consumption for water circulation pumps, pumping of make-up water and condensate of the DH steam-water heaters, and part of the plant's own power consumption (boiler and turbine plants, fuel handling, etc.). Given that the CHP has no variable speed pumps, electricity savings due to variable flow will not be fully harnessed. A 50% correlation

[52] Source: IMF World Economic Outlook, October 2016.

between savings in pumping energy and heat supply has been assumed; hence, the reduction in heat and water supply is estimated to decrease power consumption for pumping at the CHP plant by 2.9%. Pumping energy savings are quantified as avoided cost of power generation, estimated at long-run average incremental cost of USD 0.14/kWh.

140. *Life of the project*. The economic life of the project is assumed to be 20 years from the date of completion of rehabilitation works.

141. **GHG reduction benefits**. The rehabilitation of heat substations will also generate global environmental benefits in the form of a net reduction of CO_2 emissions. The CO_2 emission reduction benefits from the Project were evaluated following the World Bank's Guidance Note on Greenhouse Gas Accounting for Energy Investment Operations (June 2013). The rehabilitation of heat substations will lead to a reduction of 994,506 tCO_2 emissions. The economic analysis uses an estimate of social value of carbon starting at USD 30 in 2015 and increasing to USD 80 in real terms by 2050.

142. **Economic costs**. The economic costs of the Project include: (i) the upgrade of 1,700 substations; (ii) the cost of 231 new substations; (iii) installation of building-level smart heat and hot water meters; (iv) the preventive maintenance system; (v) design and supervision costs; and (vi) incremental O&M costs associated with maintenance of newly installed building-level meters. Total investment costs are estimated to be USD 16.85 million. 10% physical contingencies are assumed. Annual incremental O&M costs are assumed to equal KGS 6.15 million.

Table A4-1: Investment cost estimate for modernization of individual (building-level) heat substations

	Cost estimates before tax, USD million
Installing new and upgrading existing IHS	10.84
Installing smart heat and hot water meters at building-level	4.10
Preventive maintenance system	0.30
Design and supervision	0.07
Total investment costs without contingencies	**15.32**
+10% contingencies	1.53
Total investment costs with contingencies	**16.85**

143. **Results.** The economic analysis of this activity yielded an economic NPV of USD 5.22 million and an EIRR of 10.1% exclusive of social cost of avoided CO_2 emissions and an economic NPV of USD 27.47 million and an EIRR of 22.7% inclusive of social cost of avoided CO_2 emissions.

144. **Sensitivity analysis**. A sensitivity analysis was conducted to assess the robustness of the estimated Project *economic* returns to changes in the main evaluation variables. The results of the sensitivity analyses are presented in the Table A4-2.

Table A4-2: Sensitivity analysis for economic appraisal of investment in modernization of individual (building-level) heat substations

	NPV, USD million		EIRR, %	
Sensitivity variables	**10%**	**20%**	**10%**	**20%**
[1] Higher investment costs	3.81	2.39	8.7%	7.6%
[2] Less reduction in technical losses of heat and make-up water	5.07	4.92	10.0%	9.8%
[3] Lower-than-anticipated avoided heat and make-up water supply due to reduction in non-demanded heat and make-up water	4.65	4.08	9.6%	9.2%
[4] Lower-than-anticipated avoided heat and make-up water supply due to efficient use of energy	3.92	2.62	9.1%	8.1%
[5] Combination of [1], [2], [3] and [4]	1.78	(1.66)	7.3%	4.8%

145. The results of the sensitivity analysis suggest that the NPV and the economic return of the investment in modernization of heat substations is robust to substantial independent variations in each of the sensitivity variables, however their joint adverse variation by 20% produces a negative NPV of -US$1.66 million and an EIRR of less than the threshold level of 6%.

Subcomponent 1.1 – Package 2: Replacement and reconstruction of 'Vostok' transmission network

146. **Economic benefits.** The main economic benefits related to the replacement and reconstruction of the 'Vostok' transmission network are: (i) reduction in heat losses and water leakage; (ii) reduction of unserved energy; (iii) saving on water treatment and O&M costs; and (iv) pumping energy saving in BTS' network and at the CHP plant.

147. *Reduction of heat losses and water leakage*. Replacement of the worn-out pipes with pre-insulated underground pipes will result in an annual reduction of 3,116 Gcal of heat losses and 24,247 tons of water leakages, evaluated at their marginal cost of supply.

148. *Reduction in unserved heat energy*. 'Vostok' transmission pipeline delivers heat to 45 multi-apartment buildings, 29 community facilities and more than 70,000 residents, corresponding to about 31% of BTS' total customer base and total annual heat energy and hot water supply. Over the past 5 years, the 'Vostok' transmission pipeline experienced five major failures or an average of one major failure every year resulting in the disruption of heat and HW supply to end-users, which can take up to 24 hours to fix. It is assumed that underspending on maintenance will cause further deterioration of the already severely dilapidated transmission pipeline and increase the annual frequency of such disruptions to five by 2020. This also means an increase of unserved energy to about 6,200 Gcal. Replacing a section of 2.87km along the 'Vostok' transmission network (including sections financed by the HSIP and RKDF) is expected to reduce the number of major breakdowns to none.

149. The cost of unserved energy is assumed at USD 267.9/Gcal, assessed as the cost of heat supply by a back-up heating option, which is assumed to be an electric heater. Long-run average incremental cost of electricity is assumed at USD 0.14/kWh.

150. *Savings on O&M costs*. The targeted replacement along the 'Vostok' transmission pipeline is expected to generate savings on future pipeline repair costs. Repair of one major breakdown on the transmission pipelines is estimated to cost BTS about USD 80,000.

151. *Savings on water treatment costs*. The reduction of heat and hot water supply by the CHP plant to the DH system brought by reduced heat losses and water leakage is assumed to result in savings on water treatment. The cost of make-up water treatment is estimated to be USD 0.02/ton.

152. *Pumping energy savings*. Reduced heat and water losses will also decrease the required pumping energy. BTS booster pump energy is assumed to proportionately decrease by 0.16%. Following the same approach applied above, power consumption for pumping at the Bishkek CHP plant is assumed to decrease by 0.08%.

153. *Life of the project*. The economic life of the investment is assumed to be 40 years from the date of completion of transmission pipeline replacement and reconstruction works.

154. **Net GHG emissions**. Over the economic life of the replaced transmission pipeline, there is an increase in GHG emissions of 103,534 tCO_2 from the reduction in unserved energy. This is offset by the reduction in GHG emissions from reduced heat losses and pumping energy savings resulting in net emissions increase of 51,876 tCO_2. The economic analysis uses an estimate of social value of carbon starting at USD 30 in 2015 and increasing to USD 80 in real terms by 2050.

155. **Economic costs**. The investment cost of the pipeline replacement is estimated to be USD 11.87 million. The new pipeline section will also require annual maintenance, which was evaluated at 0.5% of the pipeline replacement cost or about USD 0.06 million.

Table A4-3: Investment cost estimate for 'Vostok' transmission network

	Cost estimates before tax, USD million
Pre-insulated pipes and accessories	5.32
Installation and civil works including concrete structures and related materials	5.17
Design and supervision	0.30
Total investment costs without contingencies	**10.79**
+10% contingencies	1.08
Total investment costs with contingencies	**11.87**

156. **Results**. The economic analysis of replacement of reconstruction of 'Vostok' transmission pipeline yielded an economic NPV of USD 13.72 million and an EIRR of 14.5%, exclusive of social costs of CO_2 emission, and an NPV of USD 12.89 million and an EIRR of 14.1%, inclusive of social costs of CO_2 emission.

157. **Sensitivity analysis**. A sensitivity analysis was conducted to assess the robustness of the estimated project economic returns to changes in the main evaluation variables. The results of the sensitivity analyses are presented in Table A4-4.

Table A4-4: Sensitivity analysis for economic appraisal of replacement and reconstruction of 'Vostok' transmission network

	NPV, USD million		EIRR, %	
Sensitivity variables	**10%**	**20%**	**10%**	**20%**
[1] Higher investment cost	12.65	11.58	13.2%	12.2%
[2] Lower-than-anticipated avoided unserved heat energy	11.82	9.92	13.4%	12.3%
[3] Less reduction in heat loss and make-up water leakage	13.66	13.59	14.4%	14.4%
[4] Combination of [1], [2] and [3]	10.69	7.66	12.2%	10.2%

158. The results of the sensitivity analysis suggest that the Project is economically robust even in case of substantial variation of main variables that affect its economic viability.

Component 2: Piloting efficient and clean heating stoves

159. This pilot program aims to improve access to efficient and clean solid fuel-fired heating stoves and LPBs for low income households that don't have access to DH and continue to rely on traditional, inefficient and polluting solid fuel-based heating systems. A cost-effectiveness analysis was conducted to compare more efficient coal-fired stoves/LPBs with traditional solid-fuel based heating systems in terms of their efficiency in meeting heat energy demand. The capital cost, thermal efficiency and fuel consumption assumptions in Table A4-5 below were used to compute the levelised cost of heat per unit of energy output (GJ) for the compared heat systems. Capital costs associated with purchase and installation of existing inefficient stoves proposed for replacement under Component 2 are considered sunk. Capital and recurrent fuel costs and heat generated over the life of each heating system was discounted at 6%. Economic prices of stoves and fuel costs (coal) are based on the detailed market assessment completed by the Bank in 2016.

Table A4-5: Levelised cost of heat

Heating system	Thermal efficiency	Useful life	Capital cost (KGS/GJ)	Fuel cost (KGS/GJ)	Carbon cost (KGS/GJ)	Levelised cost without carbon cost (KGS/GJ)	Levelised cost with carbon cost (KGS/GJ)
Existing inefficient heating systems							
Traditional stove	40%	8	-	366	382	366	748
Inefficient coal-fired LPB	40%	8	-	366	382	366	748
Proposed eligible heating systems							
Efficient coal-fired stove	75%	12	38	195	216	233	450
Efficient coal-fired LPB	70%	12	72	209	232	281	513

160. The results of the comparative analysis demonstrate that the fuel costs for low income households to heat their homes can be reduced by up to 45%. Even with capital costs, levelised costs of efficient heating

options are well below the recurrent costs of the existing ones. Switching to more efficient technologies will also have health benefits, which are not included in the analysis, such as reduced exposure to indoor air pollution and increase in comfort levels, benefitting in particular women, children and pensioners who spent more time at home.

Component 3: Demonstrating the benefits of energy efficiency improvements in public buildings

161. The economic and financial appraisal was conducted for representative types of facilities and energy efficiency measures to be financed under the Project. The investment costs of energy efficiency measures and energy saving estimates are drawn from the pre-feasibility studies prepared under Urban Development Project for selected schools and kindergartens in the cities of Balykchy and Toktogul.

162. **Economic benefits and costs**. The main economic benefits from energy efficiency investments in public facilities is the economic value of electricity savings for heating and other purposes, increased comfort level for occupants of the social and public facilities and O&M cost savings. Proposed energy efficiency measures are expected to achieve electricity savings in the range of 70-83%. Electricity savings are valued at USD 0.19/kWh, which equals the estimated long-run average incremental cost of electricity of USD 0.14/kWh plus the economic value of comfort level improvements assumed to be about 40% of the value of energy savings.[53] The main economic costs are the capital investment costs. The economic costs and benefits of the Project were calculated exclusive of taxes and subsidies. The results of the economic analysis are presented in the table below.

163. The energy efficiency investments will also generate economic benefits that were not quantified in this analysis, including improved quality of services provided by those facilities, e.g. improved child care and better functionality of buildings, and seismic safety measures. Seismic safety related investments costs and benefits are excluded from the analysis given the lack of reliable data on benefits associated with improved resilience of buildings (this is being assessed as part of an ongoing study with results expected to be available in late-2017).

Table A4-6: Results of economic analysis of energy efficiency investments

Public facility	NPV (USD)	EIRR (%)	Discounted payback period	CO_2 emission reduction over lifetime (t)
Balykchy – Kindergarten No: 8 "Ak-Tilek"	122,254	16%	8 years	109
Balykchy – School #5 "Aitmatova"	209,313	12%	11 years	268
Toktogul – Kindergarten No: 2 "Archa-Beshik"	146,419	18%	7 years	119
Toktogula – School #1 "Toktogula"	551,742	25%	5 years	380
Toktogul – School #2 "Bokombaeva"	241,150	13%	10 years	280

[53] World Bank, 2016 (forthcoming). Scaling up Thermal Retrofit of Residential and Public Buildings in Europe and Central Asia.

164. **Sensitivity analysis.** The key parameters, which may significantly affect economic viability of energy efficiency investments are the investment costs and the estimated energy savings. The impact of defined variation in those parameters is presented in the table below.

Table A4-7: Sensitivity analysis for economic appraisal of energy efficiency investments

Facility		Base case	Investment cost +20%	Estimated energy savings -20%	Investment cost +20% and estimated energy savings -20%
Balykchy – Kindergarten No: 8 "Ak-Tilek"	NPV (USD)	$122,254	$90,309	$71,780	$39,835
	EIRR (%)	16%	12%	12%	9%
Balykchy – School #5 "Aitmatova"	NPV (USD)	$209,313	$118,154	$85,577	-$5,581
	EIRR (%)	12%	9%	8%	6%
Toktogul – Kindergarten No: 2 "Archa-Beshik"	NPV (USD)	$146,919	$115,941	$91,501	$61,022
	EIRR (%)	18%	14%	14%	10%
Toktogula – School #1 "Toktogula"	NPV (USD)	$551,742	$477,728	$376,509	$302,491
	EIRR (%)	25%	19%	19%	15%
Toktogul – School #2 "Bokombaeva"	NPV (USD)	$241,150	$152,547	$112,028	$23,424
	EIRR (%)	13%	10%	9%	7%

b) Project financial analysis

165. **Project financial analysis Component 1**. The financial viability of the Project was assessed based on the incremental cash inflows and outflows from the perspective of BTS and will assume the Project assets and debt obligations on their balance sheets. The financial analysis adopts a number of inputs from the economic analysis, including Project construction schedule and life time, investment costs, and O&M cost savings. Kyrgyzstani Som inflation is applied to the local prices and costs in the financial analysis, and equipment supply costs are indexed to Manufactures Unit Value (MUV) Index.[54] VAT and import duties are applied accordingly.

Subcomponent 1.1 – Package 1: Modernization of individual (building-level) heat substations

166. **Financial benefits**. The financial benefits for BTS are: (i) savings on purchase of heat energy and make-up water from Bishkek CHP because of reduced technical losses and more efficient use of energy; (ii) increased revenue from higher billed energy after the introduction of building level meters; and (c) pumping energy savings.

167. *Purchase cost savings.* Reduced technical losses and efficient use of heat energy and water will result in purchase of less heat energy and make-up water from Bishkek CHP in relation to the "without project" case. Savings on purchase costs are evaluated at the sale tariff for Bishkek CHP. Heat and make-up water tariffs as of the end of 2016 were KGS 497.4/Gcal and KGS 12.4/t, inclusive of VAT, respectively, and are assumed to increase at the forecasted inflation rate of 7% in 2017 and 5% thereafter during the Project life.

168. *Net impact of building-level metering on revenues*. The introduction of building-level metering will encourage efficient use of heat energy and water. This is expected to decrease billed residential heat energy and water consumption by 10% in comparison with the "without project case" or 76,483 Gcal and 546,111 tons respectively. This means less revenue from sales for BTS. Residential consumers account for about 67% of total heat energy and 87% of make-up water consumption.

[54] Manufactures Unit Value (MUV) Index, July 4, 2014.

169. In 2016, the average heat and hot water tariffs for residential consumers were KGS 1,075/Gcal and KGS 19/t, respectively. They are assumed to stay unchanged in 2017 and increase at the rate of inflation thereafter.

170. It is also assumed that 50% of the reduction in non-demanded heat and make-up water following the installation of building-level meters will translate into an increase in billable thermal energy and hot water, hence higher sales revenues. The net impact of a more efficient use of and higher billing for heat and hot water on BTS's revenues is estimated to be negative for heat energy and positive for hot water.

171. *Pumping energy savings*. Pumping energy savings in BTS' network were computed using electricity tariffs for non-residential consumers, which equaled to KGS 2.24/kWh in 2016 and are assumed to increase at the inflation rate.

172. **Financial costs**. The main financial costs are: (i) the installation of new and upgrade of existing IHS; (ii) the preventive maintenance system; (iii) installation of building-level smart heat and hot water meters; (iv) design and supervision costs; and (v) incremental O&M costs associated with maintenance of newly installed building level meters.

173. **Results**. The financial analysis of the Project from BTS's perspective yielded a negative financial NPV of USD (6.75)[55] million and negative FIRR of -1.8%, which is due to assumed 10% reduction in end-user consumption after introduction of building level meters, as well as the fact that only half of the reduced commercial losses will translate to billable energy due to the assumption that heat and hot water supply more accurately matches the demand. As a result, overall end-users will consume less heat and hot water.

174. It is worth highlighting that besides the direct financial impacts quantified in financial analysis, the IHS upgrade generates other indirect system-level benefits which will improve the long-term financial viability and sustainability of the BTS DH system, which were not quantified in the analysis. Specifically, the ability to better control heat consumption at building-level and related bills for customers is an important factor in moving towards cost-recovery tariffs, thus, enabling BTS to ensure its financial sustainability in the long-term. Modernized substations will also enable BTS to better optimize its operational regime in terms of variable flow and temperature, which would help to improve the overall efficiency of the DH system. In addition, higher flow temperatures would increase the transmission and distribution capacity of the network, which can help to meet additional heating demand from under-served customers (e.g. under-heated buildings) and potentially connect new customers in the medium-term without requiring additional pumping capacity or larger pipe dimensions.

Subcomponent 1.1 – Package 2: Replacement and reconstruction of 'Vostok' transmission network

175. **Financial benefits**. The financial benefits for BTS are: (i) savings on purchase cost of heat energy and make-up water from Bishkek CHP because of reduced heat loss and make-up water leakage in 'Vostok' transmission network; (ii) increased sales because of reduction in unserved heat energy; (iii) saving of water treatment and O&M costs; and (iv) pumping energy savings.

[55] Applied financial discount rate is 1.25%, assuming that proposed IDA Credit and IDA Grant funds will be on-lent under a Subsidiary Agreement to BTS on the same credit terms, i.e. 1.25%, as are for state-owned power distribution company Severelectro JSC under the ongoing Electricity Supply Accountability and Reliability Improvement Project.

176. **Financial costs**. The main financial costs are: (i) the investment cost of the pipeline replacement; and (ii) incremental O&M costs.

177. **Results**. The financial analysis of the Project from BTS's perspective yielded a financial NPV of USD 7.02[56] million and a FIRR of 4.6%.

178. **Sensitivity analysis**. A sensitivity analysis was conducted to assess the robustness of the estimated Project financial returns to changes in the main evaluation variables. The results of the sensitivity analyses are presented in Table A4-8.

Table A4-8: Sensitivity analysis for financial appraisal of investment in modernization of 'Vostok' transmission network

	NPV, USD million		FIRR, %	
Sensitivity variables	**10%**	**20%**	**10%**	**20%**
[1] Higher investment cost	5.48	3.93	4.0%	3.5%
[2] Lower-than-anticipated avoided unserved heat energy	6.38	5.74	4.4%	4.3%
[3] Less reduction in heat loss and make-up water leakage	6.85	6.67	4.6%	4.5%
[4] Combination of [1], [2] and [3]	4.66	2.30	3.8%	3.0%

Component 3: Demonstrating benefits of improving energy efficiency in public buildings

179. **Financial benefits and costs.** The main financial benefits of the energy efficiency investments are the reduction of energy bills and O&M cost savings. The energy bill savings were valued at electricity tariffs. The main financial costs are the capital investments. The assessment of the financial costs and benefits was done inclusive of taxes and with adjustment for inflation. The results of financial analysis are presented in the table below. It is worth highlighting that financial returns are impacted by tariffs and under-heating of buildings, which reduces achievable energy costs savings under the assumption that part of the energy savings will be used to increase comfort levels in buildings. If 'normative' consumption (and costs) are considered, the financial NPV and FIRR would improve.

Table A4-9: Results of financial analysis of energy efficiency investments

Public facility	NPV (USD)	FIRR (%)	Discounted payback period
Balykchy – Kindergarten No: 8 "Ak-Tilek"	$377	1.3%	20 years
Balykchy – School #5 "Aitmatova"	($125,268)	-1.1%	Longer than 20 years
Toktogul – Kindergarten No: 2 "Archa-Beshik"	$9,860	1.8%	20 years
Toktogula – School #1 "Toktogula"	$107,191	3.4%	17 years
Toktogul – School #2	($111,100)	-0.9%	Longer than 20 years

[56] Applied financial discount rate is 2.36%, assuming that IDA funds, which cover 59.6% of the investment cost, will be on-lent at 1.25%, as explained in the above footnote, and the remaining RKDF funds will be provided at 4.0%.

Public facility	NPV (USD)	FIRR (%)	Discounted payback period
"Bokombaeva"			

c) Analysis and forecast of financial performance of BTS

180. The assessment of BTS' financial performance is based on: (i) the audited financial statements for 2014–2015 and unaudited financial statements for 2016; (ii) detailed information and data on tariffs and debts; (iii) projections of heat energy demand in the Kyrgyz Republic by the Bank team; and (iv) the information obtained during the discussions with the engineering as well as the financial and economic planning staff of BTS.

181. **Analysis of the current financial performance of BTS**. BTS is a regulated state-owned company that purchases and distributes heat and hot water to end-users in the region of Bishkek city. The main supplier of heat and hot water to BTS is the CHP in Bishkek. The activities of BTS are regulated and heat and hot water tariffs are set by the State Regulatory Agency of the Fuel and Energy Complex.

182. BTS is a financially viable company with low level of indebtedness and high liquidity. In 2016, it delivered 1.8 million Gcal of heat energy to its customers, and the billed energy amounted to 1.3 million Gcal. Residential consumers, which are exempt from VAT on sales, account for 67% of total heat energy consumptions. Technical losses and non-demanded energy (i.e. commercial losses) were 28%. In 2013-2016, bill collection rates averaged 99%.

183. BTS has sufficiently high liquidity to meet its current liabilities. In 2016, the current ratio was 1.8, and the cash conversion cycle was 57 days.

184. The Company has two loans - an IDA credit under the Emergency Energy Assistance Project and a loan from the Northern Fund for Development under the Power Supply and Centralized Heating System Reconstruction Project. As of December 31, 2016, the outstanding debt was KGS 249 million (USD 3.6 million), which made only 12% of the company's assets. The debt service coverage ratio was 3.2 times the debt service requirement.

185. In 2016, the net profit margin of BTS was 4%. At least 25% of the annual net income is paid out as dividends, and the retained earnings are reinvested in the company. On average 67% of the company's earnings before interest and tax (EBIT) are reinvested in 2014-2015.

186. **Projected financial performance of BTS**. The financial performance of BTS was forecasted using the following assumptions:

- In 2017-2018, heat and hot water sales are assumed to be at the average level of 2013-2016; the installation of building-level meters and consumption-based billing will induce efficient use of energy resulting in lower billed energy starting from 2019;
- Heat and hot water tariffs for Bishkek CHP and end-user tariffs for BTS are assumed to stay unchanged in 2017 and increase at the forecasted rate of inflation thereafter;
- BTS will incur USD 34.4 million new debt for upgrade of heat substations and replacement of sections 1-4 of 'Vostok' pipeline plus USD 10 million from EBRD to support the modernization of BTS'

DH pumping stations, including the replacement of select pumps with energy efficient pumps and VSD, construction of a new pumping station, and installation of a new SCADA system;

- The assumed cost of IDA funds for BTS is 1.25%, the interest rate on financing from RKDF is 4%, and the interest rate of EBRD loan is LIBOR+1%;
- Receivable turnover ratios are assumed to remain at the level of 2016;
- Inventory and payable turnover ratios are assumed to remain at the average level of 2014-2016;
- All recurrent costs are assumed to change at the forecasted rate of inflation;
- USD/KGS exchange rate is assumed to be constant.

187. The operating profit of the company is expected to be in the range of 17%-19%. BTS' debt will grow more than tenfold over the next five years to 59% of total assets. In 2021 and 2022, following the point of maximum indebtedness, current assets will make up 240% and 266% of current liabilities respectively, and the debt service coverage ratios will be at 2.5 in 2022, an indication of the company's ability to meet its short-term and long-term liabilities.

Table A4-10: Financial ratios

	2014A	2015A	2016A	2017F	2018F	2019F	2020F	2021F	2022F
EBITDA margin	13%	11%	4%	17%	17%	17%	18%	19%	19%
Current ratio	2.10	2.31	1.81	2.09	2.02	1.92	2.11	2.40	2.66
Quick ratio	1.68	1.80	1.39	1.65	1.63	1.56	1.74	2.03	2.28
Debt-to-equity*	0.26	0.28	0.23	0.38	1.20	1.79	2.13	1.98	1.80
DSCR	5.08	3.62	3.23	21.82	10.58	3.30	2.14	2.40	2.53

** includes only interest-bearing debt*

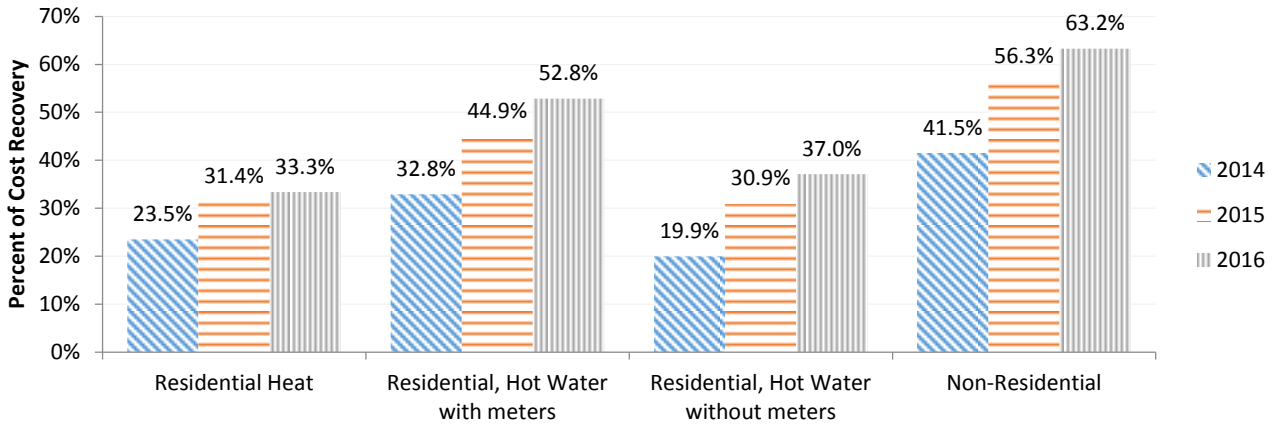
188. Forecast financial statements of BTS are presented in Tables A4-15 and A4-16.

d) Analysis of the overall financial situation in the heating sector

189. While BTS is a financially viable company, it is important to note the poor financial situation of the overall heating sector. It is estimated that the heating sector incurred a financial deficit of around KGS 2,500 million (USD 36.8 million) in 2016.[57] Heat and hot water tariffs, in particular for residential customers, remain far below cost recovery (see Figure A4-1), despite consistent improvements in the past three years. In 2014 and 2015 heat and hot water tariffs followed the tariff path set in the MTTP adopted in 2014, which was supported under an Energy Sector DPO and a Governance and Competitiveness DPO. As a result, between December 2014 and April 2015, residential and non-residential tariffs for heat and hot water were increased between 59% and 89%. However, no increases took place in 2016, and the MTTP was retroactively amended to reflect this lapse of the planned increase.

[57] Source: Analysis of the Kyrgyz Republic's Energy Sector (April, 2017).

Figure A4-1: Tariffs as percentage of cost-recovery levels



190. Heat and hot water tariffs for end-users and BTS are set in such a way that allow BTS to fully cover its purchase costs of heat and hot water, including technical and commercial losses in the distribution network, O&M expenditures and debt service costs. As a result, the brunt of below cost-recovery tariffs falls on Bishkek CHP plant. As of the end of 2016, Bishkek CHP sold heat energy at an approved tariff of KGS 444.08/Gcal, when the cost-recovery tariff is estimated at KGS 1,860/Gcal.

191. Going forward, for the overall sustainability of the heating sector, it will be important that the Government resumes the path towards closing the cost-recovery gap in order to restore the financial viability of the sector, decrease fiscal exposure and ensure that sector companies have sufficient funds to invest in supply-side improvements. In this respect, the adoption and consistent implementation of the new MTTP 2018-2023 will be critical in order to gradually increase end-user tariffs towards cost-recovery levels, including for the residential sector. To ensure that a basic level of heat consumption remains affordable to poor households, in the medium-term, it will also be important to strengthen and improve the targeting of the social assistance program. The World Bank is providing extensive technical assistance to inform sustainable tariff and social protection reforms (e.g. analytical work and advice, support for outreach activities to the population and poverty and social impact assessments), including the development of the new MTTP 2018-2023, and continues being involved in high-level policy dialogue on critical energy sector reforms. It is also expected that financial support for critical policy reforms in the energy sector, including through DPOs, will be resumed in 2018.

Table A4-11: Assumptions for project economic and financial analysis

Macroeconomic assumptions										
		Unit	2017	2018	2019	2020	2021	2026	2031	2036	2040
[1]	GDP per capita growth	[%]	0.91%	3.28%	2.65%	3.84%	2.90%				
[2]	US CPI	[Index]	1.02	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02
[3]	Kyrgyz Republic CPI	[Index]	1.07	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
[4]	Manufacturer's Unit Value (MUV) Index	[Index]	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
[5]	USD/KGS	[#]	69.93	69.93	69.93	69.93	69.93	69.93	69.93	69.93	69.93
[6]	Price of coal, Australia (constant US$)	[US$/t]	50.30	50.00	49.80	49.50	49.30	48.10	48.10	48.10	48.10
[7]	% change in the real price of Australian coal	[%]	-6.68%	-0.60%	-0.40%	-0.60%	-0.40%	0.00%	0.00%	0.00%	0.00%

Discount and tax rate assumptions		
[1]	Economic discount rate	6%
[2]	Financial discount rate for heat substation upgrade	1.25%
[3]	Financial discount rate for 'Vostok' line replacement	2.36%
[4]	Customs duty	5.00%
[5]	VAT	12.00%

Tariffs and cost of supply assumptions			
	Electricity	**[KGS/kWh]**	**[US$/kWh]**
[1]	LRAIC of electricity	-	$0.14
[2]	Electricity tariff for non-residential consumers in 2016	2.24	$0.03
	Heat energy	**[KGS/Gcal]**	**[US$/Gcal]**
[3]	Marginal cost of heat supply	938.34	$13.42
[4]	Cost of make-up water supply	13.19	$0.19
[5]	Heat and HW tariff for residential consumers	1,075.02	$15.37
[6]	Heat tariff for non-residential consumers	1,695.10	$24.24
[7]	Weighted average heat tariff	1,258.44	$18.00
[8]	Purchase cost of heat from Bishkek CHP	497.37	$7.11
[9]	Cost of unserved heat energy	18,733.51	$267.89
	Make-up water	**[KGS/t]**	**[US$/t]**
[10]	Make-up water tariff	19.20	$0.27

Tariffs and cost of supply assumptions			
[11]	Purchase cost of water from Bishkek CHP	12.28	$0.18
[12]	Average water treatment cost for 3Q of 2016	1.09	$0.02

Technical assumptions			
	Substation upgrade		
[1]	Share of heat and HW attributed to substations proposed for rehabilitation	[%]	56%
[2]	Rate of increase of technical losses due to corrosion and heat losses	[%]	0.2%
[3]	Post-project reduction in technical losses of heat and water	[%]	3.0%
[4]	Percentage of commercial losses impacted by the project	[%]	95.0%
[5]	Reduced commercial losses translated to lower consumption	[%]	50.0%
[6]	Reduced commercial losses translated to billed energy	[%]	50.0%
[7]	Reduction in consumption	[%]	10.0%
	'Vostok' pipeline replacement		
[8]	Length of the pipeline section proposed for replacement	[km]	2.87
[9]	Annual frequency of breakdowns on the pipeline	[#]	1
[10]	Annual increase of the frequency of breakdowns	[#]	1
[11]	Maximum frequency of breakdowns on the pipeline	[#]	5
[12]	Duration of supply cutoff due to breakdowns	[hours]	24
[13]	Percentage of customers served through 'Vostok' pipeline	[%]	31%
[14]	Pipe breakdown repair cost	[US$m]	$0.08
[15]	Annual pipeline maintenance and repair cost wo project	[US$/m]	$709.00
[16]	Annual pipeline maintenance and repair cost w project	[%]	0.50%
[17]	Reduction in heat losses	Gcal	3,116
[18]	Reduction in water leakage	[ton]	24,247

Table A4-12: Estimated project benefits

	Heat substation upgrade										
		Unit	2017	2018	2019	2020	2021	2026	2031	2036	2040
[1]	Reduction of technical losses of heat	[000 Gcal]	-	-	3	5	8	8	9	9	10
[2]	Reduction of commercial losses of heat translated to lower consumption	[000 Gcal]	-	-	9	19	28	29	29	30	30
[3]	Reduction of commercial losses of heat translated to billed energy	[000 Gcal]	-	-	9	19	28	29	29	30	30
[4]	Reduction of billed energy	[000 Gcal]	-	-	25	51	76	76	76	76	76
[5]	Reduction of technical losses of make-up water	[000 tons]	-	-	29	58	88	93	97	102	106
[6]	Reduction of commercial losses of make-up water translated to lower consumption	[000 tons]	-	-	205	412	619	631	642	654	664
[7]	Reduction of commercial losses of make-up water translated to billed water	[000 tons]	-	-	205	412	619	631	642	654	664
[8]	Reduction of billed energy make-up water	[000 tons]	-	-	182	364	546	546	546	546	546
[9]	Reduction of pumping electricity consumption at BTS	[MWh]	-	-	235	470	704	699	694	689	686
[10]	Reduction of pumping electricity consumption at CHP-1	[MWh]	-	-	445	888	1,331	1,322	1,313	1,304	1,297
[11]	GHG emission reduction	[ktCO2]	-	-	16	31	47	47	47	48	48

	'Vostok' pipeline replacement														
		Unit	2017	2018	2019	2020	2021	2026	2031	2036	2040	2045	2050	2055	2060
[1]	Heat loss reduction due to transmission pipeline replacement	[000 Gcal]	-	-	-	-	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
[2]	Water leakage reduction due to pipeline replacement	[000 ton]	-	-	-	-	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
[3]	O&M savings (pipeline repair costs)	[US$m]	-	-	-	-	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
[4]	Reduction of energy not supplied	[000 Gcal]	-	-	-	-	6.2	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
[5]	Reduction of pumping energy consumptions at BTS	[%]	-	-	-	-	0.16%	0.16%	0.16%	0.16%	0.16%	0.16%	0.16%	0.16%	0.16%
[6]	Pumping electricity consumption at BTS	[MWh]	-	-	-	-	19	19	19	19	18	18	18	18	18
[7]	Reduction of pumping energy consumptions at CHP-1	[%]	-	-	-	-	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%
[8]	Pumping electricity consumption at CHP-1	[MWh]	-	-	-	-	37	36	36	35	35	35	35	35	35
[9]	Net GHG emission reduction/(increase)	[ktCO2]	-	-	-	-	(1.29)	(1.29)	(1.29)	(1.30)	(1.30)	(1.30)	(1.30)	(1.30)	(1.30)

Table A4-13: Project economic analysis

Modernization of individual (building-level) heat substations

		Unit	PV	2017	2018	2019	2020	2021	2026	2031	2036	2040
	Disbursement pattern			*0%*	*33%*	*33%*	*33%*					
[1]	Investment costs	[US$m]	(14.16)	-	(5.62)	(5.62)	(5.62)	-	-	-	-	-
[2]	Incremental O&M costs	[US$m]	(0.87)	-	-	(0.03)	(0.06)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
[3]	**Total economic costs**	**[US$m]**	**(15.03)**	**-**	**(5.62)**	**(5.64)**	**(5.67)**	**(0.09)**	**(0.09)**	**(0.09)**	**(0.09)**	**(0.09)**
[4]	Reduction in technical losses of heat energy	[US$m]	1.11	-	-	0.03	0.07	0.10	0.11	0.12	0.12	0.13
[5]	Reduction in commercial losses of heat energy	[US$m]	3.84	-	-	0.13	0.25	0.38	0.39	0.39	0.40	0.40
[6]	Reduction in billed heat energy	[US$m]	10.13	-	-	0.34	0.68	1.02	1.03	1.03	1.03	1.03
[7]	Reduction in technical losses of make-up water	[US$m]	0.18	-	-	0.01	0.01	0.02	0.02	0.02	0.02	0.02
[8]	Reduction in commercial losses of make-up water	[US$m]	1.19	-	-	0.04	0.08	0.12	0.12	0.12	0.12	0.13
[9]	Reduction in billed make-up water	[US$m]	1.02	-	-	0.03	0.07	0.10	0.10	0.10	0.10	0.10
[10]	Saving of pumping electricity at CHP-1	[US$m]	1.83	-	-	0.06	0.12	0.19	0.19	0.18	0.18	0.18
[11]	Saving of pumping electricity at BTS	[US$m]	0.97	-	-	0.03	0.07	0.10	0.10	0.10	0.10	0.10
[12]	**Total economic benefits exclusive of CO2 emission reduction benefits**	**[US$m]**	**20.25**	**-**	**-**	**0.67**	**1.35**	**2.03**	**2.05**	**2.06**	**2.07**	**2.08**
[13]	CO2 emission reduction benefit	[US$m]	22.24	-	-	0.53	1.09	1.71	2.07	2.45	2.94	3.39
[14]	**Total economic benefits inclusive of CO2 emission reduction benefits**	**[US$m]**	**42.50**	**-**	**-**	**1.20**	**2.44**	**3.73**	**4.12**	**4.51**	**5.01**	**5.48**
[15]	**Net economic benefits exclusive of CO2 emission reduction benefits**	**[US$m]**		**-**	**(5.62)**	**(4.97)**	**(4.33)**	**1.94**	**1.96**	**1.97**	**1.98**	**2.00**
[16]	**Net economic benefits inclusive of CO2 emission reduction benefits**	**[US$m]**		**-**	**(5.62)**	**(4.44)**	**(3.24)**	**3.64**	**4.03**	**4.42**	**4.92**	**5.39**
[17]	**NPV exclusive of CO2 emission reduction benefits**	**[US$m]**	**5.22**									
[18]	**NPV inclusive of CO2 emission reduction benefits**	**[US$m]**	**27.47**									
[19]	**EIRR exclusive of CO2 emission reduction benefits**	**[%]**	**10.06%**									
[20]	**EIRR inclusive of CO2 emission reduction benefits**	**[%]**	**22.72%**									

Replacement and reconstruction of 'Vostok' transmission network

		Unit		2017	2018	2019	2020	2021	2026	2031	2036	2040	2045	2050	2055	2060
	Disbursement pattern			*0%*	*33%*	*33%*	*33%*									
[1]	Investment cost	[US$m]	(9.98)	-	(3.96)	(3.96)	(3.96)	-	-	-	-	-	-	-	-	-
[2]	Incremental O&M costs	[US$m]	(0.71)	-	-	-	-	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
[3]	**Total economic costs**	**[US$m]**	**(10.68)**	**-**	**(3.96)**	**(3.96)**	**(3.96)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**	**(0.06)**
[4]	Heat loss reduction	[US$m]	0.50	-	-	-	-	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
[5]	Water leakage reduction	[US$m]	0.05	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[6]	Savings on water treatment costs	[US$m]	0.00	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[7]	Reduction of heat energy not supplied	[US$m]	18.99	-	-	-	-	1.59	1.59	1.59	1.59	1.60	1.60	1.60	1.60	1.60
[8]	Savings on O&M costs	[US$m]	4.77	-	-	-	-	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
[9]	Saving of pumping electricity at CHP-1	[US$m]	0.03	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[10]	Saving of pumping electricity at BTS	[US$m]	0.06	-	-	-	-	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
[11]	**Total economic benefits exclusive of CO2 emission reduction benefits**	**[US$m]**	**24.40**	**-**	**-**	**-**	**-**	**2.04**	**2.05**	**2.05**	**2.05**	**2.05**	**2.05**	**2.05**	**2.05**	**2.05**
[12]	CO2 emission reduction benefit	[US$m]		-	-	-	-	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
[13]	**Total economic benefits inclusive of CO2 emission reduction benefits**	**[US$m]**		**-**	**-**	**-**	**-**	**2.00**	**1.99**	**1.98**	**1.97**	**1.96**	**1.96**	**1.96**	**1.96**	**1.96**
[14]	**Net economic benefits exclusive of CO2 emission reduction benefits**	**[US$m]**		**-**	**(3.96)**	**(3.96)**	**(3.96)**	**1.99**	**1.99**	**1.99**	**1.99**	**1.99**	**1.99**	**1.99**	**1.99**	**1.99**
[15]	**Net economic benefits inclusive of CO2 emission reduction benefits**	**[US$m]**		**-**	**(3.96)**	**(3.96)**	**(3.96)**	**1.94**	**1.93**	**1.92**	**1.91**	**1.90**	**1.90**	**1.90**	**1.90**	**1.90**
[16]	**NPV exclusive of CO2 emission reduction benefits**	**[US$m]**	**13.72**													
[17]	**NPV inclusive of CO2 emission reduction benefits**	**[US$m]**	**12.89**													
[18]	**EIRR exclusive of CO2 emission reduction benefits**	**[%]**	**14.5%**													
[19]	**EIRR inclusive of CO2 emission reduction benefits**	**[%]**	**14.1%**													

Table A4-14: Project financial analysis

Modernization of individual (building-level) heat substations

		Unit		2017	2018	2019	2020	2021	2026	2031	2036	2040
[1]	Investment costs	[US$m]	(20.03)	-	(6.82)	(6.93)	(7.04)	-	-	-	-	-
[2]	Incremental O&M costs	[US$m]	(2.16)	-	-	(0.03)	(0.06)	(0.10)	(0.11)	(0.13)	(0.14)	(0.15)
[3]	**Total financial costs**	**[US$m]**	**(22.19)**	**-**	**(6.82)**	**(6.96)**	**(7.11)**	**(0.10)**	**(0.11)**	**(0.13)**	**(0.14)**	**(0.15)**
[4]	Incremental revenue from heat energy supply	[US$m]	(25.20)	-	-	(0.27)	(0.58)	(0.91)	(1.15)	(1.46)	(1.86)	(2.25)
[5]	Savings on purchase cost of heat energy	[US$m]	30.36	-	-	0.32	0.67	1.06	1.36	1.76	2.28	2.79
[6]	Incremental revenue from make-up water supply	[US$m]	0.93	-	-	0.01	0.02	0.02	0.04	0.05	0.08	0.10
[7]	Savings on purchase cost of make-up water	[US$m]	8.42	-	-	0.09	0.18	0.29	0.38	0.49	0.63	0.78
[8]	Savings on electricity for pumping purposes at BTS	[US$m]	0.93	-	-	0.01	0.02	0.03	0.04	0.05	0.07	0.08
[9]	**Total financial benefits**	**[US$m]**	**15.44**	**-**	**-**	**0.15**	**0.31**	**0.50**	**0.67**	**0.89**	**1.20**	**1.51**
[10]	**Net financial benefits**	**[US$m]**		**-**	**(6.82)**	**(6.82)**	**(6.79)**	**0.40**	**0.56**	**0.77**	**1.06**	**1.36**
[11]	**NPV**	**[US$m]**	**(6.75)**									
[12]	**FIRR**	**%**	**-1.8%**									

Replacement and reconstruction of 'Vostok' transmission network

		Unit		2017	2018	2019	2020	2021	2026	2031	2036	2040	2045	2050	2055	2060
[1]	Investment costs	[US$m]	(13.33)	-	(4.69)	(4.77)	(4.84)	-	-	-	-	-	-	-	-	-
[2]	Incremental O&M costs	[US$m]	(2.13)	-	-	-	-	(0.07)	(0.08)	(0.08)	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
[3]	**Total financial costs**	**[US$m]**	**(15.46)**	**-**	**(4.69)**	**(4.77)**	**(4.84)**	**(0.07)**	**(0.08)**	**(0.08)**	**(0.09)**	**(0.10)**	**(0.10)**	**(0.10)**	**(0.10)**	**(0.10)**
[4]	Incremental revenue from heat energy supply	[US$m]	6.41	-	-	-	-	0.14	0.18	0.23	0.29	0.36	0.36	0.36	0.36	0.36
[5]	Savings on purchase cost of heat energy	[US$m]	1.35	-	-	-	-	0.03	0.04	0.05	0.06	0.08	0.08	0.08	0.08	0.08
[6]	Savings on purchase cost of make-up water	[US$m]	0.26	-	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
[7]	Savings on electricity for pumping purposes	[US$m]	0.12	-	-	-	-	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
[8]	Savings on O&M costs	[US$m]	14.33	-	-	-	-	0.45	0.51	0.57	0.64	0.70	0.70	0.70	0.70	0.70
[9]	Savings on water treatment costs	[US$m]	0.01	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[10]	**Total financial benefits**	**[US$m]**	**22.48**	**-**	**-**	**-**	**-**	**0.63**	**0.73**	**0.86**	**1.01**	**1.15**	**1.15**	**1.15**	**1.15**	**1.15**
[11]	**Net financial benefits**	**[US$m]**		**-**	**(4.69)**	**(4.77)**	**(4.84)**	**0.56**	**0.66**	**0.77**	**0.91**	**1.05**	**1.05**	**1.05**	**1.05**	**1.05**

	Unit		2017	2018	2019	2020	2021	2026	2031	2036	2040	2045	2050	2055	2060
[12] **NPV**	**[US$m]**	**7.02**													
[13] **FIRR**	**%**	**4.6%**													

Table A4-15: Balance sheet of BTS

thousand soms	2014A	2015A	2016A	2017F	2018F	2019F	2020F	2021F	2022F
Non-current assets									
PP&E	1,051,303	1,203,337	1,466,410	1,735,691	2,975,569	3,813,217	4,259,015	4,010,218	3,805,604
Intangible assets	1,888	1,985	2,106	2,070	2,075	2,075	2,075	2,075	2,075
Deferred tax assets	2,521	1,089	23,141	23,141	23,141	23,141	23,141	23,141	23,141
Other financial assets	1,924	2,325	2,777	2,777	2,777	2,777	2,777	2,777	2,777
Total non-current assets	**1,057,637**	**1,208,735**	**1,494,434**	**1,763,679**	**3,003,562**	**3,841,208**	**4,287,006**	**4,038,209**	**3,833,595**
Current assets									
Inventory	121,797	139,927	142,978	147,546	156,078	171,067	182,026	188,262	194,779
Trade and other receivables	392,443	391,531	396,715	416,083	437,934	457,387	476,524	497,759	523,126
Taxes paid in advance	19,694	6,964	5,046	5,046	5,046	5,046	5,046	5,046	5,046
Other current assets	4,869	1,210	1,866	1,866	1,866	1,866	1,866	1,866	1,866
Cash and cash equivalents	77,468	92,304	71,116	135,117	201,629	280,984	371,191	507,271	629,603
Total current assets	**616,270**	**631,936**	**617,721**	**705,658**	**802,553**	**916,350**	**1,036,654**	**1,200,205**	**1,354,421**
TOTAL ASSETS	**1,673,907**	**1,840,671**	**2,112,155**	**2,469,337**	**3,806,114**	**4,757,558**	**5,323,660**	**5,238,415**	**5,188,016**
Shareholders' equity									
Statutory capital	366,842	366,842	366,842	366,842	366,842	366,842	366,842	366,842	366,842
Reserves	110,642	88,087	85,844	85,844	85,844	85,844	85,844	85,844	85,844
Retained earnings with payout restrictions	510,532	570,009	630,697	805,059	951,053	999,071	1,023,919	1,076,249	1,161,360
Total shareholders' equity	**988,015**	**1,024,939**	**1,083,383**	**1,257,745**	**1,403,739**	**1,451,757**	**1,476,605**	**1,528,935**	**1,614,046**
Non-current liabilities									
Long-term loans and borrowings	218,457	273,101	248,908	464,487	1,623,004	2,473,065	3,022,719	2,898,130	2,773,541
Deferred income	160,941	252,274	379,047	349,289	321,866	296,597	273,311	251,854	232,081
Deferred tax liabilities	12,490	17,221	59,848	59,848	59,848	59,848	59,848	59,848	59,848
Total non-current liabilities	**391,888**	**542,596**	**687,804**	**873,625**	**2,004,719**	**2,829,511**	**3,355,879**	**3,209,832**	**3,065,470**

thousand soms	2014A	2015A	2016A	2017F	2018F	2019F	2020F	2021F	2022F
Current liabilities									
Trade and other payables	162,961	165,795	221,341	200,413	212,002	232,362	247,248	255,719	264,571
Short-term loans and borrowings	39,110	8,846	287	18,215	66,314	124,589	124,589	124,589	124,589
Taxes payable	16,159	13,254	13,471	13,471	13,471	13,471	13,471	13,471	13,471
Advance payments received	22,157	30,783	27,749	27,749	27,749	27,749	27,749	27,749	27,749
Other liabilities	53,618	54,458	70,915	70,915	70,915	70,915	70,915	70,915	70,915
Profit tax liabilities	-	-	7,205	7,205	7,205	7,205	7,205	7,205	7,205
Total current liabilities	**294,004**	**273,136**	**340,968**	**337,968**	**397,656**	**476,291**	**491,177**	**499,648**	**508,500**
Total liabilities	**685,891**	**815,732**	**1,028,772**	**1,211,592**	**2,402,375**	**3,305,801**	**3,847,055**	**3,709,480**	**3,573,970**
TOTAL EQUITY AND LIABILITIES	**1,673,907**	**1,840,671**	**2,112,155**	**2,469,337**	**3,806,114**	**4,757,558**	**5,323,660**	**5,238,415**	**5,188,016**

Table A4-16: Income statement of BTS

thousand soms	2014A	2015A	2016A	2017F	2018F	2019F	2020F	2021F	2022F
Revenues	1,565,301	1,884,129	1,903,283	1,996,203	2,101,034	2,194,364	2,286,177	2,388,052	2,509,752
Cost of sales	(1,222,419)	(1,554,678)	(1,538,387)	(1,566,414)	(1,656,995)	(1,816,124)	(1,932,471)	(1,998,682)	(2,067,869)
Sale of heat	(1,157,402)	(1,474,371)	(1,448,874)	(1,478,205)	(1,564,153)	(1,718,185)	(1,829,404)	(1,890,370)	(1,954,046)
Services	(65,016)	(80,307)	(89,513)	(88,209)	(92,841)	(97,939)	(103,067)	(108,311)	(113,823)
Gross profit	**342,882**	**329,451**	**364,896**	**429,788**	**444,039**	**378,240**	**353,705**	**389,370**	**441,883**
Cost of sold inventory	(814)	(767)	(1,589)	-	-	-	-	-	-
Investment income	4,152	12,016	8,684	-	-	-	-	-	-
Other income	19,957	51,797	12,247	29,759	27,422	25,270	23,286	21,457	19,773
Selling expenses	(83,153)	(80,233)	(94,568)	(87,448)	(92,242)	(98,603)	(104,531)	(110,122)	(115,175)
Administrative expenses	(147,694)	(184,356)	(204,888)	(145,008)	(152,119)	(159,913)	(166,007)	(172,269)	(181,049)
Financial expenses	(5,881)	(6,474)	(6,533)	(6,371)	(11,558)	(37,754)	(52,034)	(56,687)	(52,927)
Gain/loss from FX transactions	(41,497)	(66,526)	24,778	(7,409)	-	-	-	-	-
Other expenses	(8,380)	(9,251)	(4,351)	-	-	-	-	-	-
Profit before tax	**79,573**	**45,658**	**98,675**	**213,311**	**215,544**	**107,239**	**54,419**	**71,749**	**112,505**
Profit tax	(615)	(6,519)	(28,203)	(21,331)	(21,554)	(10,724)	(5,442)	(7,175)	(11,251)
Net profit	**78,958**	**39,139**	**70,473**	**191,980**	**193,989**	**96,515**	**48,977**	**64,574**	**101,255**

ANNEX 5: SUMMARY OF TRIAL PHASE ON EFFICIENT AND CLEAN HEATING STOVES

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

192. **The majority of Kyrgyz households, especially among lower income segments, use traditional, inefficient and polluting solid fuel fired stoves to keep their homes warm.** As indicated in Section II, access to DH is limited to about 17% of the 1.1 million Kyrgyz households, mainly located in Bishkek and other urban centers. The remaining 907,000 households have to resort to individual heating solutions with the majority of households relying on traditional solid fuel-fired stoves and LPBs, especially in rural areas, urban areas outside of Bishkek and among low income segments. The current stoves and LPBs in use are inefficient with thermal efficiencies as low as 25%, result in high fuel consumption and related household expenditures, cause significant indoor and outdoor air pollution, and provide insufficient comfort levels in households during cold winter days.

Objective and Scope of the trial phase

193. **Objective of trial**. The trial phase was conducted during the heating season in 2016/2017 and aimed to: (i) identify, test and select efficient and clean solid fuel-fired heating technologies; (ii) build local capacity and awareness about the benefits of using improved technologies; (iii) monitor results in selected households in terms of household satisfaction, fuel consumption and exposure to indoor air pollution; and (iv) inform the design of a scaled-up pilot program under the HSIP.

194. **Financing and implementation arrangements**. The trial phase was supported by Trust Fund resources from ESMAP, CAEWDP and a Multi-Donor Trust Fund related to the Community Support Program under the CASA-1000 Project. To support preparation and implementation of the trial, CAMP Alatoo[58] – an NGO based in the Kyrgyz Republic – was hired as local implementation partner. Selection of households and monitoring of results was done in collaboration with the EU-funded Fresh Air program, which is led by the Ministry of Health and measures personal exposures to toxic indoor pollutants ($PM_{2.5}$ and CO) before and after installation of efficient and clean heating technologies.

195. **Selection criteria for households**. Trial households were selected based on the following criteria: (i) low income status of the household as verified by the social passport of the household; (ii) current use of solid fuel fired heating stoves or simple LPBs; (iii) residence in one of the four selected focus regions (Naryn, Chui, and Jalal-Abad and Osh region) which were identified based on considerations related to climate, heating patterns/ culture, pre-selection conducted by the Fresh Air program and the CASA-1000 corridor; (iv) absence of major sources of heat losses in the building, e.g. broken windows or doors; and (v) willingness of households to participate in the trial, including regular M&E of impacts. As a result, 51 low income households were selected from about 10 villages located in four Oblasts (Jalalabad: Bazar-Korgon rayon; Osh: Nookat rayon; Naryn: At Bashi rayon; and Chui: Issyk-Ata rayon).

196. **Selection criteria for heating technologies**. The selection criteria for stoves and LPBs supported under the trial included: (i) solid fuel-fired (coal, wood, dung); (ii) overall thermal efficiency of at least 70% as

[58] Central Asia Mountainous Project Alatoo

confirmed by measurements; (iii) 6-30kW peak heating capacity; and (iv) satisfactory safety performance and reduced emissions, as qualitatively assessed. A call for proposals to stove producers and suppliers was issued in August 2016. However, no models were submitted that met these criteria *inter alia* due to the absence of locally produced efficient and clean stoves and simple LPBs. As a result, extensive technical assistance and capacity building was provided to help develop prototypes[59] and locally manufacture five different models (see Table A5-1) that meet aforementioned criteria. Four of these models were selected for field testing (Models 1, 2, 4 and 5).

Table A5-1: Prototypes developed as part of the trial phase

	Fuel	Type	Cooking	Efficiency	Fuel saving	Implemented
KG1	Dung, wood, coal	Stove that can be connected to chimney, long chimney, heating wall	yes	73%	45%	Naryn: 10 models
KG2	Dung, wood, coal	Stove that can be connected to chimney, long chimney, heating wall	yes	70%	45%	
KG3	Coal	Batch stove for heating one room only	yes	75%	45%	None as KG3 was designed to be used public buildings (e.g. classrooms)
KG4	Coal	Stove that can be connected to chimney or heating wall	yes	74%	50%	Osh/ Jalalabad: 19 models Naryn: 10 models Chui: 1 model
KG5	Coal	Central heating (LPB)	no	75%	40%	Chui: 10 models Jalalabad: 1 model

197. **Stove installation and household training**. The installation of improved stoves was done by professional teams, which had received training on energy efficient stoves as part of an earlier program. To ensure adequate performance and safe operation of the new stove, installation works also included in some households: reconstruction of the heating wall, if the existing one was damaged; replacement of leaking chimneys; dismantling of old stoves; installation of additional connectors for water pipes; etc. Average installation costs amounted to about 25% of the stove price. During installation, households also received training on the proper operation of the stoves as well as on the quantity, quality and sizing of the fuel to be used. For each of the stove models, operational manuals were developed and distributed to trial households.

198. **Household monitoring arrangements**. Monitoring of select indicators (e.g. fuel consumption, satisfaction, indoor air pollution exposure, etc.) was conducted in all trial households and a number of control-group households. In Naryn, monitoring of fuel consumption and indoor air pollution was conducted through measurements before and after installation of the new stoves. In Osh, Jalalabad and Chui, monitoring was conducted in trial and control group households. Health-related monitoring was done through household questionnaires and 48h in-house measurements of $PM_{2.5}$ and CO exposure levels, and will continue during the forthcoming heating season. For monitoring of other aspects, household questionnaires and log books on fuel consumption were developed, households trained on proper recording of consumption (e.g. including use of

[59] The prototypes were developed together with a similar trial project implemented in Tajikistan.

coal buckets) and field visits were conducted to monitor satisfaction levels (based on questionnaires), continued stove performance, fuel consumption, comfort levels, user convenience and willingness to pay.

Summary of monitoring results

199. **Main benefits of the new technologies tested**: Based on preliminary monitoring results, the main benefits of trial stoves tested are described below.

200. **It is clean.** The current stoves in use cause heavy indoor smoke, especially during ignition and refueling, which may result in respiratory diseases, increase health costs and negatively impact the living conditions of households. Measurements conducted in trial and control group households before installation of the new stoves showed that $PM_{2.5}$ emissions reached levels of up to 11.5 mg/m^3 during start-up and refueling. For comparison, the WHO Air Quality Guidelines for the annual mean of $PM_{2.5}$ concentration is 0.01 mg/m^3. Filters used for indoor air pollution exposure measurements were completely black within 48 hours. Average daily $PM_{2.5}$ concentrations in Naryn ranged from 200-800 mg/m^3 and from 50-160 mg/m^3 in Chui. This demonstrates an alarmingly high level of indoor air pollution and households usually open doors and windows to evacuate the smoke. It also requires households to paint the walls at least 3-4 times per year due to the black soot from the stove. After the installation of efficient trial stoves, average emission concentration in Naryn was reduced by more than 95% and up to 85% in Chui. Similar improvements were observed with regards to CO emissions: after the installation of trial stoves, CO concentration levels and spikes were drastically reduced throughout the day. In addition, according to household surveys conducted by the Ministry of Health as part of the Fresh Air program, respiratory and non-respiratory symptoms among trail and control group households indicate improving trends after trial stoves had been installed. These health-related improvements are expected to benefit in particular women, children and seniors who spend more time at home. Additional laboratory tests are currently being conducted to confirm the cleanness of the new stoves with additional data and measurements.

Box 1 - Household in Osh/Nookat (Uchbay village)

This household, comprising 2 adults and 5 children, reported that they were accused of stealing electricity by a meter reader from the local power distribution company because the house was warm but no smoke perceivable from the chimney or in the house. In addition, the women reported that she did not have to restart the fire since the stove was installed and estimated to be able to save about 1t of coal during the heating season.

201. **It helps to save fuel.** Baseline measurements conducted as part of an earlier market assessment and the trial showed that traditional stoves have very low thermal efficiency of around 25%. This means that households use more coal and spend more money than needed. Efficiency measurements conducted of the four trial models confirmed that their efficiency ranges between 70%-75%, thus allowing households to save up to 45-50% in terms of fuel consumption and money. This is also confirmed by feedback from trial households, which reported an almost 50% decrease in fuel consumption. Households visited in Osh using Model 4 reported that they expect to save about 1 ton of coal during the full heating season (compared to their baseline consumption of around 2.5 tons of coal in previous years). In addition, households usually use different types of

fuels; depending on the area, 2-3 tons of coal, 1 ton of wood and 1 ton of dung are commonly used during a heating season. Households using trial Model 4 indicated not only to use less coal but also less wood or dung for starting the fire.

202. **It improves comfort levels**. An earlier baseline survey indicates prevalence of substantial under-heating during winter; dung-using households heat on average only half of their living space, while it is less than one third for wood- or coal-using households (as a comparison, households using electricity as primary heating source heat about 77% of their living space and about 86% for gas-using households). The trial indicates that the improved stoves allow households to heat more of their living space and reach higher indoor temperatures.

Box 2 - Household in Osh/Nookat (Uchbay village)

This household, comprising 3 adults and 5 children, had to reduce their living space (total 32 m^2) every winter due to insufficient heat output by their old stove. Since the new stove (Model 4) was installed, the family is able to use both rooms in the house while still saving some money on coal expenses.

203. **It is convenient.** The current stoves and boilers in use require refueling every 2-3 hours during winter. The new stoves require refueling only once in 6-15 hours, which is a significant improvement in terms of convenience and comfort. In addition, while old stoves were often operated only for part of the day, heat retention and improved operation allows households to use the new stove at low power throughout the day. For instance, several trial households reported with surprise that they did not have to restart the fire since the new stove was installed. Another aspect consistently highlighted as an advantage is the cooking capacity of the new stoves, i.e. trial households reported that it takes less time to heat the cooking or water pots, which adds to the convenience of the stove, especially for women.

ANNEX 6: DRAFT PROCUREMENT PLANS

COUNTRY : Kyrgyz Republic
Heat Supply Improvement Project

Draft Procurement Plan for Component 1

Contract Description	Procurement Method	WB Review (Prior/ Post)
Supply of substations in two lots Lot#1: new building-level heat substations; Lot#2: spare parts for renovation of substations	ICB	Prior
Supply and installation of heat and hot water meters	ICB	Prior
Supply and installation of preventive maintenance system	ICB	Post
Supply pre-insulated pipelines and accessories	ICB	Prior
Installation and civil works pipelines, including supply of concrete structures and other materials	ICB	Prior
Design company conducting author's supervision of substations*	SSS*	Post
Design company conducting author's supervision of 'Vostok' transmission pipeline*	SSS*	Post
Independent technical site supervision ('Vostok' transmission pipeline)	QCBS	Post
DH expert on-call basis*	SSS*	Post
Optimization of BTS' operating regime	IC	Post
Improvement of corporate resource management	IC	Post
Customer satisfaction survey	CQS	Post
Information campaign for affected households*	CQS	Post
Project Audit	CQS	Post
Entity Audit 2018-2022	LCS	Post

*Competitively selected under ECAPDEV preparation grant and continuation of services (subject to satisfactory performance).

Draft Procurement Plan for Component 2

Component 2

Contract Description	Procurement Method	WB Review (Prior/ Post)
Eligible clean and efficient heating stoves (batches)	SH	Post
GPS equipment/map to locate beneficiaries	SH	Post
Combined services (transportation and installation of new stoves plus recycling of old stoves)	SH	Post
Laboratory tests (including transportation)	SH	Post
Printing information/ outreach materials	SH	Post
Stove development center	CQ	Post
Piloting new heating technologies	CQ	Post
Stove expert with international experience (as-needed basis)	IC	Post
Technical stove expert	IC	Post
Regional technical specialists in pilot rayons (1 specialist/rayon)	IC	Post
Regional social mobilization specialists in pilot rayons (1 specialist/rayong with reduction)	IC	Post
Information management system for stove Project cycle	CQ	Post
Information/database management Specialist	IC	Post
Household surveys (baseline and impact assessment)	CQ	Post
Communications and awareness campaign	CQ	Post

Draft Procurement Plan for Component 3

Contract Description	Procurement Method	WB Review (Prior/ Post)
Goods required for effective project implementation (car, computer and furniture)	SH	Post
First batch (2018): Energy efficient renovations of selected public buildings	NCB	Post
Second batch (2019): Energy efficient renovations of selected public buildings	NCB	Post
Third batch (2020): Energy efficient renovations of selected public buildings	NCB	Post
Seismic and energy assessments, designs, technical site supervision and commissioning	QCBS	Prior
Local capacity building for energy service providers	IC	Post
Implementation of roadmap on scaling-up energy efficiency in public sector	IC	Post
Public awareness campaign on energy efficiency	CQ	Post
EE expert with international experience (as-needed basis)	IC	Post
Technical expert for EE	IC	Post
Safeguard Specialist (full time for entire project)	IC	Post
Project Audit	LCS	Post
Baseline and impact assessment in selected buildings	CQ	Post

ANNEX 7: MAP


KYRGYZ REPUBLIC
KAZAKHSTAN
UZBEKISTAN
TAJIKISTAN
CHINA
BISHKEK
Kara-Balta
Tokmok
Kirov
Talas
Chu
CHUI
TALAS
JALAL-ABAD
NARYN
OSH
BATKEN
Kungey-Alatau Mts.
Cholpon-Ata
Karakol
Tyup
Balykchi
Lake Issyk-Kul
ISSYK-KUL
Peak Pobedy 7439 m
Barskaun
Enilchek
Shyirak
Kara-Say
Tunuk
Toktogul
Toktogul Reservoir
Chaek
Lake Sonkul
Tian Shan
Naryn
At-Bashy
Kara-Kul
Tash-Kumyr
Jalal-Abad
Kurshab
Osh
Kyzyl-Kiya
Gul'cha
Sary-Tash
Daraut-Korgan
Kyzyl Suu
Lake Charyi-Kel'
Aksay
Chatkal
To Burylbaytal
To Ushtobe
To Panfilov
To Shymkent
To Tashkent
To Bukhoro
To Hotan
To Murghab
0 25 50 75 100 Kilometers
0 25 50 75 Miles
42°N
40°N
44°N
70°E
72°E
74°E
76°E
78°E
80°E
KYRGYZ REPUBLIC
SELECTED CITIES AND TOWNS
OBLAST CAPITALS
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
OBLAST BOUNDARIES
INTERNATIONAL BOUNDARIES
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
SEPTEMBER 2004
IBRD 33430