HEATING ASSESSMENT FOR THE URBAN BUILDING SECTOR OF THE KYRGYZ REPUBLIC

World Bank
Bishkek, Kyrgyz Republic
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Foreword

This summary has been prepared as part of the World Bank's Heating Assessment for the Urban Building Sector of the Kyrgyz Republic. The World Bank initiated the Assessment because of the precarious condition of the heating infrastructure in the country, and the sector's critical importance to help addressing winter power shortages and improving the wellbeing of the population.

The objective of the Assessment was to identify viable heating options and related investment measures to meet heat demand in urban residential and public buildings in the Kyrgyz Republic. To that end, the Assessment analyzed the condition and performance of the urban heating infrastructure and building stock, and assessed in detail the available heating options in Bishkek and Tokmok. The two cities were selected because they are largely representative of current heat demand and supply characteristics in urban areas.

The Assessment was developed by the World Bank based on data provided by the Ministry of Energy and Industry, the companies operating in the sector, the technical background report prepared by Fichtner, and the Qualitative Poverty and Social Impact Assessment conducted by the World Bank. It provides a foundation for, but is not a substitute for a more detailed analysis to inform and guide specific implementation steps.

The World Bank is available to continue the policy discussion with the Government on the findings and recommendations of the Assessment. To further these discussions, the World Bank is currently supporting the preparation of an investment and implementation plan targeting efficiency and reliability improvements of the heat network supplied by the Combined Heating and Power (CHP) plant in Bishkek.

Acknowledgements

The financial and technical support by the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged. ESMAP - a global knowledge and technical assistance program administered by the World Bank - assists low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, Finland, France, Germany, Iceland, Lithuania, the Netherlands, Norway, Sweden, the United Kingdom, and the World Bank Group.

The financial support by the Central Asia Energy Water Development Program (CAEWDP) is gratefully acknowledged. CAEWDP - a knowledge and technical assistance trust fund program administered by the World Bank to catalyze a renewed long-term effort to build energy and water security for the Central Asia region through enhanced cooperation; by establishing sound energy-water diagnostics and analytical tools, strengthening regional institutions, and identifying high priority infrastructure investments. CAEWDP is governed by a Donor Advisory Committee comprised of official bilateral donors and multilateral institutions, representing the United States of America, the European Commission, Switzerland, the United Kingdom, and the World Bank Group.

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CAEWDP
Central Asia Energy-Water Development Program

ESMAP
Energy Sector Management Assistance Program

Synopsis

The availability and reliability of heating is critical for the wellbeing of the population and the operation of public services. Given the cold climate and long heating seasons, lasting one-third to one-half of the year, access to reliable heating services is an essential need in the Kyrgyz Republic.

Once the principal source for heating in the largest urban areas, District Heating (DH) systems are in poor condition with deteriorating service quality. The majority of the DH infrastructure was commissioned 20-50 years ago and is under-maintained due to the lack of funds. As a result, generation assets operate at 20-50% of their capacity, heat losses are high and service quality is deteriorating. During the heating season, DH customers supplied by the CHP in Bishkek face on average two network breakdowns per day.

As a result of the poor performance of the heating sector:

- DH now serves only about 19% of the urban population and about 16% of public buildings
- Around 35% of the urban households rely on electricity as their primary source of heating, while many others use it as supplementary source to improve comfort levels in their apartments. The increasing reliance on electricity for heating is one of the main drivers of the growing residential electricity consumption during winter months (62% from 2009-13) and has aggravated winter power shortages in recent years
- Due to the lack of access to centralized heating options, about 40% of urban households use inefficient and polluting coal-fired stoves and boilers that have negative health and environmental consequences
- In Bishkek and Tokmok alone, 20-25% of the residential and public building heat demand is unmet and results in low comfort levels in buildings. Unmet demand is likely higher in other areas without access to DH systems

A mix of investments and policy measures is needed to address the key challenges in the heating sector and meet demand in residential and public buildings.

Synopsis, continued

A multi-criteria assessment was carried out to identify the most viable heating options for different customer segments:

- In Bishkek, DH supplied by the CHP plant continues to be the most viable heating option for buildings currently served by the DH system, even after the cost of substantial network upgrades are taken into account
- Small Heat-only-Boilers (HOBs) are a viable option for multi-apartment and public buildings that have existing building-internal heating networks and are not served by the CHP - installing small HOBs may also be a viable alternative for buildings that are currently supplied by large HOBs
- The replacement of traditional coal- and wood-fired stoves/boilers and inefficient electric oil radiators with more efficient models is the most viable option for individual houses and can reduce the current fuel consumption by up to 35%

The investment needs in the heating sector are sizeable: for Bishkek and Tokmok alone, the investments needed in the next two years are estimated at US$310 million.

The time to act is now:

- The availability and affordability of natural gas supply is improving since Gazprom acquired the majority stake in Kyrgyzgas and natural gas import prices are decreasing
- To realize the full benefits of the ongoing modernization of the CHP plant for end-consumers, the reliability and efficiency of the transmission and distribution network in Bishkek needs improvement to address remaining network bottlenecks
- Unless the DH system is improved, its continued deterioration will lead to even more consumers switching to electric heating and the related dismantling of building-internal heating networks, which will likely exacerbate winter power shortages and make the future restoration of DH supply unviable
- The Medium Term Tariff Policy adopted by the Government will gradually improve the financial viability of the heating sector but future tariff increases will not be accepted by consumers unless these increases are accompanied by improved supply quality and reliability

Outline

1. Heating sector overview

- National overview
- Heating sector in Bishkek and Tokmok

2. Key Challenges

- Poor performance of the heating infrastructure
- Lack of financial viability
- Poor energy performance of buildings

3. Analysis and Recommendations

4. Roadmap

Heating Sector Overview

Nationally, individual stoves/boilers are the most common primary heating source, followed by electricity-based heating

Both poor and non-poor urban households rely heavily on electric heating

- 40% of urban households use electricity as their primary source of heating

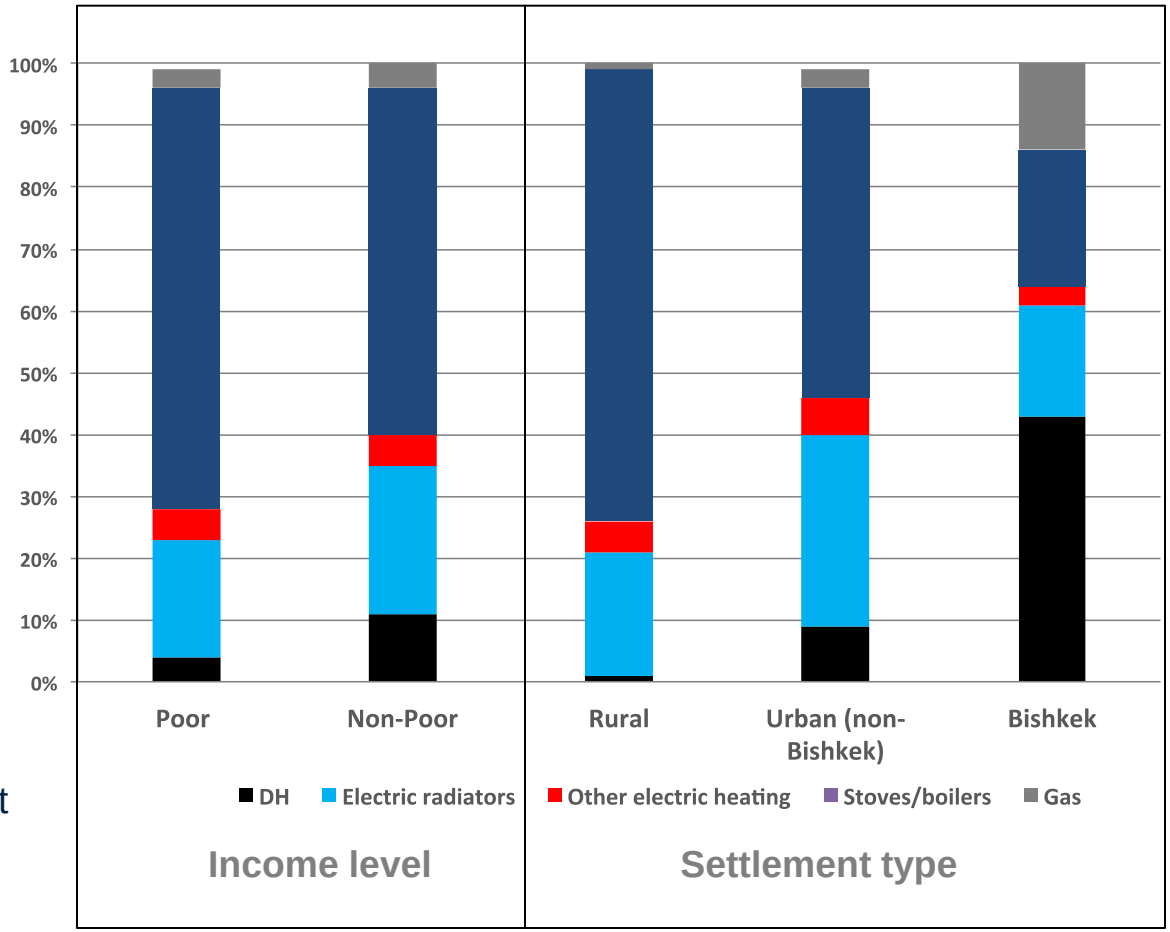
Biomass and coal are popular heating sources among both rural and urban households

- 70% of rural and 40% of urban households rely on individual coal- or biomass-based stoves and boilers

DH is the primary source of heating for 19% of all urban households

- 40% of households in Bishkek but less than 10% of households in other urban areas rely primarily on DH

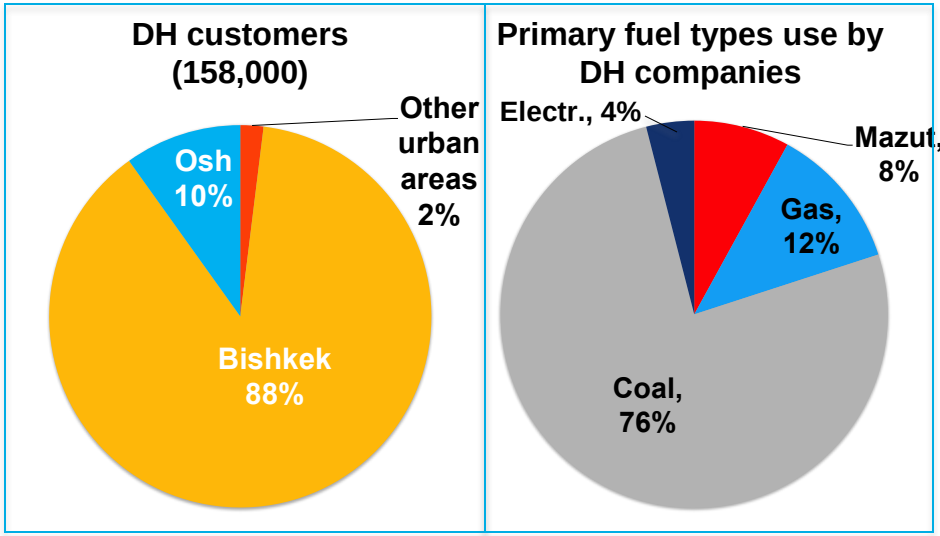
Primary heating source for residential consumers



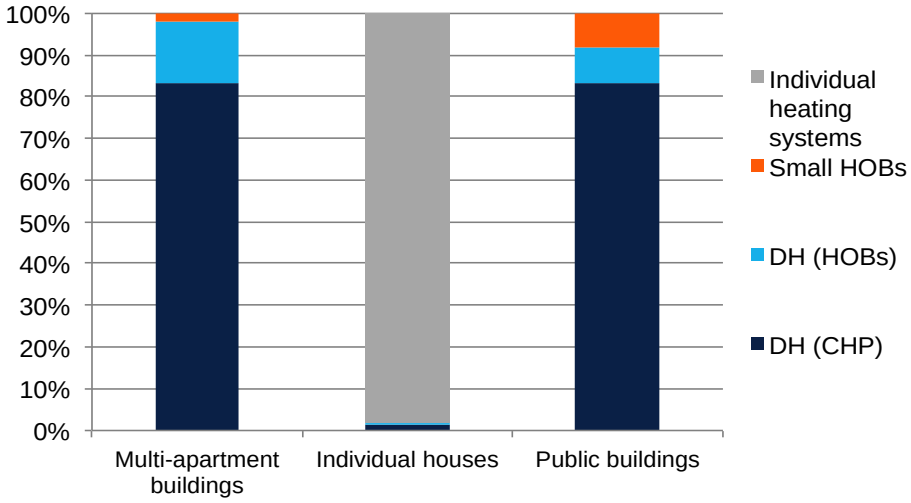
Source: Kyrgyz Integrated Household Survey (KIHS), 2012

In Bishkek and Tokmok, most apartment and public buildings rely on DH and most individual houses use individual heating solutions

- 75% of the DH is generated in Bishkek, supplying 88% of all DH customers
- Coal accounts for 76% of the fuel used by DH companies
- DH supply covers over 55% of the residential floor space in Bishkek and more than 45% in Tokmok
- More than 90% of public buildings in Bishkek and almost all in Tokmok are supplied by DH
- Almost all individual houses rely on individual heating systems such as wood/coal stoves and electric radiators

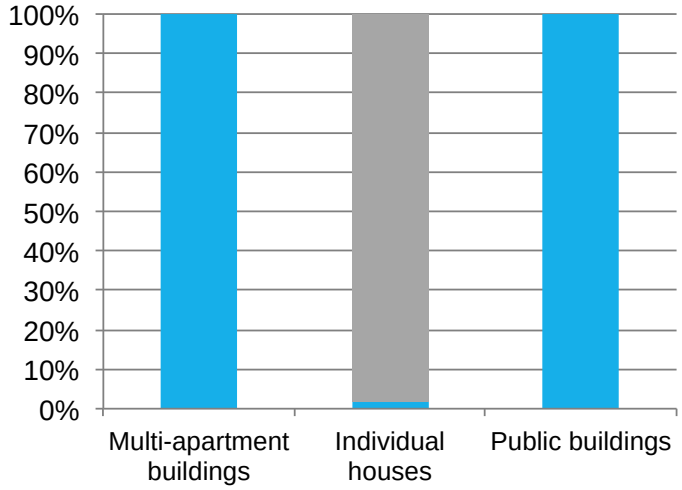


Primary heating source by building type, Bishkek



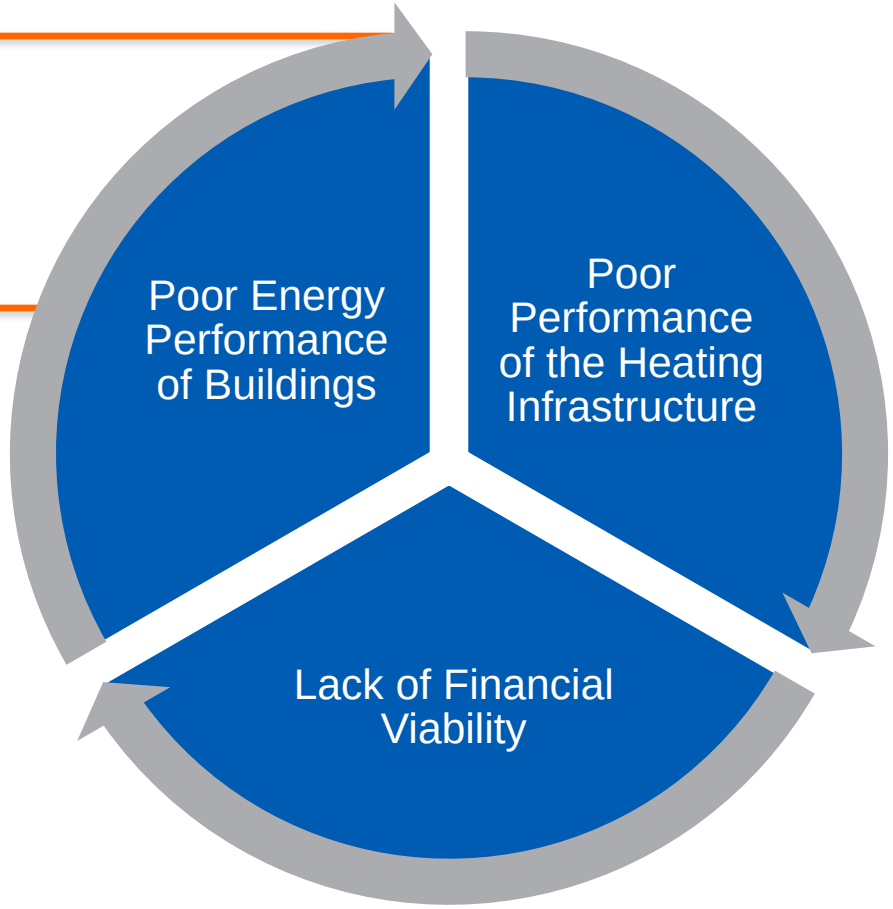
# buildings	2,399	89,014	1,005
% Res. area	56%	44%	

Primary heating source by building type, Tokmok



# buildings	234	7,058	41
% Res. area	46%	54%	

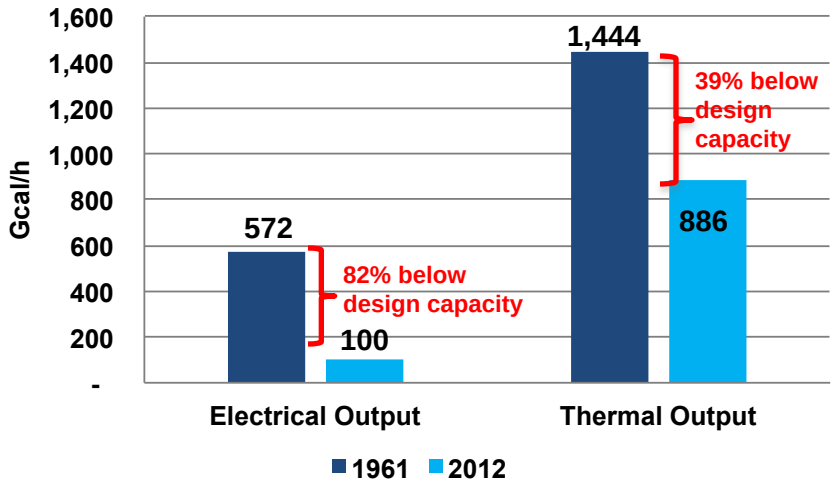
Key Challenges



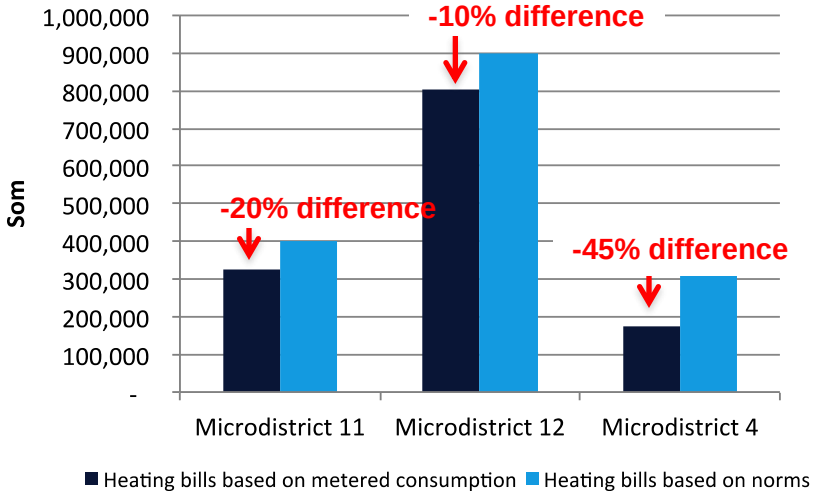
DH assets are in poor condition

- In Bishkek, generation assets and pumping stations were commissioned 20-50 years ago
- Around 70% of BTS's T&D network is more than 25 years old
- The thermal output of the CHP1 is 39% below its initial design capacity
- Technical losses exceed 25% of heat and 6% of hot water dispatched by the CHP
- Commercial losses amount to 7% for heat and 39% for hot water ('non-demanded heat')
- Norm-based billing inflates heating bills for customers (only 16% of public/residential buildings are metered)

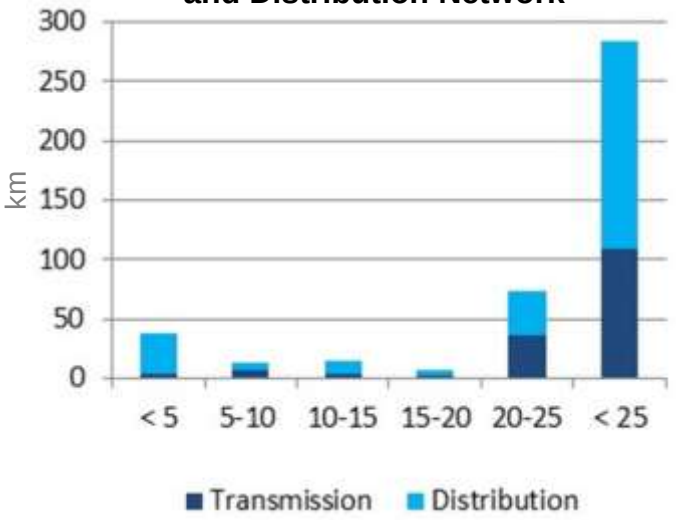
Generation Capacity of CHP1 (in Gcal/h), 1961 vs 2012



Comparison Heating Bills for 2 Heating Seasons (2012-2014)



Age of Bishkekteploset's (BTS) Transmission and Distribution Network



DH service quality is deteriorating and bottlenecks remain even after the modernization of the CHP1 plant

Pipeline breakages during the heating season have increased from 50 to 317 in 1990-2013 with serious repercussions for the population, businesses and public service delivery during the cold winter months

- Yet heating companies lack sufficient funds to replace old and dilapidated pipelines

There is a growing dissatisfaction by DH customers with low quality of heat supply (e.g. under-heating)

- Customers would be willing to pay on average 30% higher tariffs for energy services if the quality improves (Qualitative Assessment conducted by the World Bank)

The poor condition of the DH T&D network and the "open system" design may prevent the full utilization of the modernized CHP: because the open system design requires max. flow temperatures of 90-95ºC, it limits the T&D system's capacity to about 50%

- Operating the system at higher temperatures in a "closed" system would increase the amount of heat delivered to end-users, ensure safer operation and better service quality and reduce investment needs in pipes and pumps

Fuel switching and under-maintenance has reduced the efficiency of HOBs and increased losses

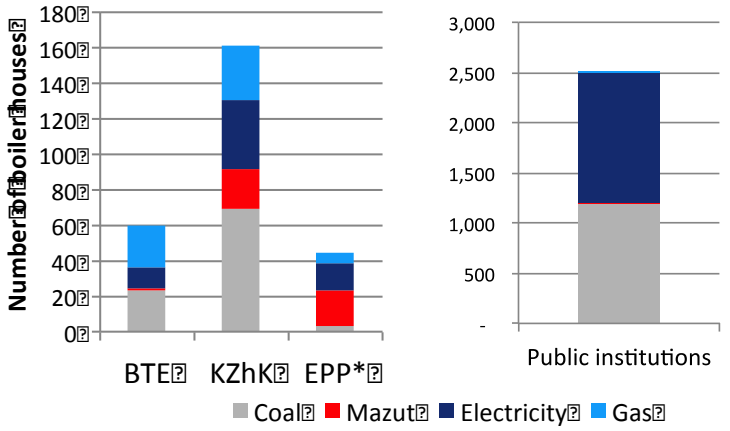
The decreased availability and affordability of gas over the past two decades has resulted in fuel switching for HOBs

- The proportion of coal- and electricity-fired HOBs has increased (46% and 48% of the boilers houses use coal and electricity, respectively), especially in small HOBs operated by public institutions
- Coal-fired HOBs have no modern flue-gas cleaning systems and are significantly more polluting than modern boilers
- Electricity-based HOBs add load to strained power networks

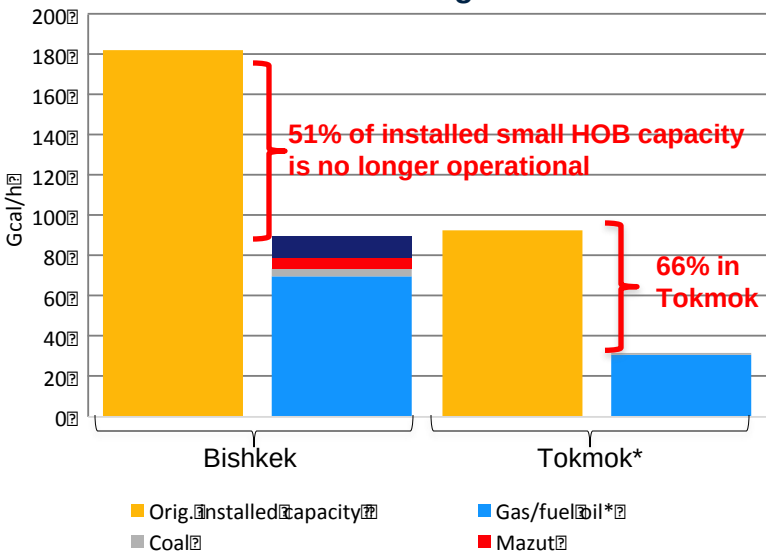
The majority of HOBs in Bishkek and Tokmok are in poor condition and under-maintained

- Most HOBs and related networks in Bishkek and Tokmok were built in 1960-1989
- The operational capacity of HOBs in the two cities is less than half of the original installed capacity
- The average efficiency of coal-fired boilers is 41% and 75% for gas-fired boilers - modern coal and gas boilers have efficiencies of 80% and 95%, respectively
- T&D losses in Tokmok are estimated at 35% because of the relatively small load served compared to the distance of the heat distribution networks

Large and small HOBs operated by energy companies and public institutions



Installed capacity vs operational capacity of small and large HOBs



* EPP only includes the boiler house in Kyzyl-Kiya, not CHPs in Osh and Bishkek; ** Operational capacity for Tokmok only includes KZhK SUE boilers

Decreasing DH/HOB service quality has increased reliance on inefficient individual heating solutions

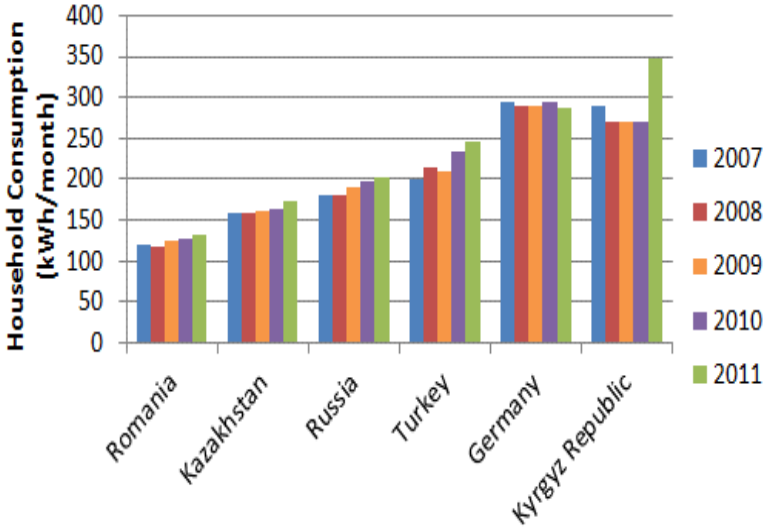
35% of urban households use electricity for heating purposes

- Electricity provides 34% and 26% of the heat demand in individual family homes in Bishkek and Tokmok, respectively
- Electricity is used both as primary heating source and to supplement DH
- Electric heating is the main driver for the high residential electricity consumption – accounting for 60% of total consumption
- Widespread use of electricity for heating contributes to winter power shortages

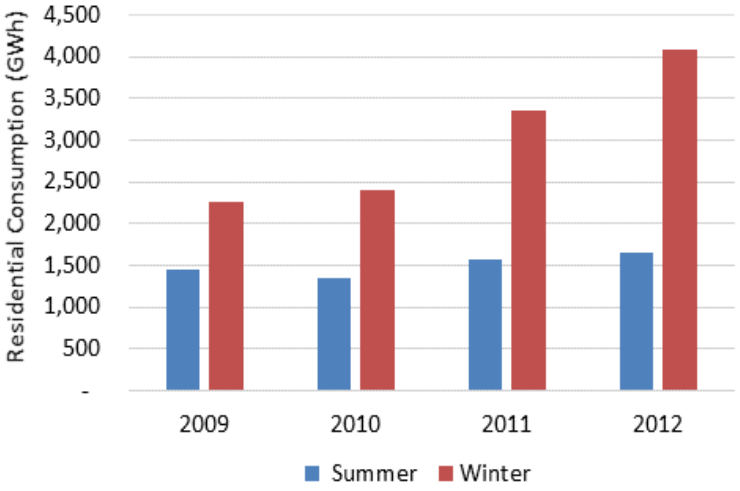
40% of urban households rely on low efficiency coal stoves/boilers

- The low efficiency of these devices results in 20-30% higher coal consumption compared to more efficient models
- Inefficient technologies accentuate the negative impact of coal (health and the environment)
- The share of households relying on coal-fired stoves is even higher in rural areas

Electricity Consumption per Household



Seasonal residential electricity consumption

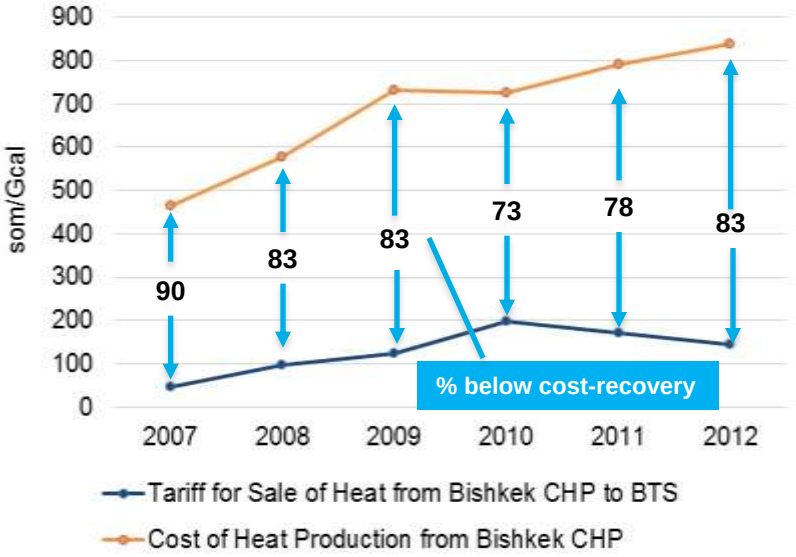


The poor financial health of heating sector companies contributes to the further decay of heating infrastructure

Heat and electricity tariffs are below cost recovery levels

- The end-user tariffs for heat from the Bishkek CHP was 75-90% below the cost of heat production in 2007-2012
- Tariffs cover only half the funds required to complete annual renovation and reconstruction on BTS' rapidly depreciating heat supply network
- The cash collected per kWh of electricity generated in the Kyrgyz Republic was 25-45% below the average cost of electricity generation in the country in 2008-2012

CHP-1 cost of heat production vs. wholesale tariff levels 2007-2012

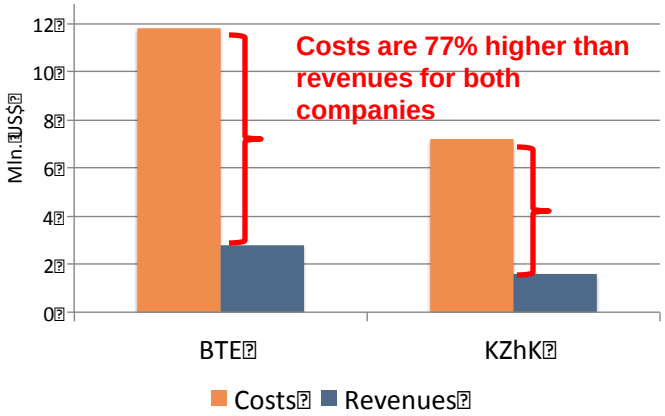


Source: Data received directly from EPP: "Tariff history on sale of heat energy of JSC" and "Performance indicators of TPS of Bishkek c. for 2007-2011 and 9 months of 2012," November 2012

Sector companies and assets are financially unsustainable

- Because tariffs are too low, heat and electric utilities operate at a loss and rely on government subsidies to cover operating costs
- However, government subsidies are insufficient to cover the total cost of necessary maintenance and new investments

BTE and KZhK costs and estimated revenues, 2012



Low tariffs are a poorly targeted end-user subsidy that also contribute to the inefficient use of energy

Challenge 2: Lack of Financial Viability

Energy poverty rates are lower than in many other ECA countries…

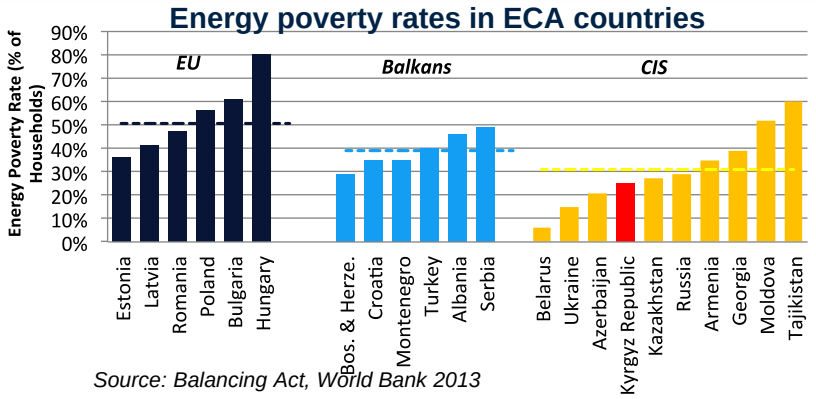
- Energy expenditures account on average for 6.5% of total household expenditures
- The relatively low energy poverty rate is partially attributable to low tariffs for heat and electricity

…but the implicit subsidies delivered through low tariffs are regressive and distortionary

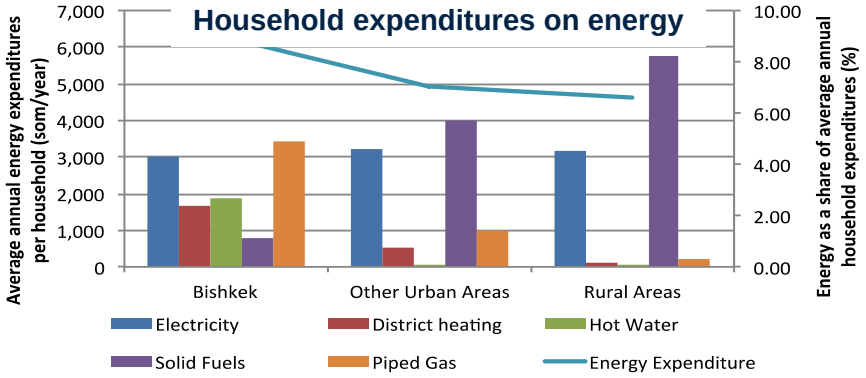
- The low DH tariffs predominantly benefit the upper 50% of consumers
- Low electricity and heating tariffs give consumers no financial incentive to invest in energy efficiency upgrades

Social safety nets are extensive but poorly targeted

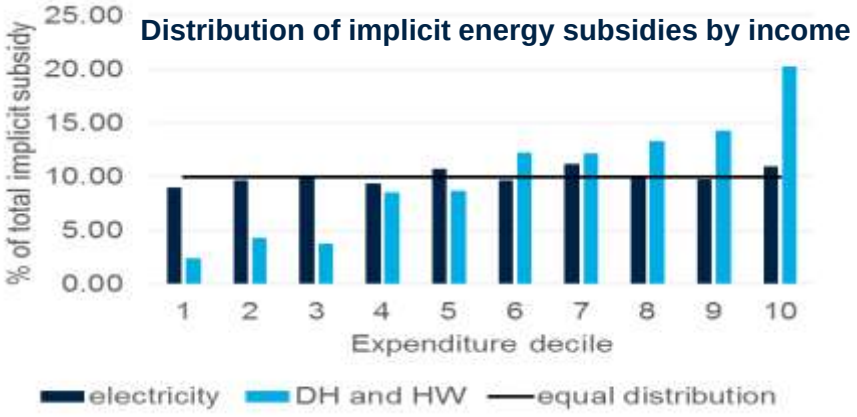
- Public spending for social transfers account for about 2% of GDP (2013)
- Only one of the social assistance programs - the Monthly Benefit for Poor Families with Children - explicitly targets the poor but coverage is low (<1/3 of the poorest 20% of the population and only about 8% of their total consumption is subsidized)
- Other programs are aimed at certain social categories (e.g. households with widows or disabled children)



Source: Balancing Act, World Bank 2013



Source: Kyrgyz National Statistics Committee, KIHS, 2012



Source: Poverty and Social Impact Assessment, 2014

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Heat losses in buildings are high and accentuate low comfort levels

Energy performance in residential and public buildings is poor

- The majority of buildings were constructed between 1960 and 1990
- Buildings are poorly insulated and maintained

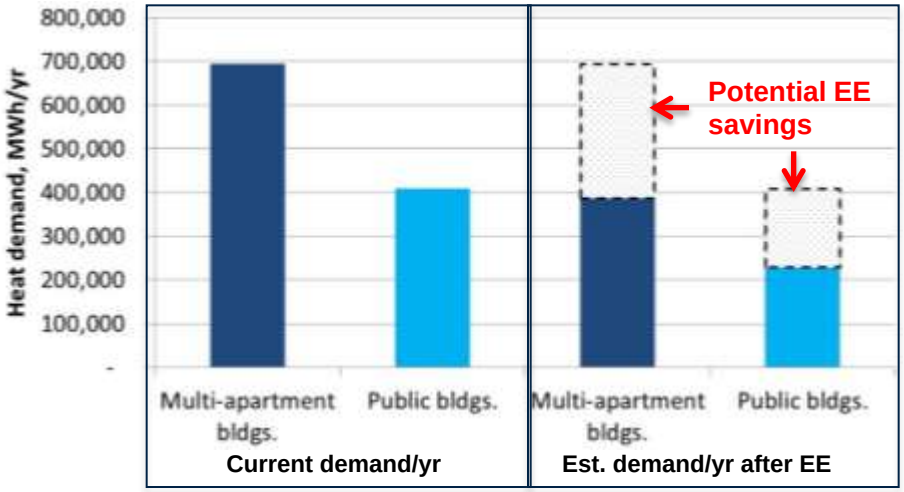
Heat in buildings losses could be reduced by 30-50%

- Through basic EE measures such as window replacement, insulation, heating system upgrades

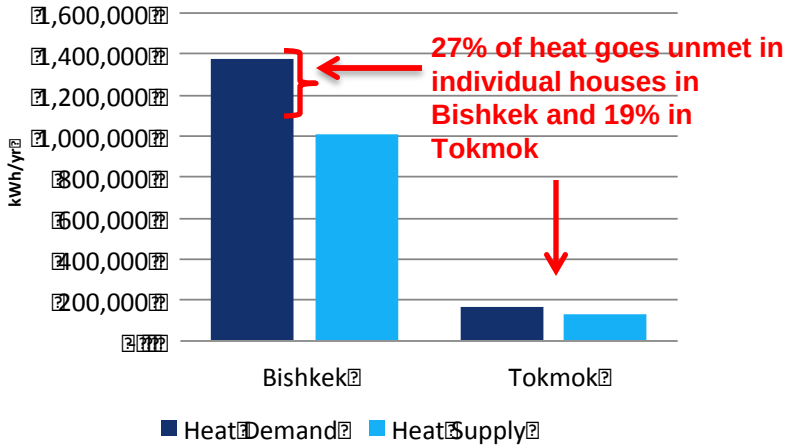
Individual houses account for more than half of the heat demand in Bishkek and Tokmok…

- ..but about 19% (Tokmok) and 27% (Bishkek) of the demand remains unmet due to the poor performance of buildings and heating infrastructure

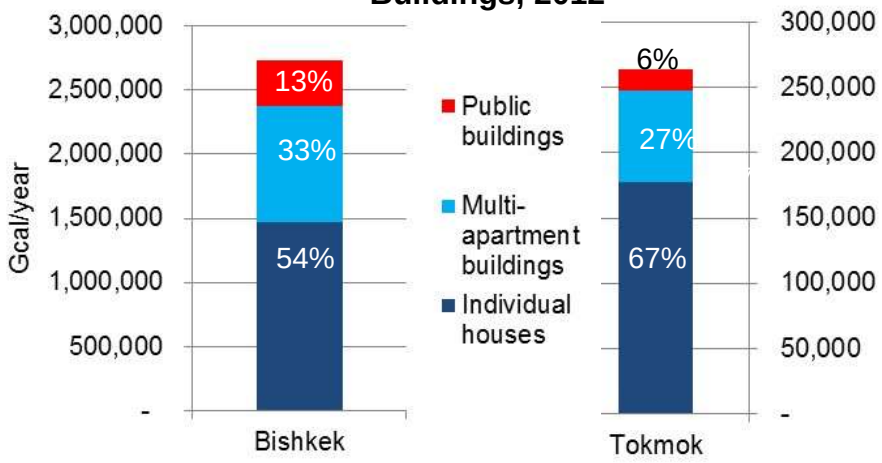
Potential demand reductions from EE investments in Bishkek and Tokmok



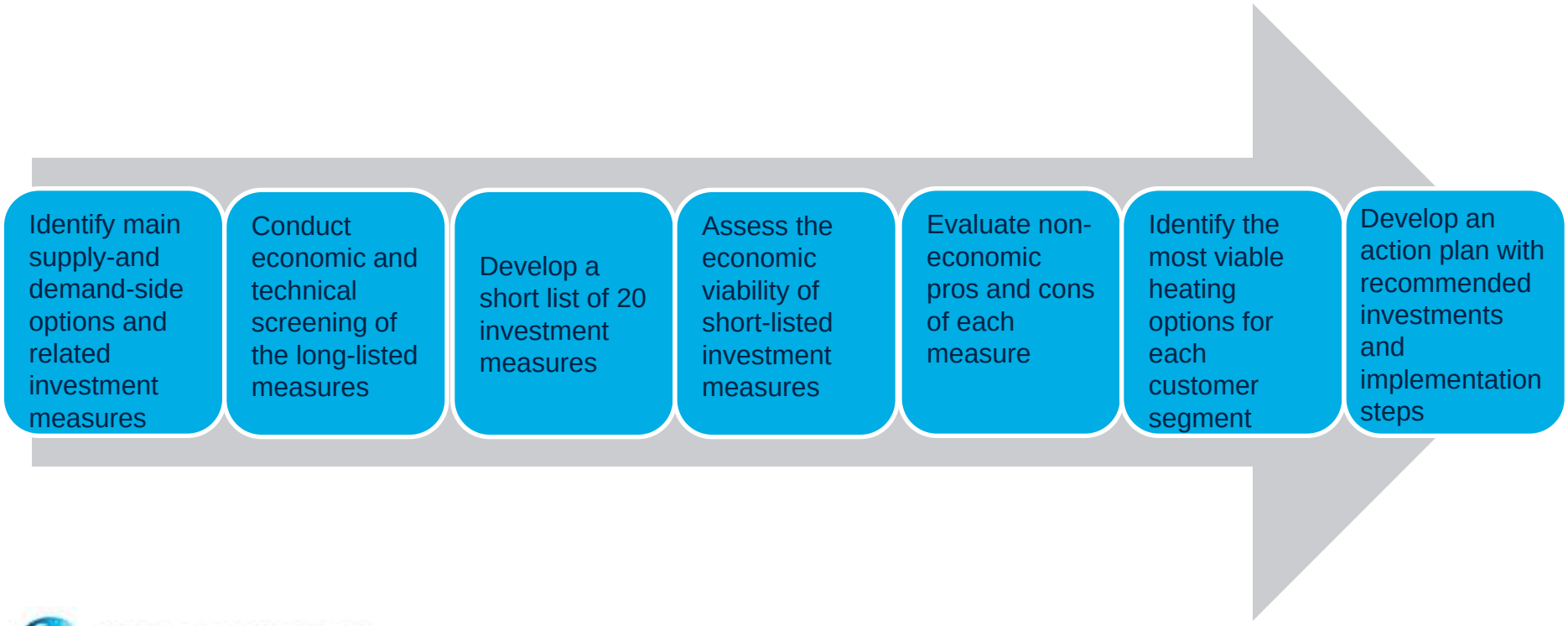
Estimated heat demand-supply in individual houses



Estimated Heat Demand Residential/ Public Buildings, 2012



Analysis and Recommendations



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The short list includes 20 measures that were economically/technically most viable and not associated with high social/environmental costs

Generation	Transmission/Distribution	End-Use
Option: DH (CHP and large HOBs)		
• Rehabilitation of CHPs • Rehabilitation of large HOBs • Construction of new large HOBs • Installation of heat meters at the outlet of heat generation units • **Solar heat production for DH**	• Replacement of transmission pipelines • **Replacement of distribution pipelines** • **Re-insulation of over-ground distribution pipelines** • Construction of new transmission and distribution pipelines • **Installation of variable speed drive pumps** • Insulation of valves and related pipeline equipment • Processing of feed-water and circulating water in the DH system	• **Installation of automatic individual substations** • **Installation of temperature and hydraulic regulation of premises service connections** • **Installation of building-level heat and DHW metering** • Hydraulic balancing of heat flow in buildings • **Rehabilitation of building-internal distribution network** • **Installation of thermostatic valves on radiators in dwellings** • **Implementation of consumption-based billing**
Option: Autonomous Heating (small HOBs)		
• **Construction of new and replacement of existing small HOBs**	n/a	• **Rehabilitation of building-internal distribution network** • **Installation of thermostatic valves on radiators in dwellings** • **Implementation of consumption-based billing**
Options: Individual heating systems (various options)		
• **Installation of efficient individual coal-fired heat boilers** • **Installation of individual gas boilers** • **Installation of individual efficient coal-fired heat stoves** • **Installation of individual gas heaters** • **Installation of heat pump systems** • Installation of solar water heaters • Installation of electric oil radiators	n/a	n/a
Option: Energy Efficiency		
n/a	n/a	• **Replacement of windows** • **Insulation of attic** • **Insulation of external walls** • **Insulation of cellar ceiling**

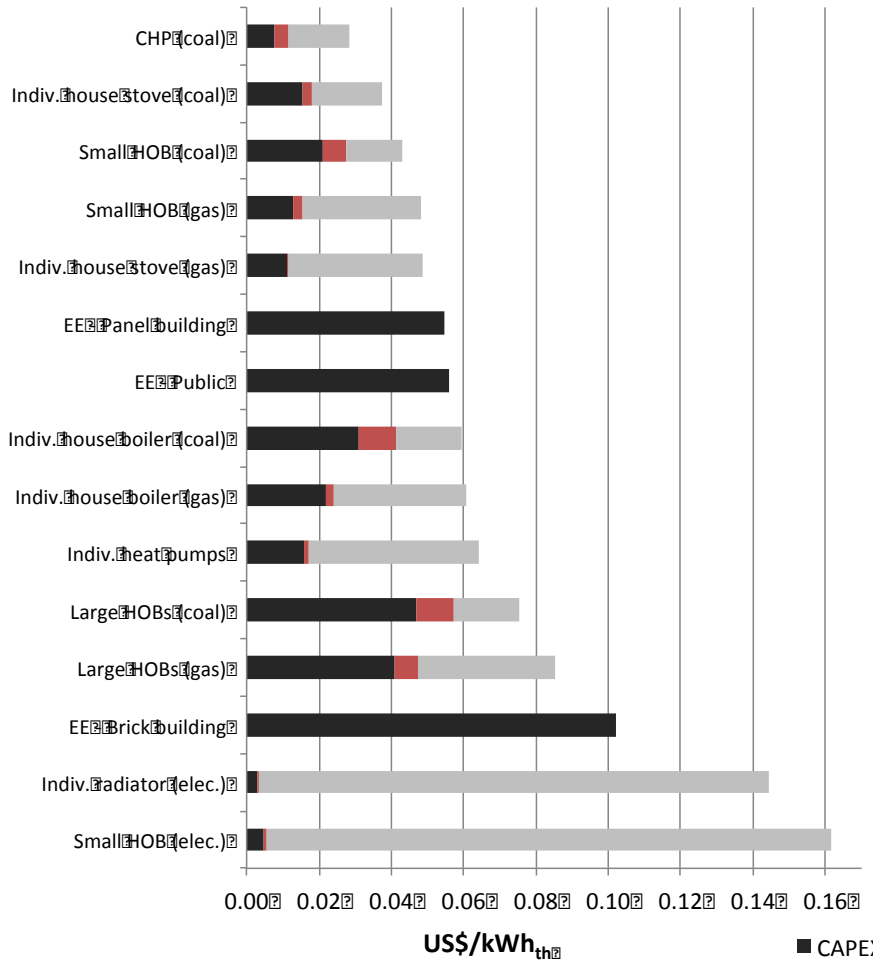
Measures highlighted in orange were short-listed based on the initial economic, technical, social and environmental screening

The economically most viable heating options are

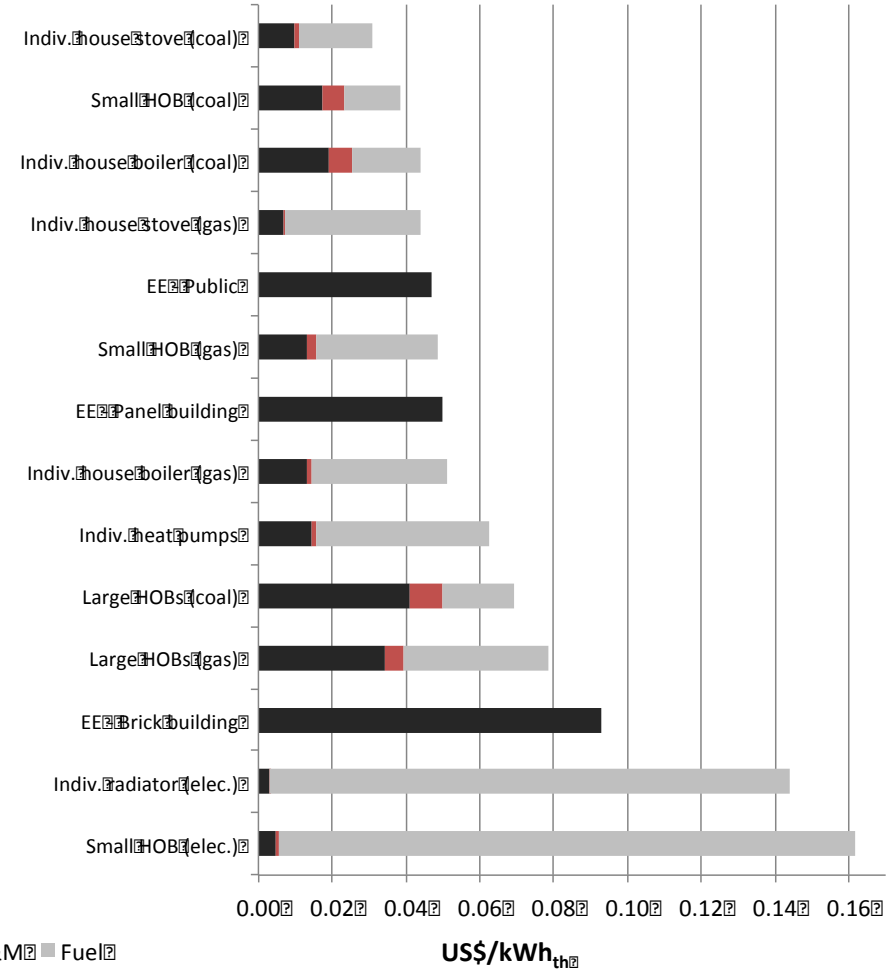
DH (CHP), individual heating solutions and small HOBs in Bishkek

Small HOBs, individual heating solutions and energy efficiency in Tokmok

Results of the levelized cost assessment for Bishkek



Results of the levelized cost assessment for Tokmok



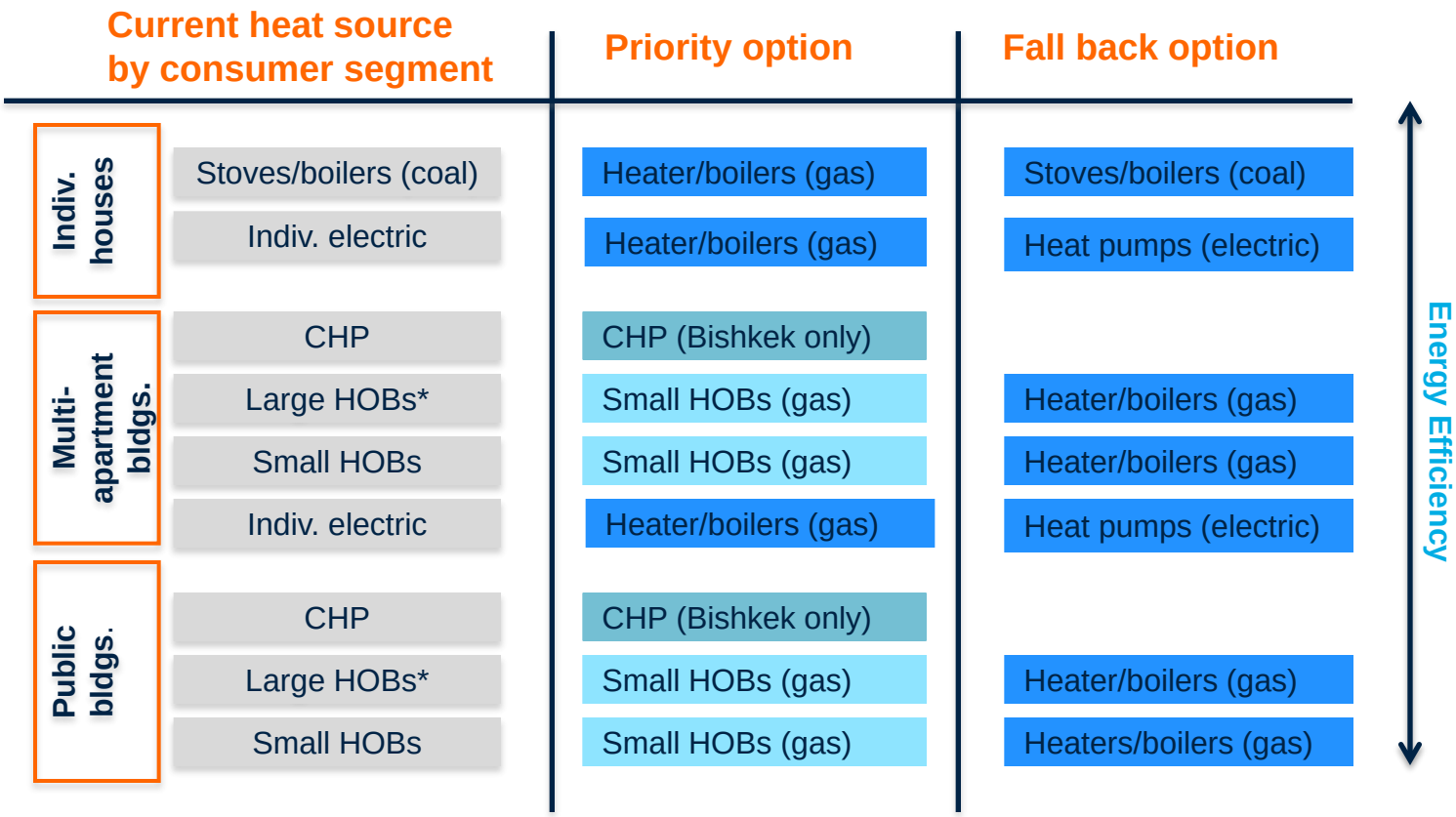
Assumptions for the levelized cost assessment

- **CHP costs:** excludes plant CAPEX (sunk cost); includes replacement of T&D pipelines older than 20 years, re-insulation of 50% of the over-ground pipelines, installation of VSD at pumping stations (baseload pumps) and installation of building-level substations in all multi-apartment and public buildings
- **Large HOB costs:** includes boiler replacement and the same investment measures as for CHP
- **Fuel price: Coal:** US$52.41/t for CHP; US$57.6/t for large HOBs; US$61.23/t for small HOBs; **Gas:** US$330/thousand m^3 ; **Electricity:** US$0.14/kWh

… but heating solutions need to take into account non-economic criteria and be customized for different consumer segments

A 'multi-criteria assessment of economic and non-economic benefits related to each heating option was used to select priority and fallback recommendations for each customer segment

- Assessment criteria included technical, institutional, environmental, health, social and economic advantages and disadvantages
- Heating options were customized to different consumer segments, taking into account their current primary heat supply infrastructure, while avoiding the switch to inferior heating solutions in terms of health and environmental impacts (e.g. switching from electricity to coal)



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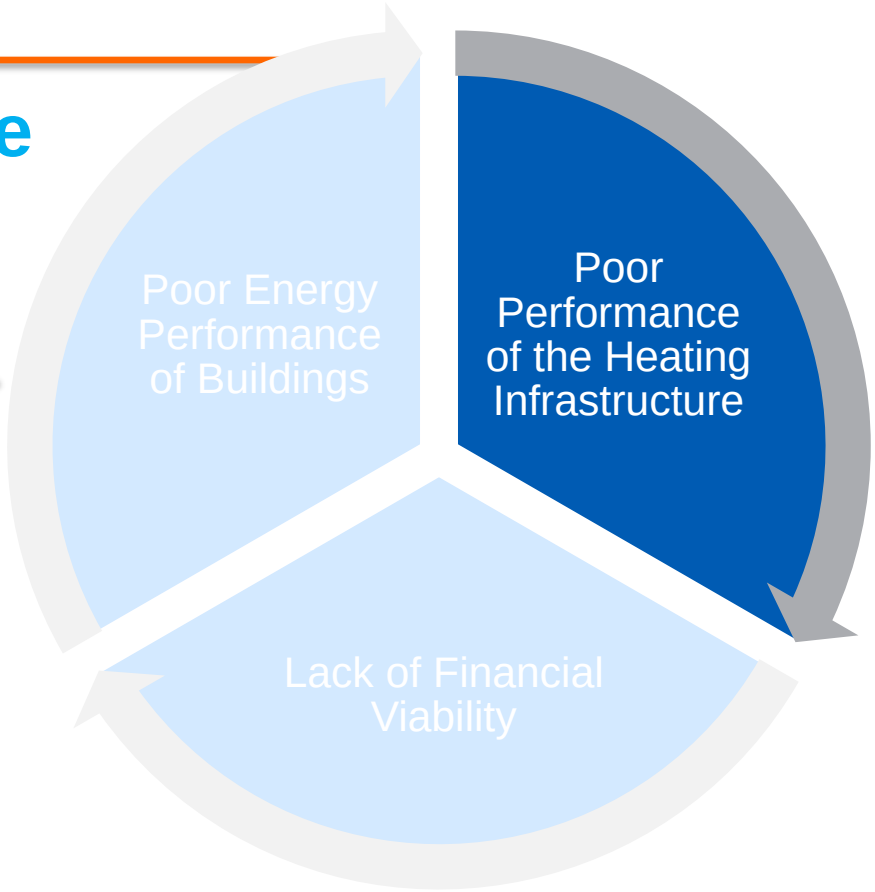
* Priority and fallback options for large HOBs would need to be determined based on the results of feasibility study and depending on the specific operational condition of each boiler house

Improving the performance of the heating infrastructure

through:

1. Enhancing the reliability and efficiency of the DH system
2. Implementing a program targeting the use of efficient individual heating solutions
3. Replacing and/or constructing small HOBs
4. Assessing the viability of large HOBs



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Investing in the DH network will be critical to improve service quality, reduce losses and harness the benefits of the CHP modernization

Potential scope: DH networks operated by BTS, BTE, Tokmok KZhK and Zhululuk servicing more than 140,000 residential and public customers

Recommendation: Implement package of priority reliability and efficiency investments, focusing in a first step on the network operated by BTS to complement ongoing modernization of the CHP1 and ensure sustainability of (ongoing and future) investments

Efficient building-level flow control and metering	Replacement/re-insulation of priority T&D pipelines	Variable speed drives at pumping stations
▪ Modern substations with heat exchangers in all multi-apartment and public buildings ▪ Building-level heat meters and apartment-level hot water meters ▪ Consumption-based billing for all multi-apartment and public buildings	▪ Replace priority T&D with pre-insulated and accurately dimensioned pipes ▪ Re-insulated over-ground pipelines	▪ Replace old pumps with modern, efficient variable speed drives pumps ▪ Modern SCADA system for controlling and monitoring DH system
Benefits:		
▪ Increase heat delivery and service quality for end-consumers ▪ Improve water quality, safer operation, less corrosion ▪ Enable customers to control energy use and bills ▪ Create incentives for EE	▪ Reduce service interruptions and improve reliability ▪ Reduce network losses	▪ Reduce electricity consumption by pumping stations and improve flow control

Technical losses in BTS' network could be reduced by about **72%**

Total energy savings potential of up to **576,000 MWh** energy savings in Bishkek and **55,000 MWh** in Tokmok

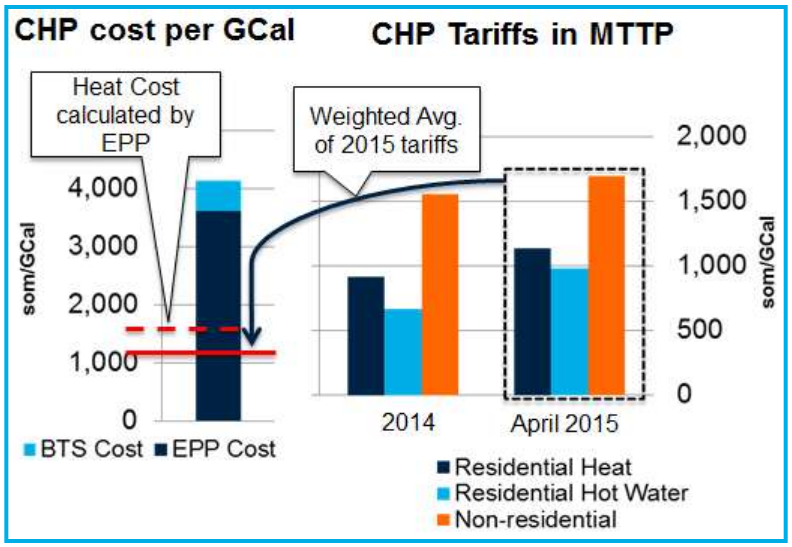
Mobilizing sufficient financing will remain challenging despite the strong business case for efficiency improvements

Implementation issues

- Poor financial condition of heating companies
- Tariff increases enacted, but remain well below cost recovery

Attracting commercial financing will be challenging for DH companies and will put additional pressure on tariffs

Need to demonstrate that tariff increases result in improved service quality



- Mobilize different sources of (concessional) financing
- Tariff reforms

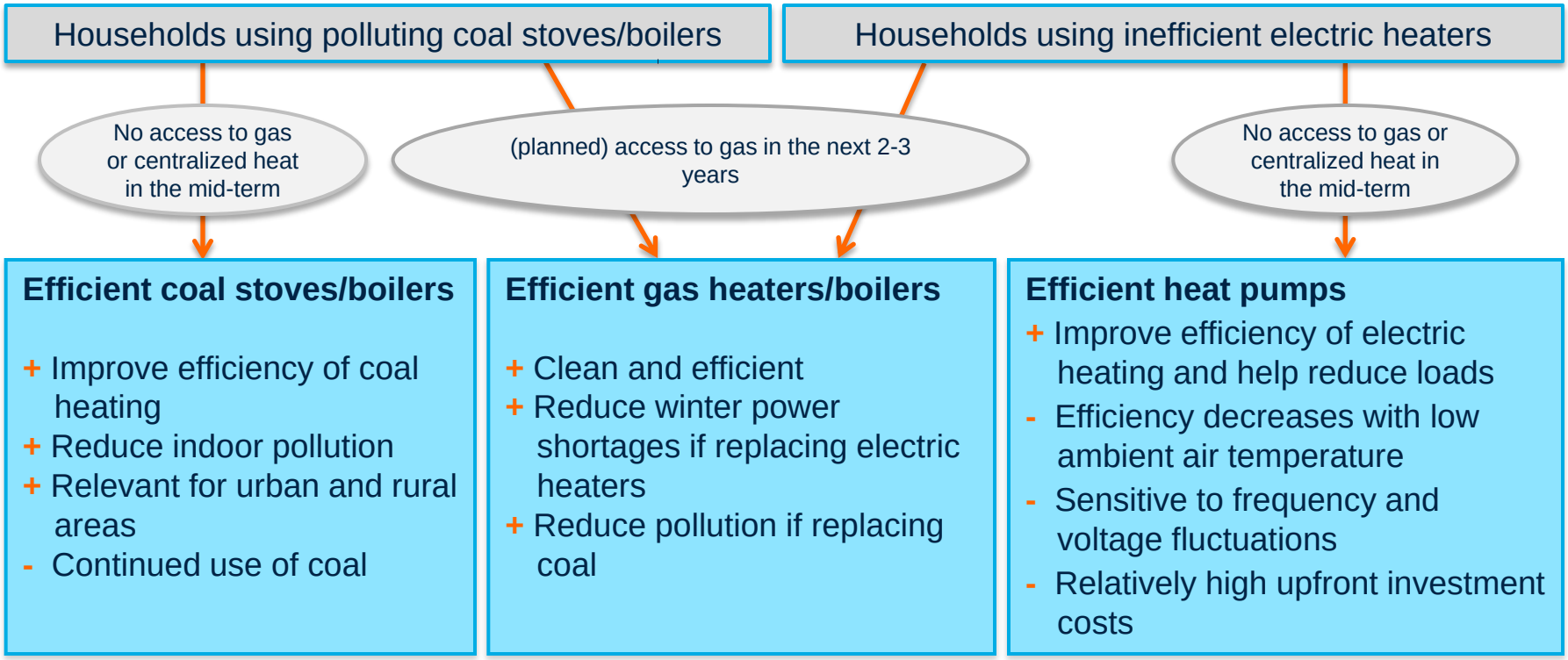
- Develop a prioritized investment and implementation plan to improve service quality of DH companies and ensure technical sustainability of investments
- Introduce regulatory changes to monitor performance of heating companies
- Extensive information and public outreach campaigns to inform customer about benefits of planned improvements

World Bank Technical Assistance: The Bank initiated a new ESMAP and CAWEDP supported technical assistance activity to develop an investment and implementation plan for BTS to identify priority investment measures targeting reliability and efficiency improvements of the DH network and to complement the ongoing modernization of the CHP1.

Switching to efficient individual heating solutions can generate energy savings, reduce pollution and improve comfort levels

Potential scope: Residential customers relying on polluting small coal stoves/boilers and inefficient electric radiators as their primary heating sources (including 95,000 households in Bishkek and Tokmok)

Recommendation: Implementation of a scalable program to replace inefficient individual heating solutions with more efficient technologies



Benefits:

- Reduce fuel consumption (up to 35% for coal)
- Increase comfort levels and decrease pollution

Individual heating programs are institutionally complex and require careful design of financing and delivery mechanisms

Implementation Issues

Lack of efficient models on the market

Strengthening the supply chain for efficient heating equipment

- Adopting technical, environmental and safety performance standards for equipment; setting eligibility criteria for products and suppliers
- Establishing mechanisms for quality verification and enforcement to ensure adequate performance of equipment
- Organizing efficient return and disposal systems for old equipment
- Capacity building and technical assistance for local producers

Lack of incentives to switch to more efficient models

Enhancing demand through dedicated financing and incentive mechanisms

- Defining eligibility criteria for households to ensure targeted replacements and incentive schemes
- Demand-side management programs
- Micro-credit lines
- Results-based financing mechanisms
- Climate finance instruments (e.g. GEF, financing for 'Intended Nationally Determined Contributions')
- Implementing public outreach campaigns

Examples: Clean Stove Initiative in Mongolia and Efficient Gas Stove Program in Armenia

The clean stove program in Mongolia supported deployment of 98,000 low-emission stoves in Ulaanbaatar in 2011-2012 by offering micro-loans to low income households and providing targeted subsidies after installation of the stoves. In Armenia, more than 8,000 low income households in urban areas were supported to get connected to gas service and/or receive an individual gas heater, installed by the gas company and based on an output-based financing scheme.

Small gas-fired HOBs are a cost-effective solution to help improving efficiency, reducing pollution and mitigating winter power shortages

Potential scope: All public buildings without access to DH, multi-apartment buildings served by large or small HOBs (i.e. with a building-internal system) and new buildings constructed in the future without access to DH

Recommendation:

- Gradual replacement of dilapidated small HOBs (incl. 48 small HOBs operated by BTE and 136 public/private owned HOBs in Bishkek)
  - → Efficient gas-fired small HOBs
  - → Extension of the DH network supplied by CHP, if viable
- Construction of new small HOBs
  - → New public and multi-apartment buildings constructed in the future
  - → To be considered for buildings served by large HOBs in need of extensive repair or buildings located at the outskirts of the service area supplied by large HOBs (especially for Tokmok)

Benefits

- Can generate **20-50% fuel savings** compared to old and inefficient models
- Reduce pollution in urban areas
- Help mitigating winter power shortages (e.g. more than 1,000 electricity-based small HOBs owned by public institutions)

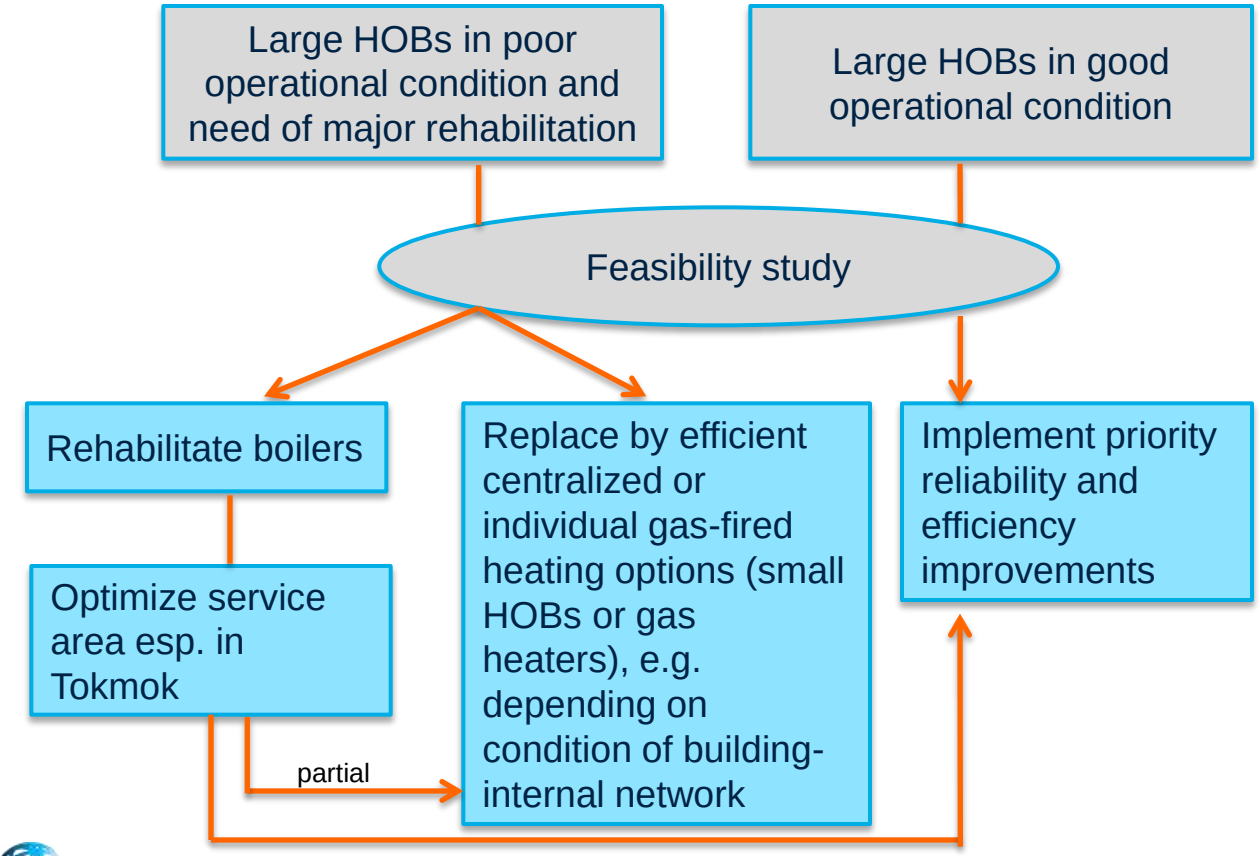
Implementation Issues

- Requires increase in access to gas
- Poor condition of building-internal heating infrastructure needs to be taken into account
- Collective decision-making process in multi-apartment buildings
- Challenge of securing sufficient financing

The future of large HOBs should be determined based on the results and findings of detailed feasibility studies

Potential scope: 9 large HOBs in Bishkek supplying around 580 public and residential buildings and 3 large HOBs in Tokmok servicing about 415 buildings

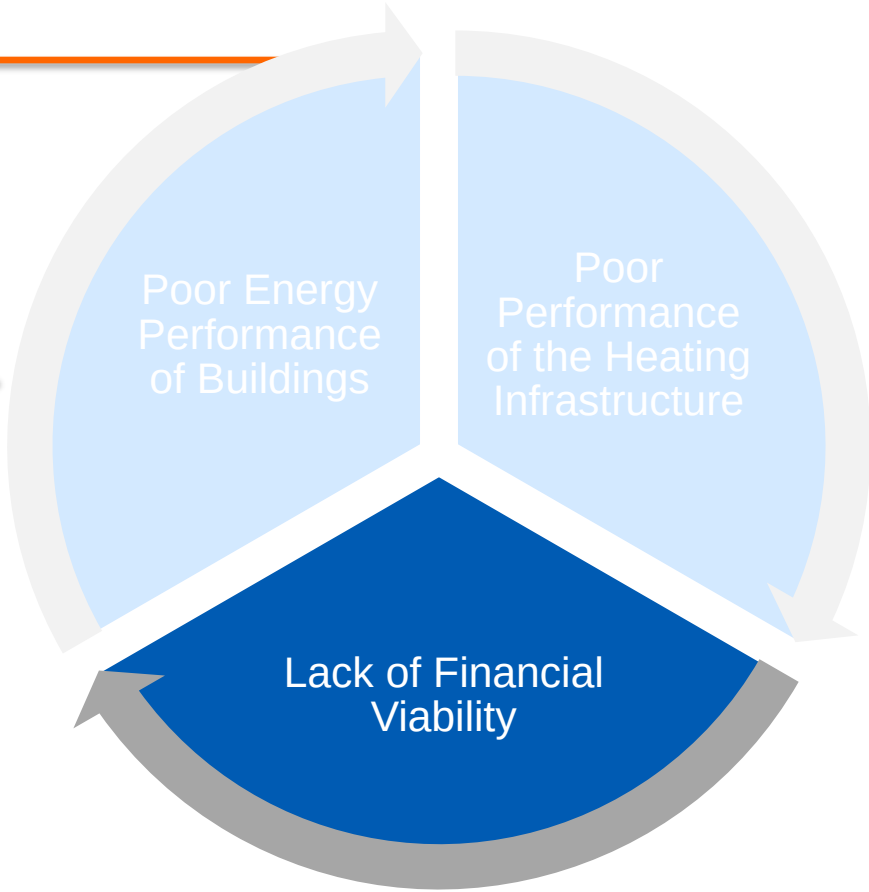
Recommendation: Conduct a feasibility study to determine whether it is economically and technically preferable to continue operating large HOBs or replace them with efficient centralized or individual gas-fired heating options



Improving the Financial Viability of the Heating Sector

through:

5. Implementation of Tariff Reforms



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Tariff and social assistance reforms are important to improve the sector financial viability and to incentivize end-user energy efficiency

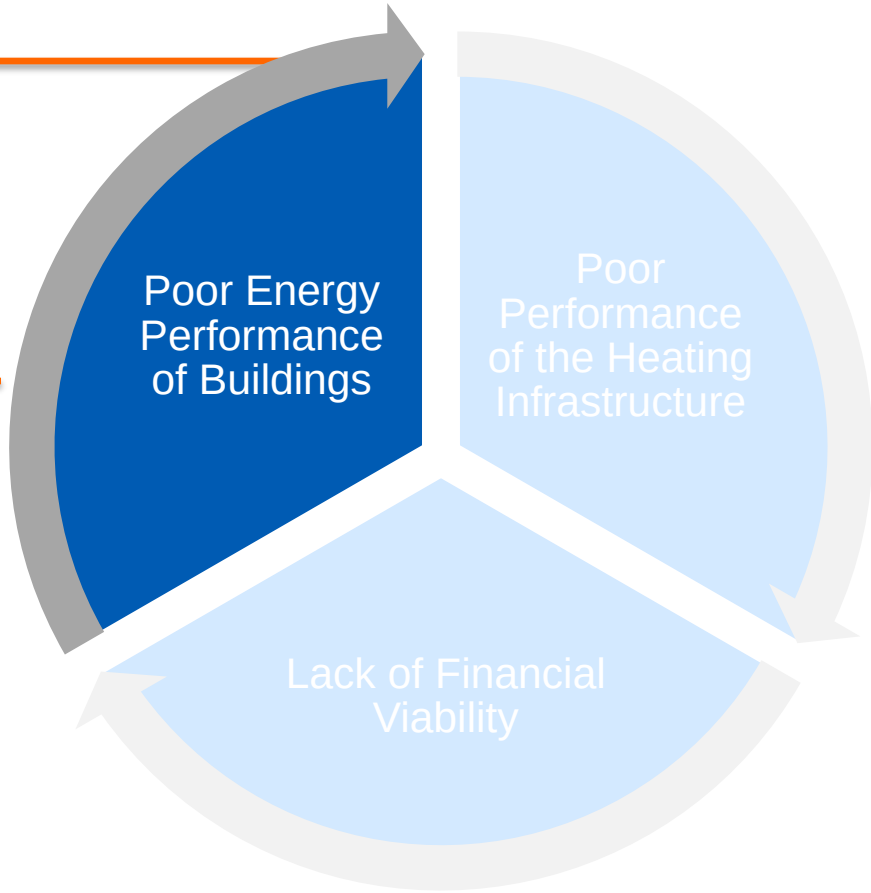
Recommendations	Benefits
Consistent implementation of electricity and heat tariff revisions in line with the approved MTTP	▪ Increase funding for heating companies to invest in supply-side improvements and enhance service quality over time ▪ Predictability of heating costs for end-user
Adoption of a clear and transparent tariff-setting methodology for heating sector companies and non-residential consumers	▪ Improved transparency of revenue allocation between heating companies ▪ Predictability of revenues for heating companies ▪ Simplification of tariff setting for non-residential consumers and reduction of regulatory burden
Transition to consumption-based billing (short-term: building-level for heat and apartment-level for hot water)	▪ Enables consumers to control consumption and adjust it according to affordability limits and desired comfort levels ▪ Can generated savings of up to 25-30% of the heat consumed ▪ Increase pressure on heating companies to improve service quality and reduce losses
Consolidation of social assistance system by topping-up programs targeting the poor and promoting energy efficiency, while phasing-out non-targeted programs	▪ Ensure that a basic level of heat consumption remains affordable to the poor ▪ Protecting the poor without increasing fiscal costs ▪ Mitigating the impact of tariff increases on the poor by reducing their heat losses

Note: it is critical that electricity tariff reform is pursued in parallel with heat tariff reform in order to prevent fuel switching from central heating to electricity

Improving the Energy Efficiency of Buildings

through:

6. Implementing a national Energy Efficiency Program



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Energy efficiency in buildings can generate energy (cost) savings, improve comfort levels and mitigate impact of tariff increases

Potential Scope: Public and/or residential buildings (in urban areas, there are 224,410 multi-apartment building, 320,800 individual houses and about 2,000 public buildings).

Recommendation: Implement an energy efficiency (EE) program targeting either public or residential buildings supported by scalable financing and implementation schemes

Benefits:

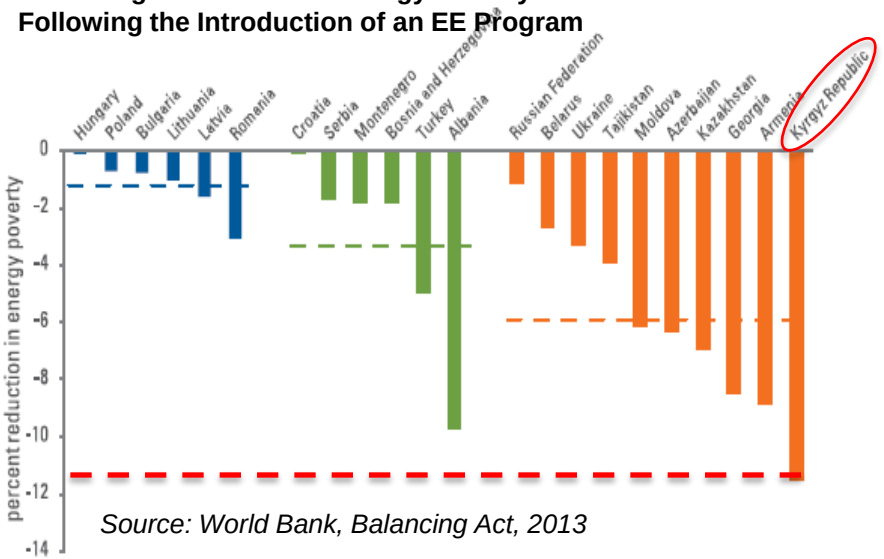
Substantial energy savings

- **30-50% energy savings** achievable through basic EE improvements
  → 480,000 MWh (Bishkek and Tokmok)
- EE can help to economically reduce heat/electricity supply bottlenecks
  → Growing energy intensity has driven the increase in residential consumption: number of residential customer increased by 5% in 2007-2011, but consumption grew by 26%

Social and environmental benefits

- Reduce energy cost expenditures for households and public institution
  → help mitigating impacts of tariff increases for households and free public resources for other development needs
- Improve comfort levels in buildings by reducing losses and reduce local/global air pollution

Percentage Reduction in Energy Poverty for Poor Households Following the Introduction of an EE Program



Source: World Bank, Balancing Act, 2013

The use of targeted financing and implementation mechanism can help to incentivize and scale-up energy efficiency investments

Implementation issues: There are a number of technical, institutional, financial, regulatory and policy barriers in the Kyrgyz Republic impeding energy efficiency

- Low financial viability and lack of incentives
- Lack of access to affordable financing
- Split incentives/ weak homeowner associations
- Low technical capacity

1. Need for a targeted financing and implementation schemes
- Select a target segment (public or residential)
- Design simple financing schemes reflecting market maturity, including incentives and phasing-in of more sustainable models

2. Continue implementing pricing and billing reforms
- Transition to cost-reflective heat and electricity prices
- Implement metering and consumption-based billing to enable energy cost savings

3. Conduct capacity building and public outreach campaigns
- Training and capacity building activities (e.g. energy auditors, construction companies, equipment suppliers, commercial banks, municipalities, etc.)
- Awareness raising and public outreach campaigns

4. Develop policy/program enhancements
- Strengthening of homeowner associations/ professional management companies
- Adopt and enforce standards for appliances/equipment, construction materials, buildings, etc.

Financing Ladder for Energy Efficiency

* Also used to finance residential energy efficiency

The investments required to improve the heating sectors in Bishkek and Tokmok are substantial

Recommended measures	Investment cost (US$)	
	Short-term	Medium/long-term
DH reliability and efficiency measures		
Install building-level substations	73,679,500	18,331,500
Metering, temperature regulation, consumption-based billing	4,576,000	70,907,504
Replacement and reinsulation of network pipelines	65,900,000	105,609,000
Variable speed drive pumps	504,000	494,080
Program for efficient individual heating systems		
Efficient small coal stoves and boilers	23,049,753	92,199,013
Gas-fired stoves and boilers	8,133,994	32,535,976
Efficient heat pumps	9,088,776	36,355,105
Replacement of all small HOBs with gas-fired small HOBs	29,507,903	-
Replacement of large HOBs with gas-fired large HOBs	-	18,422,466
Energy efficiency program		
Residential buildings	-	209,881,679
Public buildings	95,694,128	-
TOTAL	**310,134,054**	**584,736,323**

Roadmap

Roadmap for the heating sector

- **Implement tariff policy and regulatory reforms** (performance reporting and monitoring framework, updating of efficiency standards for equipment, etc.)
- **Capacity building activities and public outreach**

Short-term (next 24 month)	Mid-term
Expansion of the natural gas infrastructure ▪ Adopt a time-bound gasification plan and oversee upgrading of related natural gas infrastructure	▪ Complete upgrading of infrastructure with potential increase in coverage
Reliability and efficiency improvements of the DH network ▪ Adopt detailed investment and implementation plan for the DH network supplied by CHP1, mobilize funding and start implementation of the investment plan	▪ Complete implementation of priority investments for the DH network supplied by CHP1 ▪ Develop and adopt detailed investment and implementation plans for BTE and KZhk
Program for efficient individual heating solutions ▪ Develop a scalable program to replace polluting and inefficient individual heating solutions by efficient models ▪ Mobilize funding and implement pilot phase along with public outreach campaigns	▪ Implement full-scale program for small efficient heating technologies in urban and rural areas
Construction and replacement of small HOBs ▪ Develop and adopt prioritized investment and implementation plan for gradual replacement/construction of small HOBs ▪ Mobilize funding and start implementation based on identified priorities	▪ Complete replacement/ rehabilitation of small HOBs
Rehabilitation or replacement of large HOBs ▪ Conduct detailed feasibility studies for all large HOBs to determine most viable options, adopt investment and implementation plan	▪ Mobilize funding and start decommissioning or rehabilitating large HOBs
Implement energy efficiency program in buildings ▪ Develop a scalable energy efficiency program, mobilize funding and start implementation in selected target segment (residential or public buildings)	▪ Continue and scale-up implementation