

Document of
The World Bank

Report No:

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US\$332 MILLION

AND A PROPOSED CLEAN TECHNOLOGY FUND LOAN
IN THE AMOUNT OF US\$50.00 MILLION

TO

UKRAINE

FOR A

DISTRICT HEATING ENERGY EFFICIENCY PROJECT

December 10, 2013

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CURRENCY EQUIVALENTS

(Exchange Rate Effective October 1, 2013)

Currency Unit = 1 UAH
8.18 UAH = US\$ 1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

CHP	combined heat and power plant	IHS	Individual (building-level) heat substation
CHS	central heat substation	IMF	International Monetary Fund
CO ₂	carbon dioxide	ISA	International Standards on Auditing
CPMU	Central Project Management Unit	ISP	Implementation Support Plan
CPS	Country Partnership Strategy	Minregion	Ministry of Regional Development, Construction, Housing and Communal Services
CSO	civil society organization	NERC	National Electricity Regulator Commission
CTF	Clean Technology Fund	O&M	operation and maintenance
DA	Designated Account	ORAF	Operational Risk Assessment Framework
DH	district heating	PDO	project development objective
DHEE	District Heating Energy Efficiency	PIU	Project Implementation Unit
DHW	domestic hot water	PLESA	Program-Level Environmental and Social Assessment
EA	environmental assessment	POM	Project Operation Manual
EBRD	European Bank for Reconstruction Development	PPP	purchasing power parity
EC	European Community	RPF	Resettlement Policy Framework
EIB	European Investment Bank	SCADA	supervisory control and data acquisition
EIRR	economic internal rate of return	SIDA	Swedish International Development Cooperation Agency
EMP	environmental management plan	SIL	Specific Investment Loan
ENPV	economic net present value	tcm	thousand cubic meters
EU	European Union	TORs	terms of reference
FM	financial management	UAH	Ukrainian Hryvnia
FIRR	financial internal rate of return	UIP	Urban Infrastructure Project
GDP	gross domestic product	USAID	United States Agency for International Development
GHG	greenhouse gas	Utilities Regulator	National Commission for Regulation of Communal Services
GoU	Government of Ukraine	VSL	Variable Spread Loan
IFI	international financial institution	WACC	weighted average cost of capital
IFR	Interim Financial Report		

Regional Vice President:	Laura Tuck
Country Director:	Qimiao Fan
Sector Director:	Laszlo Lovei
Sector Manager:	Ranjit Lamech
Task Team Leader:	Yadviga Semikolenova

UKRAINE
District Heating Energy Efficiency Project

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PAD DATA SHEET
Ukraine
 District Heating Energy Efficiency
PROJECT APPRAISAL DOCUMENT

Europe and Central Asia

ECSEG

Basic Information			
Date: March XX, 2014 Country Director: Qimiao Fan Sector Manager/Director: Ranjit Lamech / Laszlo Lovei Project ID: P132741 Lending Instrument: SIL Team Leader: Yadviga Semikolenova	Sectors: Energy Efficiency in Heat and Power (100%) Themes: City-wide Infrastructure and Service Delivery (80%) Climate change (20%) EA Category: B		
Joint IFC:			
Borrower: Ukraine			
Responsible Agency: Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine			
Contact: Grygory Semchuk	Title: First Deputy Minister	Telephone No.: +380442840509	Email: stanislav.terletskyi@gmail.com
Project Implementation Period: Start Date: July 1, 2014 End Date: December 31, 2019			
Expected Effectiveness Date: June 30, 2014			
Expected Closing Date: June 30, 2020			
Project Financing Data(US\$M)			
<input checked="" type="checkbox"/> Loan	<input type="checkbox"/> Grant	<input type="checkbox"/> Other	
<input type="checkbox"/> Credit	<input type="checkbox"/> Guarantee		
For Loans/Credits/Others			
Total Project Cost :	382	Total Bank Financing :	332
Total Cofinancing :	50	Financing Gap :	
Financing Source	Amount(US\$M)		
BORROWER/RECIPIENT			
IBRD	332		
IDA: New			
IDA: Recommitted			
Others (CTF)	50		
Financing Gap			
Total	382		

Expected Disbursements (in USD Million)									
Fiscal Year	2015	2016	2017	2018	2019	2020	2021		
Annual	15	40	80	80	80	75	12		
Cumulative	15	55	135	215	295	370	382		

Project Development Objective(s)

The project development objective is to improve the energy efficiency and quality of service of selected Ukrainian district heating utilities and decrease their CO₂ emissions.

Components

Component Name	Cost (USD Millions)
Component 1: Energy Efficiency Investments	376.5
Component 2: Technical Assistance and Capacity Building	5.5

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes []	No [X]
Does the project require any waivers of Bank policies?	Yes []	No [X]
Have these been approved by Bank management?	Yes []	No []
Is approval for any policy waiver sought from the Board?	Yes []	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No []

Safeguard Policies Triggered by the Project

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

Legal Covenants

Name	Recurrent	Due Date	Frequency
Loan Agreement: Break-even covenant	yes	December 31, 2018	Annual
Description of Covenant			
(a) Except as the Bank shall otherwise agree, the Borrow shall take all measures to ensure that each participating district heating company shall be able to produce for each of its fiscal years after its fiscal year ending on December 31, 2016, total revenues equivalent to not less than the sum of its (i) total operating expenses; and (ii) the amount by which debt service requirements exceed the provision for depreciation.			
Name	Recurrent	Due Date	Frequency
Project Agreement: Break-even covenant	yes	March 1, 2018	Annual

Description of Covenant

(a) Except as the Bank shall otherwise agree, the [district heating company name] shall produce for each of its fiscal years after its fiscal year ending

on December 31, 17, total revenues equivalent to not less than the sum of its (i) total operating expenses; and (ii) the amount by which debt service requirements exceed the provision for depreciation.

(b) Before March 1 in each of its fiscal years commencing January 1, 2018 the [district heating company name] shall, on the basis of forecasts prepared by the [district heating company name] and satisfactory to the Bank, review whether it would meet the requirements set forth in paragraph (a) in respect of such year and the next following fiscal year and shall furnish to the Bank the results of such review upon its completion.

(c) If any such review shows that the [district heating company name] would not meet the requirements set forth in paragraph (a) for the [district heating company name]'s fiscal years covered by such review, the [district heating company name] shall promptly take all necessary measures in order to meet such requirements.

Team Composition

Bank Staff

Name	Title	Specialization	Unit	UPI
Yadviga Semikolenova	Senior Energy Economist	TTL	ECSEG	
Pekka Salminen	Senior Energy Specialist	Engineer, DH Specialist	ECSEG	
Viktor Loksha	Senior Energy Economist	Economist, DH Specialist	SESEG	
Pedzi Makumbe	Energy Specialist	Economist	SESEG	
Dmytro Glazkov	Operations Officer	Environmental Safeguards Specialist	ECSEG	
Alexei Slenzak	Senior Environmental Specialist	Environmental Safeguards Specialist	ECSEN	
Klavdiya Maksymenko	Social Development Specialist	Social Safeguards Specialist	ECSSO	
Irina Babich	Financial Management Specialist	Financial Management	EC3SO3	
Irina Shmeliova	Procurement Specialist	Procurement	EC3SO2	

Non Bank Staff

Name	Title	Office Phone	City
Murat Alehodzhin	Financial Specialist		Tallinn, Estonia
Kishore Nadkarni	Financial Specialist		Washington, DC

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, Vinnytsia	National	Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, Vinnytsia	Country wide		

I. STRATEGIC CONTEXT

A. Country Context

1. **Until mid-2008, Ukraine showed strong economic growth and had an active banking sector, although signs of overheating were increasingly apparent.** Ukraine's GDP posted outstanding growth between 2001 and 2008, averaging 7.5 percent. Booming commodity markets helped to improve terms of trade considerably, while inflows of external borrowings triggered development of the banking sector and fueled domestic demand. With a pre-crisis fixed exchange rate and pro-cyclical fiscal policies, abundant international liquidity translated into higher inflation and growing current account deficits.

2. **The global economic and financial crisis hit Ukraine particularly hard given its pre-existing macroeconomic imbalances, structural weaknesses, and policy shortcomings.** During the crisis of 2008-2009, Ukraine appeared to be one of the most vulnerable countries in the region, as its GDP dropped by 15 percent in 2009. The crisis highlighted the lack of Ukraine's export diversification, its poor investment climate, and large structural fiscal pressures. Cooperation with the IMF helped stop a decline in foreign reserves and controlled growth of the fiscal deficit, while structural reforms were postponed because of political reasons. Despite some economic recovery in 2010-2011, driven mostly by improvements in global commodity prices, Ukraine did not manage to change its economic structure and remained rather vulnerable to the external shocks that materialized in the second half of 2012. Weak external conditions and delays in domestic policy adjustment led to a decline in economic activity in the first half of 2013, with real GDP falling by 1.1 percent and 1.3 percent in the first and second quarters of 2013, respectively.

3. **A sustainable macro framework would require tightening Ukraine's fiscal policy and should be complemented with structural reforms to boost long-term economic growth.** The unfinished agenda in Ukraine is vast. The main focus should be on improving the business climate to strengthen competitiveness, attract investment, and create jobs to improve living standards. On the fiscal front, efficiency of public spending could be improved through a reduction in fiscal and quasi-fiscal deficits in the gas and district heating sectors and better targeted social assistance to reach the poorest segments of society.

B. Sectoral and Institutional Context

4. **Ukraine is one of the 10 most energy-intensive economies in the world.**¹ While Ukraine's energy intensity² declined at a rate of 5 percent per year during 1996-2009, it exceeds that of Germany by a factor of 3.7 (0.45 kg of oil equivalent in Ukraine vs. 0.12 kg in Germany), is three times higher than the EU average, and is about double that of the EU-12 countries. Part of Ukraine's energy efficiency problem is structural: Ukraine was an important source of heavy

¹ Measured as amount of primary energy used to produce one unit of GDP (purchasing power parity – PPP). Source: IEA World Energy Statistics and Balances; World Development Indicators.

² Energy intensity is measured herein as a kilogram of oil equivalent of energy use per constant PPP GDP. Energy use refers to use of primary energy before transformation to other end-use fuels. PPP GDP is gross domestic product converted to 2005 constant international dollars using PPP rates.

equipment in the former Soviet Union. Nearly 20 years later, most of these assets still use the same technology.

5. **Primary energy supply is dominated by natural gas (41 percent of the total).** Although gas consumption has decreased in recent years, its price has risen and energy security remains a major concern. The efficiency with which gas is used in Ukraine is well below modern standards, primarily due to the aging asset base: in the energy sector, many power plants and district heating (DH) boiler houses are operating beyond their design life. The Government of Ukraine (GoU) plans to improve efficiency through a three-pronged effort: (i) replacing the oldest assets with new equipment; (ii) upgrading plants and boiler houses with a reasonable remaining operating life (typically more than 10 years); and (iii) decreasing energy production from old plants and boiler houses while investing in new facilities.

6. **The DH sector is the third largest gas consumer in Ukraine,** after households and industry. Ukrainian DH systems were designed based on low-cost energy, mostly gas. They are inefficient but have been reliable. Boilers with limited temperature controls are common in the supply system, while most customers have no metering or temperature controls and therefore no ability or incentive to conserve energy. Most buildings in cities and towns are connected to DH networks; about 80,000 high-rise buildings consume 44 percent of the country's heat energy resources.

7. **Ukraine's DH sector faces a number of major challenges:** (i) large energy subsidies and poor energy pricing policies; (ii) weak financial state of DH companies; (iii) low energy efficiency of existing DH assets; (iv) inefficient regulatory practices; (v) inadequate sectoral transparency; and (vi) poor quality of DH services.

8. **DH in Ukraine has been heavily subsidized through the provision of gas to utilities at below-market prices and through subsidies to compensate for low residential heating tariffs.** In 2012, DH companies paid only about 22 percent of the average import gas price paid by Ukraine to Russia that year (US\$425/tcm). As a result, the average financial cost of residential heat production in 2012 was only about US\$40 per Gcal, or 50 percent below prices in the EU. Additionally, approved DH tariffs cover on average only 60 percent of the already low cost of heat production. The 2012 State Budget included about UAH 4.8 billion (US\$0.6 billion) in direct subsidies to DH companies for the difference between actual costs incurred and revenues received from low tariffs. In practice, however, these budget transfers either come late or not at all.

9. **As a result of low tariffs, DH companies are financially strapped.** They do not have funds to implement necessary investments or to maintain systems in good enough condition to provide quality service (e.g., to maintain comfortable temperatures in all apartments, minimize service disruptions, etc.). About 60 percent of heat is lost within the DH chain, especially at the end-user level.³ And because of their poor financial state and lack of collateral (assets are normally owned by the municipality), DH companies cannot borrow from local banks.

³ Ukraine Energy Policy Review, IEA (2006).

10. **Lack of funds for system modernization and maintenance has led to poor efficiency of assets and higher-than-necessary operating costs.** Maintenance and investments are carried out on an *ad hoc* basis to deal with emergency situations rather than in a systematic manner designed to reduce operating costs. In addition to this lack of funds, the outdated practice of supplying heat to consumers directly from a boiler house or through central (group) heat substations (CHSs) has led to larger fuel needs, higher losses, lower service quality, and higher CO₂ emissions than in more modern systems that supply heat to consumers through more efficient individual (building-level) heat substations (IHSs). Despite known efficiency benefits of IHSs, the sector has been reluctant to switch to them because: (i) CHSs were invented in Ukraine; (ii) many traditional DH professionals still believe in the superiority of supply-driven DH systems; and (iii) the rate of return on this investment is rather low for DH companies because most of the efficiency gains are captured by their customers.

11. **Switching to more efficient IHS-based systems is also complicated in a regulatory sense.** According to the Law on Heat Supply (No. 2633-IV), DH companies are responsible for generation, transmission, and distribution of heat up to a building's wall. Regulation of heat distribution *within* a building, which includes servicing and maintenance of internal pipes and IHSs, is left to municipalities. Homeowners' associations are still rare, and residential buildings' ownership is mostly mixed: apartments are owned by residents, while the common spaces are owned by municipalities. Thus DH companies need to get authorization from the municipality (and in some cases from the residents as well) to install IHSs. Without this authorization, which would also grant access for servicing and maintenance, IHSs cannot be included in utilities' regulated investment plans and thus tariffs. Hence, installation of IHSs requires the commitment and determination of both DH companies and municipalities. Some of the more progressive municipalities in Ukraine have started to solve this regulatory obstacle to IHS installation by either outsourcing servicing and maintenance of the internal building infrastructure to DH companies or by leasing space inside buildings to DH companies for IHS installation. However, even in these municipalities, lack of funds prevents installation of IHSs on a large scale.

12. **Lack of consumption-based billing in the DH sector affects its transparency.** About 70 percent of residential DH consumption remains unmetered;⁴ most Ukrainian households pay their heating bills according to estimated consumption based on apartment size. Below-cost-recovery residential heating tariffs discourage DH companies from investing in building-level heat meters and moving to consumption-based billing.⁵ On the contrary, DH companies have an incentive to overestimate residential heat consumption and overcharge residential consumers to reduce their financial losses. This also hides true network losses and decreases incentives to improve system efficiency.

13. **These challenges culminate in the poor quality of heating service.** According to public consultations conducted by the World Bank in 2011,⁶ many residents are not satisfied with the

⁴ According to Ukrainian State Building Norm B.2.2-9-99 of 1999, all newly constructed buildings that are connected to DH networks must have building-level heat meters.

⁵ In most of the high-rise buildings, apartment-level heat meters cannot be installed for technical reasons.

⁶ "Public Consultations in Lviv and Mykolaiv on Social Concerns about District Heating Services." May 2011. Background paper for the World Bank report "Modernization of the District Heating Systems in Ukraine: Heat Metering and Consumption-Based Billing," World Bank, 2012.

quality of service offered by their DH company. Some complained that DH companies are not able to maintain comfortable temperatures in all apartments. Others noted that the utilities start supplying heat later than they are supposed to and stop earlier, but still charge residents for the whole heating season. Many respondents mentioned disruption of service and a lack of routine maintenance of DH infrastructure.

14. **GoU has taken several steps to address the issues in the DH sector.** First, *in July 2010, the Parliament passed the Law on State Regulation in the Area of Communal Services in Ukraine*, which states that tariffs for communal services need to cover economically justifiable costs and planned profit and that investment costs can be recouped through tariffs. Second, *in July 2011, the President of Ukraine signed a decree creating a Utilities Regulator: the National Commission on the Regulation of Communal Services*. The Utilities Regulator issues licenses, regulates licensees, and approves tariffs for DH companies that operate boiler houses with a minimum capacity and production. The Utilities Regulator now has over 290 licensees that supply over 90 percent of the heat in Ukraine. The creation of the Regulator removed the process of setting DH prices from municipal government control. To date, the Utilities Regulator has calculated tariffs for the 57 largest DH utilities, which represent 80 percent of the heat market. On average, heating tariffs need to increase by 40 percent to bring them to financial cost-recovery levels. However, this is a politically sensitive matter, especially given the upcoming 2015 Presidential election. Hence, GoU has not yet increased DH tariffs.

15. **The Bank has actively supported reforms in the Ukrainian DH sector.** In 2012, the Bank published a report entitled “*Modernization of the District Heating Systems in Ukraine: Heat Metering and Consumption-Based Billing*,” which outlined a multi-step reform program. It recommended making consumption-based billing for heat obligatory and installing building-level heat meters with temperature controls in all buildings that use DH, together with temperature controls at IHSs, along with targeted social assistance for low-income households. This would reduce heat consumption by about 20 percent and reduce DH utilities’ gas consumption by 10 percent. The study also emphasized that DH tariffs should cover the full cost of gas and of investments necessary to modernize systems, while reducing heat consumption by about 50 percent through investments in energy efficiency. In 2012, GoU approved a master plan to improve energy efficiency in the DH sector based on this report. However, its implementation remains slow.

16. **In coordination with the IMF, the Bank developed a suggested path for energy price reforms in Ukraine, along with impact mitigation.** The proposed reforms include a short-term increase in DH tariffs to financial cost-recovery levels and gradual increases in gas prices to DH utilities (with corresponding heating tariff increases) over the subsequent four years. These steps would be implemented together with a reform of social safety nets to improve targeting and an aggressive energy efficiency program to reduce residential heat consumption. The new IMF Stand-By program, currently under negotiation, is consistent with the above. Also, as requested by GoU, the Bank’s proposed Second Social Assistance Modernization project could assist with expanding the Guaranteed Minimum Income (GMI) program’s coverage to protect the poorest households from the negative impacts of tariff increases.

17. **In consultation with the EC, EIB, EBRD, USAID, and SIDA, the Bank designed**

technical assistance to the Utilities Regulator to support its long-term sector reform strategy. The proposed technical assistance, expected to commence in January 2014, will support: (i) development of incentive-based methodologies and auditing principles to improve the Regulator’s capacity for setting cost-recovery tariffs; and (ii) introduction of a sector-wide benchmarking exercise that will enable the Utilities Regulator to assess DH companies’ performance over time and incentivize them to improve their efficiency. The proposed technical assistance would be implemented over two years, through a recipient-executed trust fund financed by Swedish International Development Cooperation Agency (SIDA). Successful implementation of this activity would stimulate improved efficiency and quality of service of DH companies and move them toward financial viability. The proposed activity has been closely coordinated with USAID and EBRD. This activity would become a part of the Integrated Approach to Reform in the Ukrainian District Heating Sector of the development partners (see Annex 8 for more details).

18. **The project is an important part of the Bank’s comprehensive sector strategy** to address the major challenges in the DH sector and as a vehicle to continue the policy dialogue, including on DH tariffs. The project will finance investments to modernize systems in 10 Ukrainian DH companies that cover about 30 percent of Ukraine’s heat market. These investments will have a significant economic impact and that will improve efficiency of heat production and delivery, reduce network losses, and decrease building-level heat consumption. In the medium term, these investments are expected to decrease DH production costs, hence making DH services affordable to the population. By also promoting consumption-based billing at the building level, it will provide incentives to both utilities and households to implement energy efficiency measures and will improve transparency and governance in the sector.

C. Higher Level Objectives to which the Project Contributes

19. The project is fully aligned with GoU’s strategic objectives to reduce energy intensity by 50 percent by 2030 and its master plan to reduce energy intensity in the DH sector. By promoting lower-cost, higher quality, efficient, and affordable DH in Ukraine, the project also supports the World Bank’s twin goals of reducing poverty and increasing shared prosperity.

20. The proposed District Heating Energy Efficiency (DHEE) Project is included in the Country Partnership Strategy (CPS) for Ukraine for fiscal years 2012-2016 under Pillar 2 (Improving Policy Effectiveness and Economic Competitiveness: Support to Building Relations with Businesses). The proposed project supports the Pillar’s results area “Improving Infrastructure for Business Activities” by improving efficiency in the public sector (expected outcome 14).

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

21. The project development objective is to improve the energy efficiency and quality of service of selected Ukrainian DH companies, improve their financial viability and decrease their CO₂ emissions.

22. The global objective is to reduce greenhouse gas (GHG) emission through avoided heat generation by improving heat generation efficiency, reducing heat losses in DH transmission and distribution systems and reducing residential heat consumption.

Project Beneficiaries

23. The main and primary beneficiaries are participating DH companies.

24. The secondary beneficiaries are the residential consumers (both men and women) who will benefit from the more reliable, better quality service provided by participating companies.

PDO Level Results Indicators

25. The following key indicators are proposed to assess the achievement of the PDO: (i) decreased gas needs of participating DH companies for heat production, transmission and distribution; (ii) energy saved/ avoided CO₂ emissions of participating companies; (iii) improved quality of domestic hot water service and more comfortable temperatures in apartments in buildings where IHSs are installed; (iv) improved ratio of total revenues to total operating costs (including debt service requirements) of participating DH companies; and (v) number of people who gain access to more efficient heat generating facilities.

26. The indicator for decreased gas needs will be calculated as avoided heat generation, based on the following intermediate indicators: increased efficiency of heat-generation facilities, decreased network heat losses, and decreased residential heat consumption in participating DH companies. As heat generation in participating DH companies is predominantly gas-based, the impact will be calculated as avoided gas heat generation. The avoided CO₂ emissions indicator will be calculated based on avoided heat generation and decreased electricity use of participating DH companies. Intermediate indicators also include a regulatory reform indicator that traces the implementation of technical assistance to the Utilities Regulator.

III. PROJECT DESCRIPTION

A. Project Components

27. The proposed DHEE Project consists of two components: (i) an energy efficiency investments component; and (ii) a technical assistance and capacity-building component. The description and objectives of each component are summarized below.

28. **Component 1: Energy Efficiency Investments (US\$376.5 million: US\$326.5 IBRD and US\$50 million CTF).** This component will increase the efficiency of participating utilities, reduce their costs, enhance the reliability of their services and improve the quality of heat supply. This component will cover: rehabilitation of boiler houses; closure of redundant boiler houses; installation of mini-CHPs (combined heat and power plants); replacement of network pipes with pre-insulated pipes; installation of IHSs in residential buildings; installation of building-level heat meters; and installation of SCADA management systems to optimize the heat production and supply of participating DH companies. Component 1 includes Clean Technology Fund (CTF) co-financing that will cover installation of IHSs (together with connecting pipes) and

building-level heat meters.

29. Component 1 will target DH companies in the following municipalities: Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, and Vinnytsia. The participating DH companies and municipalities were selected competitively based on governance indicators and financial indicators. Governance indicators included: availability of boiler-level gas and heat meters; prevalence of residential consumption-based billing;⁷ and availability of IHSs and/or readiness to install IHSs. Financial indicators included: the cost-recovery level of heating tariffs and the collection rate. All selected DH companies have 100 percent gas meters on their boiler houses, and almost all of their boiler houses have boiler-level heat meters. The average cost recovery of the selected utilities is 70 percent (compared to 60 percent average in Ukraine).

30. The sizes and details of investment programs have been finalized for the following utilities: Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Mykolayiboblteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). The size of the investment programs has been discussed with the Ministry of Finance; the investment programs have been identified and finalized with the support of the CTF Project Preparation Grant.

31. The size of investment for Donetskmiskteplomerezha (Donetsk) has been agreed with the Ministry of Finance; the components of the investment program will be finalized soon after Board approval. The DH company is financing a feasibility study with its own funds.

32. The sizes of investment programs have been discussed and are pending approval of the Ministry of Finance for the following utilities: Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), and Kirovohradteplo (Kirovograd). The sizes of the investment programs for these utilities will be finalized before negotiations; the details of the investment programs will be finalized soon after Board approval. The investment programs will be identified and finalized with the support of SIDA's Urban Infrastructure Project (UIP) Grant.

33. **Component 2: Technical Assistance and Capacity Building (US\$5.5 million).** Component 2 will finance technical assistance to the Ministry of Regional Development, Construction, Housing and Communal Services (Minregion), which will oversee the implementation of the project. Technical assistance will support: (i) supervision of project implementation; (ii) guidance and training to the participating DH companies in project implementation, monitoring, and evaluation; (iii) capacity building and knowledge-sharing workshops for participating DH companies; (iv) annual quality of service surveys of the consumers of participating DH companies; (v) annual project audits; (vi) preparation of case studies, including technical studies; and (vii) incremental operating costs of Minregion related to all eligible expenses.

⁷ Share of residential heat consumption, which is billed according to readings of building-level meters.

B. Project Financing

Lending Instrument

34. The lending instrument will be a Specific Investment Loan (SIL). The Ministry of Finance will be the Borrower under the project. GoU, through the Ministry of Finance, will lend to participating DH companies. DH companies, in full coordination with Minregion, will be responsible for procurement, financial management (FM), and disbursement aspects of their respective components of the project. Minregion will be responsible for procurement, FM, and disbursements in its component, as well for supervision of the DH companies in the above-listed aspects.

35. The Borrower has selected a Variable Spread Loan (VSL), to borrow an amount equal to three hundred thirty two million dollars (US\$332,000,000) with IBRD terms of a 5 year grace and a 18 year maturity. The borrower will be charged a front end fee of 0.25 percent of the loan amount (US\$830,000) to be financed out of the loan proceeds (i.e., capitalized). The Borrower shall pay interest on the principal amount of the loan withdrawn and outstanding at a rate for each interest period equal to Libor + 0.47 percent.

36. The CTF loan of US\$50 million is extended under harder concessional terms. The CTF loan is offered with a service charge of 0.75 percent per annum on the disbursed and outstanding loan balance and a 20-year maturity, including a 10-year grace period, with principal repayments at 10 percent for Years 11-20. Principal and service charge payments accrue semi-annually. A management fee equivalent to 0.45 percent of the total loan amount (US\$225,000) will be charged, to be capitalized from the loan proceeds, following loan effectiveness.

Project Cost and Financing

37. Total project financing requirements are estimated to be US\$382 million, including 5 percent for physical contingences and 10 percent for price contingences and a front-end fee. Out of the total project financing, US\$332 million equivalent will be financed by an IBRD loan and US\$50 million by a CTF loan. Table 1 provides a breakdown of project costs and financing by component and financing source.

Table 1: Project Costs and Financing Sources

Project Components	Project Cost (US\$ Mln)	IBRD Financing (US\$ Mln)	CTF Financing (US\$ Mln)	% of Costs Financed by IBRD (US\$ Mln)
1. Energy Efficiency Investments	326.474	283.191	43.283	87%
2. Technical Assistance and Capacity Building	5.5	5.5		100%
Total Baseline Costs				
Physical contingencies (5%)	331.974	288.691	43.283	87%
Price contingencies (10%)	16.324	14.160	2.164	87%
	32.647	28.319	4.328	87%
Total Project Costs	380.945	331.17	49.775	87%
Front-End Fees	1.055	0.83	0.225	79%
Total Financing Required	382	332	50	87%

C. Lessons Learned and Reflected in the Project Design

38. Strong commitment from companies, municipalities, and GoU are critical for implementing municipal projects. Ownership by the Client is important during project implementation, especially in Ukraine where municipal projects have been slow to implement. The experience of UIP, which worked with municipal water utilities, showed that the strong drive and determination of the participating utilities was crucial for successful implementation of their investment programs. The participating DH companies and municipalities were chosen through a competitive selection; Minregion, the Ministry of Finance, the Ministry of Economic Development and Trade and the Utilities Regulator participated in the selection process. Competitive and inclusive selection approach was applied to ensure commitment and ownership of participating DH companies, municipalities and GoU.

39. Careful selection of participating DH companies according to clear, pre-identified criteria including governance indicators is essential for successful project implementation. The World Bank report “Ukraine: Creditworthiness of District Heating Utilities,” prepared in 2012, developed recommendations for GoU, the Utilities Regulator, DH companies, and donors on how to facilitate sector reforms. The report recommended that donors work with carefully selected DH companies that meet clear qualifications. The suggested criteria for utilities selection included technical, financial, and governance indicators. The selection of DH companies and municipalities for the project was based on the suggested indicators to ensure that companies are committed and have transparent governance structure.

40. Combining capacity building and technical assistance with investment strengthens project implementation and sustainability. As demonstrated in the implementation of SIDA’s UIP technical assistance grant, providing capacity-building support to participating water utilities improved their technical competence, institutional capacity, and governance, thus supporting the sustainability of investments. The project includes Technical Assistance and Capacity Building component to ensure knowledge building and sharing among the participating DH companies. This component will enhance companies’ technical capacity, improve quality of project implementation, thus contributing to sustainability of the project investments.

41. Public outreach and awareness campaigns on project implementation are essential for generating community support. Some investments under the project (e.g., IHSs) will improve consumers’ comfort and thus affect their perception of the quality of heating service. Other investments (e.g., rehabilitation of boiler houses) will drastically reduce the probability of system collapse, thus improving companies’ reliability. Since participating DH companies must have their tariffs increased to cost-recovery levels, it is essential that they communicate to their customers what investments are being made and the effect this will have on service so as to build their awareness and avoid public unrest. Communication strategies in the participating municipalities are being developed with the support of the CTF Project Preparation Grant.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

42. The project will be implemented by 10 participating DH companies, namely Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), Donetskmiskteplomerezha (Donetsk), Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Kirovohradteplo (Kirovograd), Mykolayiboblteploenergo (Mykolaiv) and Vinnytsiamiskteploenergo (Vinnytsia). Each participating utility has established, using its existing staff, a Project Implementation Unit (PIU) that consists of: a general manager, a procurement specialist, an FM specialist, a technical supervisor (engineer), a and safeguards specialist. The responsibilities of the local PIUs will include: preparing tender documents, preparing technical specifications, leading procurement processes according to World Bank guidelines, leading FM according to World Bank guidelines, supervising physical works, conducting environmental and social assessments, monitoring and evaluation, and preparing progress reports.

43. The project implementation of each participating company will be supervised by Minregion. A Central Project Management Unit (CPMU) was created around an existing PIU in Minregion implementing the CTF Project Preparation Grant. The responsibilities of the CPMU will include: reporting to the World Bank; providing procurement and FM support to the local PIUs; aggregating data and reports; checking invoices and delivering them to the Ministry of Finance; supervising quality of service surveys; and monitoring and evaluation. The existing CTF PIU capacity will be increased by adding procurement, FM, engineering, safeguards, and accounting specialists. The DHEE CPMU will benefit from the lessons learned and experience of the UIP CPMU in Minregion that has supervised implementation of the UIP since 2007.

44. Additionally, each participating DH company will present its annual investment programs, financed by the project, to the Utilities Regulator for its review, approval, and inclusion in the investment component of its heating tariffs.

45. Since most of the participating DH companies have no experience implementing World Bank projects, the local PIUs as well as new members of the CPMU participated in a training on Bank procedures conducted by Bank staff and Minregion. The Bank and Minregion will continue to provide regular in-depth trainings on procurement, FM, and safeguards issues to the PIUs and the CPMU during project implementation.

B. Results Monitoring and Evaluation

46. Monitoring of project implementation progress and results indicators, as well as progress towards achievement of the PDO, will be the responsibility of Minregion as well as participating DH companies. The CPMU will collect data and reports from the PIUs and bi-annually present to the Bank the data on progress in achieving the key and intermediate indicators. This will be followed up in conjunction with Bank team supervision missions.

C. Sustainability

47. The key to sustainability is to ensure that participating DH companies increase their reliability and improve their efficiency; that the benefits of investments exceed their costs; and that efficient and reasonable costs are recovered from heating tariffs. The Bank is closely engaged in high-level policy dialogue in Ukraine concerning gas and heating tariffs in coordination with the IMF and other donors, and is supporting GoU’s DH sector reform program and its sector regulatory framework through SIDA-World Bank technical assistance to the Utilities Regulator. However, tariff increases remain a politically sensitive matter, especially given the upcoming 2015 Presidential election. It is expected that participating DH companies will achieve financial cost recovery by the end of 2017, after the 2015 Presidential election and before the mid-term review of project implementation.

48. At the project level, participating DH companies have shown their determination to improve the efficiency of their DH systems through their interest and willingness to apply modern efficient technologies, including IHSs and SCADA management systems, and to improve their transparency by installing building-level heat meters and moving towards 100 percent consumption-based billing.

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

Stakeholder Risk	Moderate
Implementing Agencies’ Risk	
- Capacity	Substantial
- Governance	Substantial
Project Risk	
- Design	Substantial
- Social and Environmental	Moderate
- Program and Donor	Low
- Delivery Monitoring and Sustainability	Moderate
- Other (Optional)	
- Other (Optional)	
Overall Implementation Risk	Substantial

B. Overall Risk Rating Explanation

49. A “Substantial” rating was selected for the overall project implementation to reflect stakeholder, project, and implementing agencies’ risks. This rating reflects the risk that participating DH companies will not get the financial cost-recovery tariffs necessary for sustainability of the investments; the governance and capacity risks of the implementation agencies; and the potential social risks associated with the project.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analyses

50. Economic and financial analyses were carried out for the subprojects included in the investment programs of the following utilities: Ivano-Frankivskteplokominenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanskyi), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Mykolayivobltteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). Since the remaining four DH companies participating in the project are similar to the ones already assessed, their investment programs will be generally similar in nature (although different in scale); consequently, their internal rates of return (EIRRs and FIRRs) are expected to be generally similar and their net present values (NPVs) substantial. The overall project net benefits (benefits less costs) will be aggregated from the respective net benefits of each subcomponent.

Economic Analysis

51. The economic analysis for the project was carried out following the Bank's Guidelines for Economic Analysis of Investment Projects (April 2013). Detailed reports and analytical files with regard to the analysis are available in the Project Files. The main features and results are provided in Annex 6.

52. **Relevance of Investments to Project Development Objectives:** The proposed investments under the project are of high relevance for meeting the PDOs of increasing energy efficiency, improving reliability, reducing emissions, and improving quality of service (discussed in Annex 2).

53. **Rationale for Public Sector Investment:** In Ukraine, DH services have traditionally been supplied by public sector companies under municipal/regional ownership. Given the basic essential services nature of the activities, the concerned municipal/regional governments have been closely involved in approving key aspects of the operations, including investments and setting of tariffs. Starting in 2011, the responsibility for regulatory oversight, including tariff-setting, was devolved to a new regulatory agency, the Utilities Regulator. Depending on the progressive experience under this framework, greater interest from the private sector may emerge in the future. However, at present, DH companies remain under municipal/regional ownership and have not attracted much private investment. Because DH utilities continue to be the principal suppliers of essential services to the population, their reliability and efficiency need to be improved.

54. **Rationale for Bank Involvement:** The Bank has been involved in a sector dialogue with GoU for some time. It has provided technical assistance and advice through preparation of specific studies in the sector. DH companies in Ukraine have faced severe financial constraints over the years that have led to progressive deterioration in their heat production and distribution facilities. The investments necessary to increase the operating efficiency of these facilities are large and beyond the financial capacity of the concerned companies unless substantial amounts of funds are made available on a concessional basis. In particular, DH companies would be reluctant to invest in new technology such as IHSs without the availability of concessional

financing; e.g., from CTF funds. The involvement of the Bank enables the inclusion of a significant amount of CTF funds to be employed for justifiable investments under the project. Overall, Bank financing continues to be among the most favorable sources of funds for these activities.

55. **Methodology of Selection of the Investments:** Based on relevant experience in the region, it has been established that DH provides an economically sound and often least-cost alternative for providing heating services in urban areas where the density of the heat load is in excess of 1 Gcal/h per km of heating pipeline network. It was assessed that all participating DH utilities meet this test. Based on the investment program of each utility and the results of the relevant feasibility studies, the priority investments were determined, taking into account the expected impacts and specific circumstances in each city (details in Annex 2).

56. **Assessment of Net Economic Benefits of the Investments:** The net economic benefits of the investments are estimated on an incremental basis; i.e., as the difference between costs and benefits under the “with project” and “without project” scenarios. Benefits and costs are valued at economic prices. The indicators used are the Economic Internal Rate of Return (EIRR) and the Economic Net Present Value (ENPV) at a discount rate of 10 percent. The principal quantifiable benefits associated with the selected investments come from: (i) operating cost savings through improvements in the operating efficiency of facilities; (ii) reduced heat consumption (resulting in lower gas usage in heat production) in buildings through increased installation of IHSs and building-level heat meters; and (iii) reductions in emissions and associated carbon credits. In some cases, there may possibly be additional revenues through increased heat or electricity supply, but these would be less significant. The economic benefits will include increased reliability of supply and decreased risk of collapse of key facilities, and other improvements in the quality of service that are more difficult to quantify.

57. **Summary of Economic Costs and Benefits:** The ENPV (at a discount rate of 10 percent) and EIRR estimates of the investment program for each utility and overall for the project are given in Table 2. Further details are given in Annex 6.

Table 2: Key Indicators of Net Economic Benefits

Utility	Net Present Value (ENPV) (USD million)	Internal Rate of Return (EIRR) (%)	Sensitivity Analysis	
			Gas prices +20%	Gas prices -20%
Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk)	3.52	14%	16%	12%
Miskteplovodenerhiya (Kamyanets-Podolsky)	18.10	44%	50%	37%
Khersonteploenergo (Kherson)	3.14	14%	16%	12%
Kharkivski Teplovi Merezhi (Kharkiv)	122.22	37%	38%	36%
Mykolayiboblteploenergo (Mykolaiv)	17.32	34%	40%	28%
Vinnysiamiskteploenergo (Vinnysia)	16.42	24%	28%	20%
Overall Project	180.72	27%	30%	25%

58. **Sensitivity Analysis:** The major part (62 percent) of the project's benefits comes from fuel (gas) savings through the increased efficiency enabled by project investments. The benefits are therefore sensitive to changes in gas prices; increases in gas prices would increase the net benefits. The main risk is the relatively unlikely event of a decrease in international gas prices. For a 20 percent decrease in gas prices, the EIRRs by component and overall would be as shown in Table 2. Changes in the companies' heat sales tariffs would not have a significant impact on the project's economic benefits since a relatively small part of the benefits comes from increased heat sales. However, the levels of heat sales tariffs would have a substantial impact on the overall financial wellbeing of DH companies, as discussed below in the relevant sections.

Financial Analysis

59. Financial analyses were carried out for the six participating DH companies: (i) at the project level, to estimate the financial rate of return (FIRR) for each investment subproject; and (ii) at the entity level, to assess each DH company's financial situation and ability to meet its financial obligations in regard to operating expenses and debt service during project implementation and operation periods.

60. The financial analysis of each investment program for the six participating DH companies is based on the feasibility studies prepared in 2013 with the support of the CTF Project Preparation Grant, and the companies' historical financial statements for 2010-2012 accounts, as well as their latest financial projections. The project FIRRs are calculated at constant 2012 prices and compared to the estimated weighted average cost of capital (WACC). The FIRRs for all investment subprojects range from 6.8-29.6 percent, higher than the WACC for each subproject. The analyses show that all investment projects are financially efficient. Further details are provided in Annex 6; detailed reports and analytical files are available in the Project Files. Similar analyses will be carried out for the remaining selected DH companies when their feasibility studies are prepared and their investment programs finalized.

61. **Financial Assessment of the DH Companies.** The financial position of the participating DH companies in Ukraine is strongly influenced by the regulated heat tariffs for residential consumers, which are set below the full cost-recovery level. The cost recovery of residential tariffs in the involved utilities varies from 51-85 percent. The companies differ significantly in terms of operating scales and service areas but in each of them, the majority of heat is provided to residential clients (the share of heat sales to residential consumers in the utilities varies between 75-85 percent). DH companies are supposed to receive compensation from the budget for the difference between actual costs incurred and revenues from residential consumers. The budget compensation to DH companies is usually paid with long delays (if ever) and the companies' financial results depend highly on receipt of the compensation. The Utilities Regulator has discussed increasing residential heat tariffs to the full cost-recovery level, but the actual timing of such a tariff increase is not clear at present, especially given the upcoming 2015 Presidential election.

62. Heat invoice collection rates have increased in recent years and are now at a satisfactory level (90 percent and higher) in all companies. However, difficulties in collection in earlier years led to the build-up of receivables, which vary between 2.1-6.4 months' value of heat sales. In

parallel with the increase in receivables, payables amounts have also increased for some of the companies. The largest share in payables is for natural gas; the natural gas payable varies between 2.9-8.5 months' value of gas supply. Introduction of cost-recovery tariffs together with the achieved savings due to the investments financed by the project will help participating DH companies remain in sound financial condition in the future. Further details are provided in Annex 6.

63. **Sensitivity analysis:** Assessment of the participating companies' financial sustainability has been prepared for three scenarios: (i) the base/ "with project" case assuming unchanged current levels of residential heat tariffs; (ii) introduction of the financial cost recovery residential tariffs in 2016; and (iii) gradual increase of residential tariffs to financial cost recovery levels between 2015 and 2018. The analysis has shown that, as has already been noted in economic analysis, setting residential tariffs at the financial cost recovery level is crucial for achieving the long-term financial sustainability of the companies. Further details are provided in Annex 6.

B. Technical

64. The project's technical design is considered sound. Comprehensive feasibility studies for the six DH companies have been completed and were reviewed by the relevant government agencies as well as the Bank. The individual subprojects meet accepted international standards. Comprehensive feasibility studies are underway for the remaining four DH companies. Since these companies are similar to the ones already assessed, their investment programs are expected to be similar to those already finalized.

C. Financial Management

65. The FM arrangements for project implementation have been confirmed as "Satisfactory," subject to implementation of the conditions listed below (effectiveness conditions). Minregion is currently implementing the UIP and the CTF Project Preparation Grant, and will continue to use similar arrangements for the FM of this project, except in the areas as described below, taking into account lessons learned during implementation of the UIP. Current FM arrangements in the UIP and CTF Project Preparation Grant were developed to a satisfactory level during both projects' implementation and its existing capacity, particularly at the UIP CPMU and CTF PIU, is being retained and strengthened for this project's implementation. The CPMU established for implementation of the project based on the existing CTF PIU will be strengthened with additional staff, including a dedicated financial specialist (effectiveness condition). The FM assessment of the project covered both Minregion and the CTF PIU (which will be expanded into the CPMU), and included a capacity assessment of participating DH companies. The overall FM risk rating for this project is "Moderate," and specific risk factors and measures to address them are provided in the detailed FM assessment report.

66. All participating DH companies are new to implementation of Bank-financed projects. All have already established PIUs that include a financial specialist. The PIUs at participating DH companies will take responsibility for a substantial portion of FM and disbursement tasks related to their respective investment components. As the participating DH companies do not have experience in FM of World Bank-financed projects, extensive training will be provided prior to project approval and during implementation. The CPMU will be responsible for FM and

disbursement of the Minregion component, as well as for review of documents and reports received from participating companies; consolidation of project data; and further coordination with Minregion/Ministry of Finance. These roles are further described in Annex 3 and will be further detailed in the Project Operational Manual (POM) (adoption of the POM is a project effectiveness condition).

67. Disbursements of both IBRD and CTF financing will follow the traditional disbursements mechanism, which includes direct payments, special commitments, and use of Designated Accounts (DAs). Ministry of Finance will open DAs for Minregion (for its component) as well as for each participating DH company. DAs will be opened in Ukreximbank in US\$, and additional transit accounts may be opened as needed for payments in other currencies. Ministry of Finance will delegate to Minregion and the participating companies' management of payments from DAs, but will retain the oversight function. Such disbursement arrangements will enable efficient control over the flow of funds, reconciliation of accounts balances, and preparation of periodic reports.

68. Project accounting records will be maintained by the financial specialist of each participating utility for its respective component. The accounting records for the project will be maintained in a set of accounts, segregated from other activities of the utility, in an automated accounting system, where available. At the same time, the CPMU will keep records for the entire project, including its own component as well as the components of participating utilities, separately for IBRD and CTF sources of funding. The CPMU has a sophisticated customized accounting system, 1-C, which has wide functionality. Consolidated quarterly Interim Financial Reports (IFRs) will be prepared during implementation of the project separately for IBRD and CTF. The CPMU will prepare consolidated reports with inputs from the PIUs. The consolidated reports will be due 45 days after the end of each calendar quarter, while the individual reports from the PIUs will be submitted to the CPMU 30 days after the end of each quarter to allow CPMU time to review and consolidate them.

69. Annual audits of consolidated *project financial statements* will be required. These audit reports will need to be publicly disclosed by Minregion as well as the World Bank on their respective websites, as required by the Information Disclosure Policy of the Bank. Audits of project financial statements will be financed from loan proceeds. Annual audits of *entity financial statements* of each participating utility will be required. Such audits will be carried out in accordance with International Standards on Auditing (ISA) by locally licensed audit firms, and submitted to the Bank within six months from the end of each fiscal year. These audits will be required by the project team to enable availability of reliable financial data for the ongoing monitoring of financial performance of the DH companies, and also as part of capacity-building activities aimed at strengthening the accounting and reporting framework of each company. Audits of entity financial statements may be financed from the operating costs of the loan. Audit reports of DH companies will be publicly disclosed by the Bank as well as by each respective utility.

D. Procurement

70. The project will be implemented by 10 selected DH companies owned by municipal/oblast councils of the following Ukrainian cities: Chernigiv, Dnipropetrovsk, Donetsk, Ivano-

Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, and Vinnytsia. Each company will have its procurement plan and will be responsible for conducting procurement and managing contracts. Each DH company will establish and maintain a PIU with its own staff. If needed, and on a case-by-case basis, additional specialists may be hired to assist the companies with project implementation.

71. The general coordination of project implementation will be provided by Minregion. The CPMU has been established by Minregion around the existing PIU that has been implementing the CTF Project Preparation Grant to provide assistance to the participating DH companies, particularly on the procurement aspects of project implementation. The procurement specialist of the existing PIU has several years of experience in Bank procurement and implementation of infrastructure projects. Procurement under the project will be carried out in accordance with the Bank's procurement rules and procedures. The CPMU will provide continuous assistance to utilities in conducting procurement and will help Minregion with implementation of the capacity-building component of the project.

72. The assessment of the procurement capacity of participating DH companies was conducted during field trips to the above-listed cities in April, May, and November 2013, and included, in particular, a review of current and past procurement practices and procedures and the experience of each DH company. It was concluded that although the companies have different capacities and experience in conducting both national and international procurement, all of them have duly-trained staff in national procurement rules (which are generally based on internationally recognized principles); all of them have formally established evaluation committees and practical experience in application of Ukraine's Public Procurement Law.

73. The overall procurement capacity is rated "Moderate," taking into account the discussed and agreed mitigation measures. The detailed procurement capacity assessment is provided in the Procurement Risk Assessment Module (P-RAMS).

74. The agreed mitigation measures to be completed during project preparation are as follows: (i) the Bank will assist DH companies with preparation of the Procurement Plan for the whole project implementation period; and (ii) Bank staff will conduct training on fiduciary requirements and specific procurement procedures to develop the capacity of the DH companies' procurement specialists.

75. The following agreed mitigation measures will be completed by loan effectiveness to ensure the timely launch of procurement procedures: (i) the POM will be prepared by the CPMU and approved by each DH company. Its procurement section will provide, in particular, for delegation of approval authorities; internal guidelines for recordkeeping of procurement documents; anticorruption guidelines and provisions related to disclosure of conflicts of interest; and a code of ethics for the evaluation committee members. It will also outline the arrangements for close collaboration between procurement and FM specialists on planning expenditures, the responsibilities of the companies' technical experts in preparation of the technical requirements of the bidding documents, evaluation of bids and acceptance of the goods and works; and (ii) the bidding documents for at least the first six months of project implementation will be prepared by each DH company.

76. The following agreed mitigation measures will be carried out throughout project implementation: (i) the CPMU will provide continuous assistance to the participating DH companies in conducting procurement and will facilitate communication with the Bank; and (ii) the Bank procurement team will provide continuous support and guidance to the CPMU and participating DH companies.

E. Social (including Safeguards)

77. The project will not involve changes in energy infrastructure or institutions that will pose significant adverse impacts on final consumers, particularly with regard to ownership of energy-generating assets. Moreover, it is possible that increasing energy efficiency may help mitigate the impact of increases in residential energy prices in the future. As part of the environmental assessment, the project components and associated short-term social and environmental impacts expected to occur during the construction phase and ways to mitigate them have been discussed with key stakeholder groups, including: government officials; local NGOs; and local populations and businesses located in Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, and Vinnytsia.

78. **Involuntary resettlement.** The OP 4.12 is triggered by the project. The proposed investments will not cause any permanent physical displacement. Projects causing any permanent or temporary physical displacement will not be selected for support. However, acquisition of some municipally-owned land for project purposes is likely to cause economic displacement, and in some places, illegal trade pavilions or street markets may be temporarily displaced by the works related to pipeline rehabilitation. The Resettlement Policy Framework (RPF) is described in one section of the Program-Level Environmental and Social Assessment (PLESA) and attached to it as Annex 4. The RPF was duly disclosed as a separate document in every project location in local language and on the Bank's Infoshop. As site-specific technical designs are finalized, the abbreviated RAPs will be prepared by the Borrower where relevant consultations with project affected persons (PAPs) are held and mitigation measures implemented prior to the start of project works. The PIUs were trained in the Bank's safeguards policies and will alert the CPMU and the Bank in case of any displacement caused by project works. The designated environmental specialist in the CPMU will closely monitor the subprojects for any temporary economic displacement.

79. **Utilities' social accountability capacity.** All participating DH companies have a good understanding of the importance of proper management of their relations with their customers, both institutional and individual. Every company has at least one telephone number functioning 24/7 to dispatch service to cope with physical break-downs and to register grievances. In all cases, calls to the dispatcher's line are registered and analyzed; analysis of the calls forms the basis for planning works, coordinating with municipal services, etc. All DH companies have an information line for users to get information on any or at least some aspects of customer relations.

80. Qualitative data from two middle-size cities representative of east and west Ukraine (Mykolaiv and Lviv) suggest that there is a low level of trust of DH companies and low expectations for more consistent and transparent policy on their behalf. Similar statements by

respondents in both cities reveal that consumers expect positive outcomes from the introduction of building-level heat metering.

81. Six out of 10 DH companies have websites with information on contacts, tariffs, services, and their access. The websites have different levels of interactivity and different extents of information disclosed on the companies' activities, plans, and structures. However, the concept of enabling and analyzing feedback from customers and creating channels for customers' participation is rather new to DH companies. None of the participating DH companies has an ongoing partnership with a civil society organization (CSO), and none conducts a regular customer satisfaction survey.

82. The capacity-building component of the project will therefore include training to build DH companies' capacity to: (i) understand and react to customers' concerns based on user satisfaction surveys; and (ii) hold meaningful public consultations and engage with CSOs and citizen groups. Specific support will be provided to the selected DH companies to develop websites to proactively share information and reinforce customer relations.

83. **Gender Aspects.** In many Ukrainian households, women pay the municipal bills and are therefore often in a good position to monitor and manage the household's heating expenditure. As such, they may be an important source of user feedback. Changes in household expenditures on municipal services may impact men and women differently due to their roles in household decision making and their different uses of disposable income (after paying for services). Women are more likely to head single-person and single-parent households, which have the lowest income and are particularly vulnerable to any energy sector interventions, especially if they lead to tariff increases. The project design systematically applied a gender lens to ensure that the project does not lead to unintended negative gender impacts and to record possible unexpected positive gender impacts. To ensure that any potential gender disparities in project impacts are captured and addressed, the project will: (i) ensure that both men and women are included in consultations on interventions in the DH sector, and that women's voices are not absent in policy dialogue; and (ii) integrate a gender aspect into quality of service surveys and data collection where relevant to obtain gender-disaggregated information at minimum cost.

F. Environment (including Safeguards)

84. Potential negative environmental impacts are local and manageable and will mainly be caused by rehabilitation and/or construction works undertaken within the footprint of DH companies or urban areas already occupied by various communal and transport infrastructure. The impacts are expected to be similar to those under the ongoing UIP project and include air pollution and noise from trucks, other construction machinery and works broadly, local soil disturbance, construction waste generation and other small-scale impacts. These environmental impacts can be mitigated by good construction and general housekeeping practices. Given the scale of the potential impacts the project is assigned Environmental Category B.

85. An environmental assessment (EA) for the activities of the project was undertaken and a PLESA was prepared by the Client. The project will have positive impacts on the environment and human health due to: (i) the decreased amount of fossil fuels burned as a result of the

enhanced energy efficiency of boiler houses; and (ii) reduced air pollution as a result of the introduction of more efficient heat-generating equipment and pollution control systems.

86. Two types of documents concern the environmental safeguards of the project. Document (a) was disclosed in November 2013, and Document (b) will be disclosed upon completion of subprojects' preparation in 2014. PLESA was prepared in 2013, documenting potential negative impacts, proposed mitigation measures, and a monitoring plan for implementation of mitigation measures during project implementation. PLESA is based on data from a representative sample of subprojects in six participating municipalities (Ivano-Frankivsk, Kamyanets-Podilsky, Kharkiv, Kherson, Mykolaiv, and Vinnytsia). Site-specific Environmental Management Plans (EMPs) will be prepared at the stage of detailed design of the subprojects. The site-specific EMPs for subprojects in Ivano-Frankivsk, Kamyanets-Podilsky, Kharkiv, Kherson, Mykolaiv, and Vinnytsia will take into account comments and proposals received during public consultations on PLESA. The EMPs for other subprojects (Chernigiv, Dnipropetrovsk, Donetsk and Kirovograd) will be prepared by the Client and disclosed in due course.

87. The project is in compliance with GoU and World Bank regulations, policies, and procedures for EAs. The anticipated adverse environmental impacts will occur mainly during the construction stage and are likely to be site-specific. The project is not expected to significantly affect the population, to involve a conversion or degradation of natural habitats, or to have a negative impact on forest ecosystems. In most cases, the proposed mitigation measures will be able to significantly reduce any adverse impacts and can be readily designed.

G. Other Safeguards Policies Triggered (*if required*)

88. No other safeguards policies are triggered.

Annex 1: Results Framework and Monitoring
UKRAINE: District Heating Energy Efficiency Project
Results Framework

Project Development Objective (PDO): To improve the energy efficiency and quality of service of selected Ukrainian DH companies, improve their financial viability and decrease their CO ₂ emissions.													
PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator One: Project lifetime fuel savings, calculated as decreased gas needs of participating utilities for heat production*	X	Thousand cubic meters (tcm)	0							Annually	Semi-annual progress reports of participating utilities and Minregion	Participating DH companies, Minregion	The indicator reports gas savings generated by the Project in the participating DH companies. Gas savings are estimated as avoided gas-based heat generation due to (i) improved efficiency of heat generation, (ii) decreased network losses; and (iii) decreased residential heat consumption. For each company, gas savings are estimated as a sum of gas savings generated by each component of their investment programs.
Ivano-Frankivskteplokounergo (Ivano-Frankivsk)				339	949	1,559	2,169	2,779	3,389				
Miskteplovodenerhiya (Kamyanets-Podolsky)				561	1,571	2,581	3,591	4,601	5,611				
Kharkivski Teplovi Merezhi (Kharkiv)				1,249	3,496	5,744	7,991	10,239	12,486				
Khersonteploenergo (Kherson)				179	502	825	1,148	1,471	1,794				
Mykolayiboblteploenergo (Mykolaiv)				654	1,831	3,009	4,186	5,363	6,540				
Vinnytsiamiskteploenergo (Vinnytsia)				768	2,150	3,532	4,915	6,297	7,679				
Chernihivteploelectrocentral (Chernigiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator Two: Energy savings/ avoided CO₂ emissions of participating DH companies*													
Ivano-Frankivskteplokunenergo (Ivano-Frankivsk)		GWh/ Tons of CO ₂	0	4 / 850	10 / 2,379	17 / 3,908	23 / 5,437	30 / 6,966	36 / 8,496	Annually	Semi-annual progress reports of participating utilities and Minregion	Participating DH companies, Minregion	The indicator reports energy savings/ reduction of CO ₂ emissions generated by the Project in the participating DH companies. Energy savings and avoided CO ₂ emissions of the companies are estimated as avoided gas-based heat generation (due to improved efficiency of heat generation, decreased network losses and decreased residential heat consumption) as well as decreased/avoided electricity use. The avoided electricity use is assumed to be coal-based base-load electricity. For each company, energy savings and reduction of CO ₂ emissions are estimated as a sum of energy savings and reductions in emissions generated by each component of their investment programs.
Miskteplovodenerhiya (Kamyanets-Podolsky)	6 / 1,578			17 / 4,417	27 / 7,257	38 / 10,097	49 / 12,936	60 / 15,776					
Kharkivski Teplovi Merezhi (Kharkiv)	13 / 18,897			37 / 52,913	61 / 86,928	85 / 120,944	109 / 154,959	133 / 188,974					
Khersonteploenergo (Kherson)	2 / 488			5 / 1,367	9 / 2,246	12 / 3,126	16 / 4,005	19 / 4,884					
Mykolayiboblteploenergo (Mykolaiv)	7 / 1,082			19 / 3,029	32 / 4,976	45 / 6,922	57 / 8,869	70 / 10,816					
Vinnytsiamiskteploenergo (Vinnytsia)	8 / 1,789			23 / 5,009	38 / 8,229	52 / 11,449	67 / 14,670	82 / 17,890					
Chernihivteploelectrocentral (Chernihiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator Three: Percentage of households that reported improved quality of service in buildings where IHSs were installed				Each year, at least 80 percent of all respondents in each participating DH company reports better quality of domestic hot water service, more comfortable temperatures in their apartments						Annually	Annual quality of service survey conducted by Minregion	Minregion	This indicator reports how improvements in quality of service are perceived by households that live FOR ONE FULL HEATING SEASON in buildings where IHSs are installed as a part of the project. Usually after one heating season with an IHS, households notice better, more comfortable temperatures within their apartments as well as better domestic hot water service. These qualitative measures will be assessed annually as a part of the quality surveys, included in the Technical Assistance component of the project.
Ivano-Frankivskteplokunenergo (Ivano-Frankivsk)		%	0										
Miskteplovodenerhiya (Kamyanets-Podolsky)													
Kharkivski Teplovi Merezhi (Kharkiv)													
Khersonteploenergo (Kherson)													
Mykolayiboblteploenergo (Mykolaiv)													
Vinnytsiamiskteploenergo (Vinnytsia)													
Chernihivteploelectrocentral (Chernigiv)													
Donetskmiskteplomerezha (Donetsk)													
Dniproteploenerho (Dnipropetrovsk)													
Kirovohradteplo (Kirovohrad)													

PDO Level Results Indicators*	Core	Unit of Measure	Baseline (2013 forecast)**	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator Four: Ratio of total revenues to total operating costs (including debt service requirements)	X	Number								Annually	Semi-annual progress reports of utilities and Minregion	Participating DH companies, Minregion	This indicator evaluates financial viability of participating DH companies. It is estimated as a ratio of total revenues of a company to its total operating costs, including debt service requirements. Total revenues are defined as the sum of total operating revenues and net non-operating income. Net non-operating income is the difference between revenues from all sources other than those related to operations, and expenses, including taxes. Total operating expenses are defined as all expenses related to operations and provision for depreciation. Debt service requirements are defined as the aggregate amount of repayments of debt, including interest and other charges.
Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk)			0.8				≥ 1	≥ 1	≥ 1				
Miskteplovodenerhiya (Kamyans-Podolsky)			0.8				≥ 1	≥ 1	≥ 1				
Kharkivski Teplovi Merezhi (Kharkiv)			0.8				≥ 1	≥ 1	≥ 1				
Khersonteploenergo (Kherson)			0.7				≥ 1	≥ 1	≥ 1				
Mykolayiboblteploenergo (Mykolaiv)			0.8				≥ 1	≥ 1	≥ 1				
Vinnysiamiskteploenergo (Vinnysia)			0.8				≥ 1	≥ 1	≥ 1				
Chernihivteploelectrocentral (Chernigiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

** Any possible compensations of difference between residential tariffs and incurred costs are not taken into account in the forecasts

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator Five: Number of people who gain access to more energy-efficient heat-generating facilities	X	Number	0							Annually	Semi-annual progress reports of utilities and Minregion	Participating DH companies, Minregion	This indicator reports the number of people who gain access to more energy efficient boiler houses. For Kherson, the exact number of people-beneficiaries has been provided by the company. For Ivano-Frankivsk, Kamyanets-Podilsky and Vinnytsia, the number of beneficiaries was estimated as the number of households that will be served by rehabilitated boiler houses (provided by the companies) multiplied by the average household size in a city. For Mykolayv and Kharkiv, the number of beneficiaries was estimated as a share of the total consumers served by the rehabilitated boiler houses, determined by the share of the connected heat load served by the rehabilitated facilities.
Ivano-Frankivskteplokunenergo (Ivano-Frankivsk)				3,350	9,381	15,412	21,443	27,474	33,504				
Miskteplovodenerhiya (Kamyanets-Podolsky)				1,085	3,039	4,992	6,946	8,899	10,852				
Kharkivski Teplovi Merezhi (Kharkiv)				35,556	99,558	163,559	227,560	291,561	355,563				
Khersonteploenergo (Kherson)				4,970	13,917	22,863	31,810	40,756	49,703				
Mykolayiboblteploenergo (Mykolaiv)				8,905	24,934	40,964	56,993	73,022	89,052				
Vinnytsiamiskteploenergo (Vinnytsia)				2,595	7,265	11,936	16,606	21,277	25,948				
Chernihivteploelectrocentral (Chernigiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Indicator Six: Direct Project beneficiaries (for 6 appraised companies)*	X	Number	1,960,705							All residential consumers of participating DH companies are direct project beneficiaries. Hence, this indicator is estimated as the total number of residential consumers served by all participating DH companies.			
of which female	X	%	50										

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

INTERMEDIATE RESULTS

INTERMEDIATE RESULTS													
	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Efficiency of heat generation/ fuel saved due to efficiency gains	X												
Ivano-Frankivskteplokcomunenergo (Ivano-Frankivsk)				0 / 0	0.5% / 844	1.0% / 1,687	1.5% / 2,531	2.0% / 3,375	2.3% / 3,881				
Miskteplovodenerhiya (Kamyanets-Podolsky)				0 / 0	0.1% / 6	0.2% / 12	0.3% / 18	0.4% / 24	0.5% / 30				
Kharkivski Teplovi Merezhi (Kharkiv)				0 / 0	1.0% / 843	3.0% / 2,530	5.0% / 4,216	7.0% / 5,903	8.0% / 6,746				
Khersonteploenergo (Kherson)				0 / 0	1.0% / 1,442	2.5% / 3,605	4.0% / 5,768	5.5% / 7,931	6.4% / 9,229				
Mykolayiboblteploenergo (Mykolaiv)				0 / 0	0.5% / 1,305	1.0% / 2,611	2.0% / 5,221	3.0% / 7,832	4.0% / 10,442				
Vinnytsiamiskteploenergo (Vinnytsia)				0 / 0	0.2% / 887	0.4% / 1,773	0.6% / 2,660	0.8% / 3,546	1.0% / 4,433				
Chernihivteploelectrocentral (Chernigiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR 5	YR 6				
Reduction in network heat losses													
Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk)		Gcal	0	1,253	3,507	5,762	8,016	10,271	12,526	Annually	Semi-annual progress reports of participating utilities and Minregion	Participating DH companies, Minregion	This indicator traces reduction of heat losses due to network rehabilitation as envisioned within the project. It is estimated as the difference between losses in old pipes (defined by old technical characteristics) and losses in the new replacement pipes (defined by new technical characteristics). The indicator reports losses only on replaced segments of the network, but not on the entire network run by a company.
Miskteplovodenerhiya (Kamyanets-Podolsky)				304	852	1,399	1,947	2,494	3,042				
Kharkivski Teplovi Merezhi (Kharkiv)				273	763	1,254	1,744	2,235	2,725				
Khersonteploenergo (Kherson)				194	544	893	1,242	1,592	1,941				
Mykolayiboblteploenergo (Mykolaiv)				307	861	1,414	1,967	2,521	3,074				
Vinnytsiamiskteploenergo (Vinnytsia)				4,109	11,505	18,901	26,297	33,693	41,089				
Chernihivteploelectrocentral (Chernigiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	YR 2	YR3	YR 4	YR5	YR6				
Reduction in residential heat consumption in buildings where IHSs were installed													
Ivano-Frankivskteplokounenergo (Ivano-Frankivsk)				1,028	2,878	4,728	6,578	8,429	10,279				
Miskteplovodenerhiya (Kamyants-Podolsky)				388	1,085	1,783	2,480	3,178	3,875				
Kharkivski Teplovi Merezhi (Kharkiv)				5,124	14,347	23,570	32,793	42,016	51,239				
Khersonteploenergo (Kherson)				61	170	279	388	497	606				
Mykolayiboblteploenergo (Mykolaiv)				762	2,132	3,503	4,874	6,245	7,616				
Vinnytsiamiskteploenergo (Vinnytsia)				1,281	3,588	5,894	8,201	10,507	12,814				
Chernihivteploelectrocentral (Chernihiv)*													
Donetskmiskteplomerezha (Donetsk)*													
Dniproteploenerho (Dnipropetrovsk)*													
Kirovohradteplo (Kirovohrad)*													

* Indicators for the remaining four participating DH companies will be determined soon after Board approval, after their feasibility studies are completed

	Core	Unit of Measure	Baseline	Cumulative Target Values**						Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				YR 1	Y R 2	YR3	Y R 4	Y R 5	Y R 6				
Adoption of the new transitional (from “cost plus” to “incentive-based”) methodologies by the Utilities Regulator			Methodologies not developed/ applied	Methodologies, regulatory accounting forms and auditing principles developed		Methodologies, regulatory accounting forms and auditing principles approved and used				Annually	Semi-annual progress reports of the Utilities Regulator	Utilities Regulator	These indicators trace implementation of the SIDA-World Bank technical assistance to the Utilities Regulator. Successful implementation of the technical assistance will contribute to the sustainability of investments, financed by the project.
Applications of the new transitional methodologies in pilot municipalities by the Utilities Regulator			Methodologies not developed/ applied	Selection criteria for pilot municipalities finalized; potential pilot municipalities are identified		Methodologies, regulatory accounting forms and auditing principles are applied in selected pilot municipalities				Annually	Semi-annual progress reports of the Utilities Regulator	Utilities Regulator	
Sector-wide benchmarking exercise completed by the Utilities Regulator			Benchmarking has not been done	Standardized performance template developed		Country-wide benchmarking exercise completed				Annually	Semi-annual progress reports of the Utilities Regulator	Utilities Regulator	

*Please indicate whether the indicator is a Core Sector Indicator (see further <http://coreindicators>)

**Target values should be entered for the years data will be available, not necessarily annually

Annex 2: Detailed Project Description

UKRAINE: District Heating Energy Efficiency Project

1. The proposed District Heating Energy Efficiency (DHEE) project consists of two components: (i) an energy efficiency investments component; and (ii) a technical assistance and capacity building component. The detailed description and objectives of each component are summarized below.

2. **Component 1: Energy Efficiency Investments (US\$376.5 million: US\$326.5 IBRD and US\$50 million CTF).** This component will increase the efficiency of participating utilities, reduce their costs, enhance the reliability of their services, and improve the quality of heat supply. This component will cover rehabilitation of boiler houses; closure of redundant boiler houses; installation of mini-CHPs; replacement of network pipes with pre-insulated pipes; installation of IHSs in residential buildings; installation of building-level heat meters; and installation of SCADA (supervisory control and data acquisition) management systems to optimize the heat production and supply of participating DH companies. Component 1 includes Clean Technology Fund (CTF) co-financing that will cover installation of IHSs (together with connecting pipes) and building-level heat meters.

3. Component 1 will target DH companies in the following municipalities: Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv, and Vinnytsia. The participating DH companies and municipalities were selected competitively based on governance indicators and financial indicators. Governance indicators included: availability of boiler-level gas and heat meters; prevalence of residential consumption-based billing;⁸ and availability of IHSs and/or readiness to install IHSs. Financial indicators included the cost-recovery level of heating tariffs and the collection rate. All selected DH companies have 100 percent gas meters on their boiler houses, almost all of which have boiler-level heat meters. The average cost recovery of the selected utilities is 70 percent (compared to 60 percent average in Ukraine).

4. The size and details of investment programs have been finalized for the following utilities: Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Mykolayiboblteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). The size of the investment programs was discussed with Ministry of Finance; the investment programs were identified and finalized with the support of the CTF Project Preparation Grant.

5. Based on the discussions of the priority investment programs proposed in the feasibility studies, each assessed DH company identified additional investments that will complement its agreed investment programs and improve its efficiency savings as well as benefit more customers. These additional investments are also included in the project.

6. The size of investment for Donetskmiskteplomerezha (Donetsk) was agreed with the Ministry of Finance; the components of the investment program will be finalized soon after

⁸ Share of residential heat consumption, which is billed according to readings of building-level meters.

Board approval. The DH company is financing a feasibility study with its own funds.

7. The sizes of investment programs were discussed for the following utilities and are pending approval of the Ministry of Finance: Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), and Kirovohradteplo (Kirovograd). The sizes of the investment programs for these utilities will be finalized before negotiations; the details of the investment programs will be finalized soon after Board approval. The investment programs will be identified and finalized with support from Swedish International Development Cooperation Agency's (SIDA) Urban Infrastructure Project (UIP) Grant.

8. The rest of this annex provides a short description of each of the six assessed participating DH companies and their investment programs as well as additional investments included in the project for each of them.

A. Ivano-Frankivskteplokomunenerho (IF-TKE), Ivano-Frankivsk

Table A2.1: Basic Indicators for IF-TKE

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, #	140,000 (approx.)
Number of budgetary consumers, #	229
Number of industrial and commercial consumers, #	273
Total heat sales, Gcal	363,600
Heat sales to households, Gcal	275,700
Heat sales to budgetary institutions, Gcal	72,800
Heat sales to industrial and commercial consumers, Gcal	15,100
Heat Generation Capacity	
Number of boiler houses	35
Installed capacity, boiler houses, Gcal/h	343.0
Installed capacity, total boiler houses and CHP, Gcal/h	347.1
Fuel	Predominantly natural gas
Average age of boiler plants, yrs	17
Pipeline Network and Heat Load Density	
Total length of the district heating network, km	130.7
Total connected load, Gcal/h	205.5
Space heating, Gcal/h	148.1
Domestic hot water, Gcal/h	57.4
Total density of the load, Gcal/h per km	1.57
Technology	
Number of Central Heat Substations (CHSs)	28 operated, 17 owned
Number of Building-level Heat Substations (IHSs)	No modern IHSs
Pre-insulated pipe penetration rate	18.7%
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	281.66
Budgetary consumers	871.63
Industrial and commercial consumers	895.44
Cost Recovery Through Tariff (2012)	
Households	73%

Indicator	Value
Budgetary	
Commercial	
Staffing	
Total staff	770

9. **General Information.** Established in 1996, Ivano-Frankivskteplokunenerho (IF-TKE) is a DH company owned by Ivano-Frankivsk Municipality in western Ukraine. Its main business is production, transport, and supply of heat. IF-TKE's market share in the Ivano-Frankivsk DH market is about 70 percent. The other 30 percent is served by a private DH company operating one large boiler house. The assets operated by IF-TKE are owned by the Municipality.

10. Households are the company's largest consumer of heat, accounting for 76 percent of heat sales. The company produces heat for 539 residential buildings and domestic hot water (DHW) for 371 residential buildings. Budgetary consumers account for 20 percent of heat sales; the share of commercial consumers is 4 percent.

11. With the residential heat tariff still at only about 73 percent of financial cost recovery, the company relies on government subsidies and cross-subsidies from other consumer groups to stay in operation. Over the period 2010-2012, while tariffs for non-residential customers increased by 50 percent, residential tariffs grew by only 10 percent. As a consequence, the company has been incurring operating losses.

12. Previously, the company faced difficulties in paying taxes to the government in a timely manner and accumulated arrears. The company attempted to apply debt restructuring procedures to its arrears. Resolving the arrears issue requires prompt action from the company's management.

13. **Technical Information. Boiler houses and mini-CHP:** IF-TKE operates 35 boiler houses and 5 mini-CHPs based on gas motors. It has about 140 boilers, installed between 1966 and 2013, which vary greatly in size. The largest 28 boilers contribute about 80 percent of the total installed capacity. The most powerful units are also the oldest ones. Extensive maintenance has been required to keep the average efficiency of large boilers at the current level of about 89 percent. Since the break-up of the Soviet Union, no new large boiler plants have been built.

14. The installed capacity of heat-generating equipment is 347.1 Gcal/h, 343 Gcal/h from boilers and 4.1 Gcal/h from mini-CHPs. Electricity produced by the latter is generally used by the company for its own needs, but summertime surpluses are sold to the grid. The major boilers and the mini-CHPs use natural gas. However, three boilers with a total installed capacity of 3.78 Gcal/h in two boiler houses use biomass (wood) fuel.

15. The large boiler houses were automated in the 1970s, such that the control desks located inside the boiler rooms provide control of the main parameters. Only the new, small boiler houses are equipped to operate unmanned (e.g., the rooftop boiler houses, with a total installed capacity of 2.23 Gcal/h).

16. **DH networks:** The company's DH network consists of primary (two-pipe) and secondary (two-pipe and four-pipe) systems, 25-600 mm in diameter. Currently, the total length of the network is 130.7 km. The linear heat load density of IF-TKE is about 1.57 Gcal/h per km, making the DH business sufficiently attractive from an economic standpoint.

17. The average age of the DH networks is 27 years, and 67 percent of the pipelines have been in operation for over 20 years. It is estimated that about 28.6 km of pipelines require immediate replacement. Much of the network is Soviet-built, with pipes laid in concrete channels and insulation materials including mineral wool and sometimes asbestos. The total losses in the network are reported at about 15 percent of heat sales. However, they vary widely for different segments of the network, exceeding 20 percent in several cases and reaching 27 percent in one case.

18. To address the deteriorating condition of its DH network, the company prioritized network replacements using modern pre-insulated pipe technology, including steel pre-insulated and PEX pipes. Currently 24.5 km of networks have been replaced with pre-insulated pipes, corresponding to 18.7 percent of the total network length.

19. **Heat substations and building connections.** For space heating purposes, buildings are connected to the DH network in three different ways: (i) via central heat substations (CHSs); (ii) directly to the DH network using ejector pumps (hydro elevators); and (iii) via old-type "IHSs" with tube heat exchangers and no automation.

20. In the first case, heat exchangers at CHSs separate the primary two-pipe network water from the secondary DHW and space heating networks. In the case of direct connection of the building to the DH network, DHW is prepared at a CHS while hot water for space heating is passed through to the building. IHSs are connected to the primary two-pipe DH network, with hot water for both heating and domestic use prepared separately in the building.

21. Historically, the IHS option has been viewed by the company as an option to be applied in exceptional circumstances. The company is interested in applying modern automated IHS technology and is in the process of resolving regulatory barriers with the Municipality.

22. **Priority Investment Program Financed by the Project.** The agreed investment program focuses on rehabilitating a boiler house serving about 40 percent of all utility customers; installing a SCADA system at the rehabilitated boiler house; and rehabilitating heat transmission and distribution networks as well as improving operational efficiency throughout the DH supply chain. Rehabilitation of the networks is the largest component. The company will install 240 IHSs, together with building-level heat meters, and close all CHSs currently connected to the boiler house that will be rehabilitated.

23. Rehabilitation of one of the biggest boiler houses operated by the utility will lead to gas, electricity, water, O&M, and staff savings. Installing SCADA in the rehabilitated boiler house will lead to additional gas, electricity, and staff savings. These investments will be accompanied by replacing the oversized and rapidly deteriorating heat transmission networks with pre-insulated pipes of appropriate diameter; this investment will generate savings on fuel costs due to

drastically reduced network losses and leakages. All buildings connected to the rehabilitated boiler house will be equipped with modern IHSs and building-level heat meters. Installation of IHSs in buildings, coupled with the SCADA installation, will increase the efficiency of heat supply by enabling variable flow operation of the DH system and demand response by consumers. IF-TKE is in the process of solving regulatory issues concerning IHS installation with the Municipality.

24. Table A2.2 describes the investment program for Ivano-Frankivskteplokomunenergo to be financed by the project:

Table A2.2: Investment Program for Ivano-Frankivskteplokomunenergo

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Rehabilitation of a boiler house	Replacement of 13 burners in 3 boilers; full automation of the boilers; full replacement of pumps and air fan motors	The initial investment outlay is recovered through savings on the costs of fuel, O&M and staff; reduced electricity consumption and water	6,856	6,856		6,856
2. SCADA	Installation of SCADA systems in rehabilitated boiler house	Savings on O&M (primarily labor), fuel and electricity costs	552	552		552
3. Rehabilitation of the DH network	Insulation of above-ground DH network pipes connected to 18 boiler houses	Savings on fuel costs due to reduced losses in the DH networks	10,261	10,261		10,261
4. IHSs Installation; building-level heat meters	Installation of 240 IHSs with building-level heat meters; closure of all CHSs connected to the rehabilitated boiler house	Savings due to reduced heat consumption by matching building-level heat demand with heat supply	7,313		7,313	7,313
5. Implementation support			1,277	1,277		1,277
TOTAL			26,259	18,936	7,313	26,259

B. Miskteplodenerhiya (KP-MTE), Kamyanets-Podilsky

Table A2.3: Basic Indicators for KP-MTE

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, #	61,900
Number of budgetary consumers, #	50
Number of industrial and commercial consumers, #	172
Total heat sales, Gcal	176,566
Heat sales to households, Gcal	140,950

Indicator	Value
Heat sales to budgetary institutions, Gcal	32,976
Heat sales to industrial and commercial consumers, Gcal	2,640
Heat Generation Capacity	
Number of boiler houses	9
Installed capacity, boiler houses, Gcal/h	127
Installed capacity, total boiler houses and CHP, Gcal/h	259
Fuel	Predominantly natural gas
Average age of boiler plants, yrs	22
Pipeline Network and Heat Load Density	
The total length of the district heating network, km	62.5
The total connected load, Gcal/h	97.3
Space heating, Gcal/h	88
Domestic hot water, Gcal/h	9.3
The total density of the load, Gcal/h per km	1.56
Technology	
Number of Central Heat Substations (CHSs)	23
Number of Building-level Heat Substations (IHSs)	None
Pre-insulated pipe penetration rate	7.3%
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	243.37
Budgetary consumers	962.56
Cost Recovery Through Tariff (2012)	
Households	51%
Budgetary	
Commercial	
Staffing	
Total staff	860

25. **General Information.** With a population of about 100,000, the town of Kamyans-Podilsky is the smallest of the project cities. Miskteplovodenerhiya of Kamyans-Podilsky (KP-MTE) is a municipal services company whose main business is DH, combined with the provision of water and wastewater services. Ownership by the Kamyans-Podilsky Municipality was established in 2002. From 2004 to 2010, the company was rented out to a private operator but since February 2010, it has been back under municipal management. The company is the only DH provider in Kamyans-Podilsky. Households are the largest consumers of heat generated by KP-MTE, with an 80 percent share of heat sales, followed by budgetary consumers (19 percent); the share of commercial consumers is small (1 percent). At least one-half of the heat generated by KP-MTE comes from an old CHP plant originally built as a source of heat and electricity for a now-defunct sugar factory. In its present condition, the oversized CHP is making large operating losses. As a source of heat for the city, the location of the CHP is problematic due to distance.

26. In recent years, the company has made significant advances in terms of technological modernization of its central monitoring and dispatch system (SCADA), allowing it to improve operational efficiency and reduce staff.

27. **Technical Information. Boiler houses and CHP:** connected load of the system, which stands at about 97 Gcal/h (88 Gcal/h for heat and 9 Gcal/h for hot water).
28. The CHP operated by the company has 132 Gcal/h of total installed thermal capacity and 12 MW electric. Electricity produced by the CHP is generally supplied for the company's own production needs. All boilers use natural gas. The CHP may also use heavy fuel oil as a reserve fuel.
29. The age of the boilers is 22 years on average but varies widely, with the four largest boilers at the CHP being the oldest. These units require extensive maintenance to keep their nominal average efficiency at about 90 percent. Newly constructed boilers are efficient but relatively small in size.
30. The company's SCADA system holds promise for improved efficiency in the future. Production control is partly dispatched. Main data about heat production and gas consumption are downloaded to the central dispatch point at the boiler house at the company's headquarters. The data on water and electricity consumption are also downloaded automatically, but not from all heating sources. Several new modular boiler houses built by the company will be fully automated and remotely dispatched, eliminating the need for permanent operators on each site.
31. In the past, asbestos has been used for insulation inside boilers as well as in the heat distribution networks, creating environmental and health safety risks that will need to be addressed.
32. **DH networks and heat substations:** The DH network of KP-MTE consists of main (two-pipe) and distribution (two-pipe and four-pipe) systems with diameters of 50-600 mm. The total length of the DH network is 62.5 km. The linear heat load density of KP-MTE is about 1.56 Gcal/h per km, making the DH business potentially attractive from an economic standpoint.
33. Ninety-three percent of the network's pipelines are "Soviet Type" insulated pipes, mostly underground, in concrete channels. Pipes are insulated using asbestos-based mortar, glass wool, or mineral wool, with bitumen board coating. The company has started to use pre-insulated polyurethane pipes in new pipeline installations.
34. KP-MTE operates 23 units of CHS, all of them used for DHW preparation. The majority of them (21) are also used to pump cold water to customers. Outside the CHS network, the company supplies DHW directly to buildings equipped with building-level DHW preparation devices. There are 43 units of such installations in the city, sometimes referred to as "IHSs." However, the lack of in-building heat exchangers for space heating and the absence of automation or metering make this technology inferior to that of modern IHSs.
35. Heat losses in the company's networks are estimated to be at least 20 percent due to the age of and outdated technology used in the majority of the networks.

36. **Priority Investment Program Financed by the Project.** The agreed investment program of KP-MTE focuses on the closure of the loss-making CHP and reconnection of its customers to newly constructed, rehabilitated, or existing boiler houses; connecting the newly constructed and rehabilitated boiler houses to the existing SCADA system; reducing losses in heat distribution; and improving the efficiency of DH supply and distribution. The company will install 83 IHSs, together with building-level heat meters.

37. The closure of the CHP and construction of two new boiler houses is the largest component, which will lead to large savings on the costs of fuel, O&M, and staff, as well as decreased network losses. Connecting the newly constructed and rehabilitated boiler houses to SCADA will lead to additional gas, electricity, and staff savings. This will be accompanied by replacing the oversized heat transmission networks with pre-insulated pipes of appropriate diameter. All buildings that consume both DHW and heat provided by the newly constructed boiler houses will be equipped with modern IHSs and building-level heat meters. KP-MTE is in charge of servicing and maintaining the internal building DH infrastructure and hence has the right to install and service IHSs in buildings.

38. Table A2.4 describes the investment program for Miskteplvodenerhiya to be financed by the project:

Table A2.4: Investment Program for Miskteplvodenerhiya

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Closure of a loss-making CHP; construction of two new boiler houses; rehabilitation of 1 boiler house	Closure of a CHP which is loss-making due to over-installed capacity and overstaffing; construction of two new boiler houses and reconnecting CHP consumers to new and existing boiler houses; installation of 2 burners on existing new boilers	Savings on the costs of fuel; O&M; decreased network losses; improved efficiency of heat supply due to increased connected load; reduced staff costs because of the CHP closure	6,601	6,601		6,601
2. SCADA	Full automation of the new boiler houses with SCADA; construction of a control room	Savings on O&M, staff, fuel and electricity costs	552	552		552
3. DH network rehabilitation	Replacement of existing oversized primary heat transmission network with smaller diameter, pre-insulated pipes (1.89 km)	Savings on fuel costs due to reduced losses in the DH networks	1,673	1,673		1,673
5. IHSs installation; building-level heat meters	Installation of 83 IHSs with building-level heat meters	Savings due to reduced heat consumption by matching building-level heat demand with heat supply	2,000		2,000	2,000

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
6. Implementation support			1,434	1,434		1,434
TOTAL			12,260	10,260	2,000	12,260

C. Kharkivski Teplovi Merezhi (KTM), Kharkiv

Table A2.5: Basic Indicators for KTM

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, #	1,331,000
Number of budgetary consumers, #	5,113
Number of industrial and commercial consumers, #	455
Total heat sales, Gcal	4,807,506
Heat sales to households, Gcal	4,166,221
Heat sales to budgetary institutions, Gcal	429,273
Heat sales to industrial and commercial consumers, Gcal	212,012
Heat Generation Capacity	
Number of boiler houses	224
Installed capacity, boiler houses, Gcal/h	4,073
Installed capacity, total boiler houses and CHP, Gcal/h	7,235
Fuel	Predominantly natural gas
Pipeline Network and Heat Load Density	
The total length of the district heating network, km	1,594
The total connected load, Gcal/h	2,280
Space heating	1,237
Domestic hot water	1,043
The total density of the load, Gcal/h per km	1.430
Technology	
Number of Central Heat Substations (CHSs)	123
Number of Building-level Heat Substations (IHSs)	5
Pre-insulated pipe penetration rate	7.0%
Average age of boiler plants, boilers and networks, years	50
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	304.03
Budgetary consumers	899.94
Industrial and commercial consumers	899.94
Cost Recovery Through Tariff (2012)	
Households	87.0%
Budgetary	
Commercial	
Staffing	

Indicator	Value
Total staff	7,272
Managers/specialists	1,867
Workers	4,648
Others	756

39. **General Information.** Construction of the DH system in Kharkiv started in the early 1930s, making it one of the oldest in Eastern Europe. The centralized DH zone is formed as a joint thermal network interconnecting 80 percent of its heat-generating capacities. Outside the DH zone, thermal energy is provided by local and residential boiler houses serving one or more blocks, as well as basement boiler houses within one or more buildings.

40. **Kharkivski Teplovi Merezhi (KTM)** is a municipal heating company resulting from a merger in 2001 between the PO “Kharkovteploelectrocentral” and OPO “Kharkoveteploenergo.” The former company operated large heat-only boiler (HOB) and CHP production units while the latter operated hundreds of small boiler houses. The current integrated company belongs to Kharkiv municipality. The founder of the company is Kharkiv City Council; the company reports directly to the Department of the Municipal Property of the Kharkiv City Council.

41. The total heat generation capacity of the combined company was 4,073 Gcal/h in 2012. The company is the second largest DH provider in Ukraine and the largest DH supplier in Kharkiv. The company provides about 73 percent of the centrally supplied heat in the city. Another major heat producer is CHP-5, with a share of about 26 percent. Heat produced by CHP-5 is purchased by KTM and supplied to end-users through its heat networks. The remaining 1 percent of the city’s total heat demand is met by small, local, industrial boiler houses.

42. Households are the biggest consumers of heat generated by the company, with an 87 percent share of heat sales. The remaining 13 percent is divided between budgetary, industrial, and commercial consumers.

43. **Technical Information. CHP and Boiler houses:** The total installed heating capacity of the company’s heat-only boilers is 4,073 Gcal/h, and 7,235 Gcal/h when CHPs are included. The company uses natural gas as fuel, except for one small (0.25 Gcal/h) coal-fired boiler. There are 224 heat generating facilities connected to Kharkiv’s DH network. Installed capacity of the units varies widely, but the heat production capacities of the 10 largest units, which represent 86 percent of the total connected heating load (excluding CHP-5’s load), fall within the range of 10-470 Gcal/h.

44. The most powerful heat generation units are CHP-3 (1,353 Gcal/h) and CHP-4 (825 Gcal/h), followed by three large district boiler houses (780 Gcal/h, 300 Gcal/h, and 400 Gcal/h).

45. As construction of Kharkiv’s DH system started more than 80 years ago, many technical solutions for boiler plants, pipelines, and heating and water supply networks in buildings are based on outdated norms. Since the break-up of the Soviet Union, no large new boiler plants have been built. Major units were built between 1933 and 1989. The average age of boilers \geq 50 Gcal/h, which represent 83 percent of total installed capacity, is 51 years. Although the boiler plant equipment is rather well maintained, much of it is very near the limit of its operational life.

46. The nominal average efficiency of the larger boiler plant units is relatively good, at 90 percent. Newly constructed boilers are fairly efficient but small. Old, small boilers have the weakest efficiencies, bringing the overall average efficiency of the company's boilers to about 85 percent.

47. At CHP-3, the company has invested in a new backpressure steam turbine (type PT-20 with capacity of 20 MWe and 80 Gcal/h), but construction has been disrupted by a lack of funding. The mechanics of the turbine have been completed, but electrification, automation, and some piping works remain unfinished. The company estimates that about 60 percent has been completed, and the time required from project restart to commissioning is 1-1.5 years.

48. KTM has installed a centralized remote monitoring system for monitoring main measurements and status information connected to the DH network of major boiler houses, CHSs, and pumping stations. The system uses GSM-connections between substations and monitoring stations. The current system works for monitoring purposes only. The company intends to upgrade the system from its current monitoring mode to a control and operation mode using modern SCADA technology.

49. ***DH networks and heat substations:*** The age of the networks roughly corresponds to the age of the boiler plants. No new large diameter pipelines have been erected in a long time. The supply chain from production to consumption is below modern technology standards and largely based on manual operation.

50. The DH networks of the company consist of main transmission (two-pipe) and distribution (two-pipe and four-pipe) networks with diameters from 40-1220 mm. The total length of the heat network is 1,594 km in two-pipe equivalent. Pre-insulated pipes have not yet been applied on a substantial scale, with most of the network utilizing underground pipes in concrete channels or above-ground pipes insulated with mineral wool. Ninety-three percent of the pipeline are "Soviet Type" insulated pipes, of which 91 percent are underground pipes in concrete channels and 9 percent are above-ground, mineral wool, insulated pipes covered with metal plate. The company has started to use pre-insulated polyurethane pipes in new pipeline installations.

51. Heat transmission and distribution to end-users is carried out with three different configurations: (i) directly-connected buildings equipped with ejectors or pumps; (ii) buildings connected via CHSs; and (iii) buildings with IHSs. The latter group of buildings is very small at present, while there are about 123 CHSs for heat and DHW.

52. Heat losses in the company's networks are estimated at 19 percent of the total heat generated. Pipeline damage is an increasing concern, especially in the DHW network.

53. KTM's linear heat load density is about 1.43 Gcal/h per km, excluding CHP-5, which is not owed by the company. If CHP-5 is included, KTM's heat load density is 2.437 Gcal/h per km, making the DH business attractive from an economic standpoint.

54. **Priority Investment Program financed by the Project.** The proposed investment program focuses on modernizing the DH system, improving the efficiency of DH supply, and reducing losses in heat distribution. Twenty-two boiler houses will be closed, with part of their load connected to other sources of supply. The closure of redundant and inefficient boiler houses will be accompanied by rehabilitation and upgrade of 52 other boiler houses. Renovation of boiler houses, rehabilitation of main network pipelines with the introduction of pre-insulated pipes, and installation of IHSs are the three largest components of the proposed investment program.

55. Overall, 300 IHS units are expected to be installed, so that hot water will be prepared in buildings instead of in CHSs, as is currently the case. KTM is in charge of servicing and maintaining the internal building DH infrastructure and hence has the right to install and service IHSs in buildings. To achieve comprehensive operating improvements throughout the system, SCADA will be installed in all boiler houses operated by the company, frequency converters for main network pumps will be installed, and temperature and pressure sensors will be included throughout the network. Overall, a total of 288 boiler houses will be equipped with SCADA and 1,000 heat meters will be installed in all areas of the city. The efficiency of the heat and electricity generation capacity will be improved by introducing new steam turbine capacity at CHP-3 and supplying waste heat to the DH network. The introduction of a mini-CHP operating in base load mode will produce electricity cost savings.

56. Table A2.6 describes the investment program for Kharkivski Teplovi Merezhi to be financed by the project:

Table A2.6: Investment Program for Kharkivski Teplovi Merezhi

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Closure of boiler houses	Closure of 22 boiler houses and connection of most of their loads to other sources of supply	Savings on gas, electricity, staffing, water	2,396	2,396		2,396
2. Rehabilitation of boiler houses	Renovation of 52 boiler houses	Energy and other savings due to improved efficiency of boiler houses	22,129	22,129		22,129
3. CHP-3	Completion of construction and automation of the 20MW steam turbine generator at CHP-3	The additional base-load heat output from CHP 3 will decrease the need for purchasing heat from external sources and improve the system efficiency	8,280	8,280		8,280

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
4. Mini-CHP	Two units of mini-CHPs with a capacity of 2MW each	Savings on purchased electricity costs due to lower cost of generation on-site	7,535	7,535		7,535
5. Rehabilitation of pipes	Renovation of 8.8 km of main pipeline network	Savings on fuel costs due to reduced losses in the DH networks	20,892	20,892		20,892
6. Frequency converters	Frequency converters for main network pumps	Energy and water savings due to more efficient operation of main network pumps	3,726	3,726		3,726
7. SCADA	A total of 288 boiler houses will be equipped with SCADA and temperature and pressure sensors will be added to the network system	Primarily labor savings due to the automation of boiler house monitoring and control	16,560	16,560		16,560
8. IHS installation, building-level heat meters	300 IHSs with building-level heat meters will be installed in several areas of the city	Energy savings due to more efficient heat supply to buildings and reduced heat network losses	10,805		10,805	10,805
9. Control systems installation	1,000 control units (three way valve + circulation pump + building-level heat meter) for buildings which are directly connected to the main network	Energy savings due to more efficient heat supply to buildings	11,730	11,730		
10. Implementation support			3,519	3,519		3,519
TOTAL			107,572	96,767	10,805	107,572

D. Khersonteploenerho (KTE), Kherson

Table A2.7: Basic Indicators for KTE

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, # persons	96,890
Number of budgetary consumers	223
Number of industrial and commercial consumers	391
Total heat sales, Gcal	282,814
Heat sales to households, Gcal	232,859
Heat sales to budgetary institutions, Gcal	39,872
Heat sales to industrial and commercial consumers, Gcal	10,083
Heat Generation Capacity	
Number of boiler houses	38
Installed capacity, Gcal/h	563
Fuel	Natural gas
Pipeline Network and Heat Load Density	
The total length of the district heating network, km	97
The total connected load, Gcal/h	170
Space heating	166
Domestic hot water	4
The total density of the load, Gcal/h per km	1.75
Technology	
Number of Central Heat Substations (CHSs)	46
Number of Building-level Heat Substations (IHSs)	None
Pre-insulated pipe penetration rate	4.6%
Average age of boiler plants, boilers and networks, years	25
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	314.36
Budgetary consumers	897.42
Industrial and commercial consumers	908.77
Cost Recovery Through Tariff (2012)	
Households	72.0%
Budgetary consumers	94.7%
Industrial and commercial consumers	
Staffing	
Number of staff	673

57. **General Information.** Khersonteploenerho is a municipal DH company producing, transporting, and selling heat in Kherson. The company provides about 50 percent of the DH in the city. The Kherson CHP plant is another major heat producer, with a share of about 47 percent. The remaining 3 percent is supplied by a small private company, Teplogeneratsia.

58. Household consumers are KTE's main customers, accounting for 82 percent of thermal energy used, followed by budgetary institutions (14 percent) and commercial enterprises (4 percent).

59. KTE was established in 2001 as the result of a merger of the existing DH company with some smaller industrial heat producers. The company is owned by the Kherson Municipality and has full operating management rights for the assets. The assets and their depreciation are included on the company's balance sheet. The company has 673 staff members.

60. Construction of Kherson's DH system started more than 40 years ago. The main technology and solutions for construction of boiler plants, pipelines, and heating and water service networks in buildings are based on the technical norms of the former Soviet Union. The average age of boiler plant equipment and networks is about 20 years, with the major units built between 1978-1997. Since the collapse of the Soviet Union, no new large boiler plants have been built. Only some small boilers (< 0.3 Gcal/h) have been recently constructed.

61. KTE receives different tariff rates for households, budgetary institutions, and other customers. The residential heat tariffs set at the beginning of 2013 are about 72 percent of the full financial cost-recovery level. Due to this, the company is operating at a loss, requiring support from municipal and regional budgets. In 2010-2013, tariffs grew by 50 percent for budgetary consumers, by 51 percent for commercial and industrial consumers, but by only 10 percent for households. This tariff adjustment practice increases the cross-subsidy across consumer groups.

62. **Technical Information. Boiler houses:** Heat demand is met by 38 gas-fired boiler houses with a total installed capacity of 563 Gcal/h. The majority of boiler houses operated by KTE are relatively small, with a capacity of 5 Gcal/h or less; however, there are a few boiler houses with capacities of 25 Gcal/h and larger. The largest boiler house is designed for 50 Gcal/h. The ages of the boilers differ widely, with some 25 years and older. The average efficiency of boilers is relatively low (89 percent), although some smaller and relatively new boilers are quite efficient.

63. **DH networks and heat substations:** The length of the DH network is 97 km in two-pipe equivalent; the linear heat load density of KTE is about 1.75 Gcal/h per km, which is considered acceptable for a DH system to be competitive. The heat distribution technology currently utilized by KTE is based on CHS, with no modern IHSs installed. The company operates 46 CHSs. Hot water is produced by six boiler houses, only during the heating season, except for one boiler house that produces hot water outside the heating season. Elsewhere, households produce hot water by individual electrical boilers. In addition to the CHSs, direct connections to buildings are used. The load connected to CHSs is 116 Gcal/h, 68 percent of the total connected load (170 Gcal/h); direct connections comprise the other 32 percent. KTE has renovated five CHSs with modern sub-central units (modern plate heat exchangers, pumps, automation etc.).

64. A four-pipe system is in use only in one CHS where KTE supplies hot water. The two-pipe system supplying heat only is used elsewhere. Pre-insulated pipe has not yet been applied on a substantial scale, with most of the network utilizing underground pipes in concrete channels or above-ground pipes insulated with mineral wool. Ninety-five percent of the pipeline are "Soviet Type" insulated pipes, of which 65 percent are underground pipes in concrete channels and 35 percent are above-ground, mineral wool, insulated pipes covered with metal plate. The

company has started to use pre-insulated polyurethane pipe in new pipeline installations. The current share of pre-insulated pipes is 4.6 percent of the total length. Estimated heat losses in the network are 45,000 Gcal per year.

65. **Priority Investment Program Financed by the Project.** The proposed investment program focuses on modernizing the DH system, improving the efficiency of DH supply, and reducing losses in heat distribution. Renovation of boiler houses is the largest component. The company will install 21 IHSs and 200 building-level heat meters and will introduce a SCADA system. KTE is in the process of solving regulatory issues concerning IHS installation with the Municipality.

66. Renovation of boiler houses will achieve major savings on O&M, fuel, and electricity costs. The proposed investment program focuses on renovation of two boiler houses including the largest boiler house in the Shumensky district of the city, and closure of inefficient boiler houses. This will be accompanied by the construction of some new pipelines to redirect the heat supply to the newly renovated heat-generation capacities as well as rehabilitation of the old networks connected to the renovated boiler houses. The existing pipeline network will be replaced with new pre-insulated pipes; this will generate savings on fuel costs due to reduced network losses. Equipping boiler houses with SCADA will lead to major savings on operating costs. Installation of IHSs in residential buildings will reduce their heat consumption; installation of heat meters will increase the share of consumption-based billing of residential consumption to almost 100 percent in Shymensky.

67. Table A2.8 describes the Khersontploenerho Priority Investment Program financed by the project:

Table A2.8: Investment Program for Khersontploenerho

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Closure of boiler houses / DH connection pipeline/ DH pipe rehabilitation	Closure of 4 boiler houses, and connection of pipes to meet the demand previously served by the boiler houses; renovation of 2 large pipes (6.6km)	Labor, O&M, and gas savings due to closure of inefficient boiler houses; additional savings due to reduced losses in the renovated portion of the DH pipe systems	4,241	4,241		4,241
2. Boiler houses rehabilitation, including:	Renovation of 2 large boiler houses	Savings on O&M and fuel due to renovated boiler houses	12,366	12,366		12,366
2.1. Rehabilitation of major CHSs connected to rehabilitated boiler houses (where IHSs are not installed)	Renovation of 4 CHSs	Savings from improved CHSs' operational efficiency; utilizing benefits from boiler house rehabilitation	475	475		475

Component No. and Name	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
3. IHSs installation, building-level heat meters	Installation of 21 IHSs, and 200 meters	Savings due to reduced heat consumption by matching building-level heat demand with heat supply; more accurate billing	1,648		1,648	1,648
4. SCADA	Installation of SCADA systems in 26 boiler houses	Primarily labor savings due to automation of boiler house monitoring and control	1,683	1,683		1,683
5. Maintenance and equipment	Purchase of 1 crane and 1 excavator		345	345		345
6. Implementation support			897	897		897
TOTAL			21,655	20,007	1,647	21,655

E. Mykolaivoblteploenerho (MOTE), Mykolaiv

Table A2.9: Basic Indicators for MOTE

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, #	189,776
Number of budgetary consumers, #	329
Number of industrial and commercial consumers, #	600
Total heat sales	597,039
Heat sales to households, Gcal	503,342
Heat sales to budgetary institutions, Gcal	75,926
Heat sales to industrial and commercial consumers, Gcal	17,771
Heat Generation Capacity	
Number of boiler houses	123
Installed capacity, Gcal/h	623
Fuel	Natural gas
Pipeline Network and Heat Load Density	
The total length of the district heating network, km	209
The total connected load, Gcal/h	348
Space heating	
Domestic hot water	
The total density of the load, Gcal/h per km	1.665
Technology	
Number of Central Heat Substations (CHSs)	72
Number of Building-level Heat Substations (IHSs)	none
Pre-insulated pipe penetration rate	6.3%
Average age of boiler plants, boilers and networks, years	28

Indicator	Value
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	269.95
Budgetary consumers	880.38
Industrial and commercial consumers	951.62
Cost Recovery Through Tariff (2012)	
Households	79.6%
Budgetary consumers	93.1%
Industrial and commercial consumers	
Staffing	
Number of staff during heating period	1,287
Number of staff during non-heating period	822

68. **General Information.** Mykolaivoblteploenerho produces, transports, and sells heat in Mykolaiv City. The company is in joint ownership of Mykolaiv City Municipality (60 percent) and Mykolaiv region (40 percent). The market share of Mykolaivoblteploenerho (MOTE) in Mykolaiv is about 75 percent; the remaining 25 percent of DH in the city is provided by the Mykolaiv CHP. About half of CHP's heat supply is transported through MOTE's heat networks. In 2012, the company had 1,287 staff members during the heating period and 822 staff members during the non-heating period.

69. MOTE was founded on the basis of joint property of villages, settlements, and towns in Mykolaiv region. Pursuant to the decision of Mykolaiv Regional Council,⁹ the company is managed by Mykolaiv Regional State Administration (Department of Housing and Utility Infrastructure). The Company Director is appointed by the Order of the Head of the Regional Administration and exercises his power on the basis of a contract signed between the Company Director and Mykolaiv Regional State Administration.

70. MOTE operates assets that are in the ownership of the Mykolaiv Municipality and Mykolaiv region. The municipality's assets have been transferred to MOTE on the right of the full operating management; the assets owned by Mykolaiv region are rented to the company for a symbolic price of UAH 1/annum. All assets are included in MOTE's balance sheet and the company calculates depreciation on these assets.

71. Construction of the DH system in Mykolaiv started more than 45 years ago. The main technology and solutions for construction of boiler houses, pipelines, and heating and water service networks in buildings are based on old Soviet norms and standards. The average age of boiler plants, boilers, and networks is about 28 years; the age of the networks corresponds to the age of the boiler plants. Since the collapse of the Soviet Union, no new large boiler houses have been built; only new, small boilers have been recently constructed.

72. MOTE's heat supply chain is below modern technology standards and is based on manual operation, resulting in high losses in fuel and electricity use. At present, MOTE does not

⁹ Decision No. 16 dd. 26.10.2000 On Management of Property in Common Ownership of Territorial Communities of Mykolaiv Oblast.

have CHP plants. The main products of the company are space heating, DHW, cold water booster pumping, and DH water transmission for the CHP company. Household consumers are MOTE's main customers (84 percent of total heat sales), followed by budgetary institutions (13 percent) and commercial consumers (3 percent).

73. Tariffs for heating and hot water supply are set separately for each customer group. The tariffs are approved centrally by the Utilities Regulator and do not fully cover the cost of production, transportation, and supply of heat. As of January 1, 2013, MOTE's cost-recovery level of approved heating tariffs for households was 79.6 percent, and 93.1 percent for budgetary, industrial, and commercial consumers. In 2012, revenues of the company from heat sales covered only 83.5 percent of incurred costs.

74. **Technical Information. Boiler houses:** Heat demand is met by 123 gas-fired boiler houses with a total installed capacity of 623 Gcal/h. The vast majority of boiler houses operated by MOTE are relatively small, with a capacity of 5 Gcal/h or less; a few boiler houses have a capacity of 25 Gcal/h and larger. DH for customers is generated in water boilers and steam boilers (7 units). The major units were constructed between 1968-1977.

75. **DH networks and heat substations:** The length of the DH network is 209 km; MOTE's linear heat load density is about 1.7 Gcal/h per km, which is considered acceptable for a DH system to be competitive. The heat distribution technology currently utilized by MOTE is based on CHSs, with no IHSs installed. The company operates 72 CHSs commissioned between 1966-2004. The company has renovated seven of them with modern sub-central units (modern plate heat exchangers, pumps, automation, etc.). All modernized CHSs are connected to the company's centralized remote control system.

76. Pre-insulated pipes have not yet been applied on a substantial scale, with most of the network utilizing underground pipes in concrete channels or above-ground pipes insulated with mineral wool. Ninety-four percent of the pipeline are "Soviet Type" insulated pipes, of which 69 percent are underground pipes in concrete channels and 31 percent are above-ground, mineral wool, insulated pipes covered with metal plate. The company has started to use pre-insulated polyurethane pipe in new pipeline installations. The current share of pre-insulated pipes is 6.3 percent of the total length.

77. **Priority Investment Program Financed by the Project.** The proposed investment program focuses on modernizing the DH system, improving the efficiency of DH supply, and reducing losses in heat distribution. Renovation of boiler houses is the largest component. The company will install 93 IHSs and introduce a SCADA system. MOTE is in the process of solving regulatory issues concerning IHS installation with the Municipality.

78. Renovation of boiler houses will achieve major savings on O&M, fuel, and electricity costs. A number of small boiler houses with outdated technology will be closed, with the customer loads switched to supply from other sources, such as the CHP plant. In the process of switching, additional pipeline network will be installed based on new pre-insulated pipe technology. Insulation of above-ground pipes will create savings on fuel costs due to reduced network losses. Equipping boiler houses with SCADA will lead to major savings on operating

costs. Much of the operation in the renovated boiler houses will require only a small number of staff. Installation of IHSs in residential buildings will reduce their heat consumption.

79. Table A2.10 describes the Mykolaivoblteploenerho Priority Investment Program financed by the project.

Table A2.10: Investment Program for Mykolaivoblteploenerho

Component	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Closure of boiler houses/ connection pipes	Closure of 19 small boiler houses and connection of most of their loads to the heat supply network of existing CHP plant	The initial investment outlay is recovered through savings on the costs of fuel and O&M which are generally higher than the price of heat purchased from the CHP.	2,454	2,454		2,454
2. Rehabilitation of boiler houses, including:	Renovation of 31 boiler houses	Savings on O&M, fuel and electricity costs	10,611	10,611		10,611
2.1. Rehabilitation of major CHSs connected to rehabilitated boiler houses (where IHSs cannot be installed)	Modernization of 4 major CHSs	Savings from improved CHS operational efficiency; utilizing benefits from boiler house rehabilitation	584	584		584
3. IHSs installation; building-level heat meters	Installation of 93 IHSs	Savings due to reduced heat consumption by matching building-level heat demand with heat supply	2,384		2,384	2,384
4. Insulation of pipes	Insulation of above-ground DH network pipes connected to 18 boiler houses	Savings on fuel costs due to reduced losses in the DH networks	1,238	1,238		1,238
5. SCADA	Installation of SCADA systems in 31 boiler houses	Savings on O&M (primarily labor), fuel and electricity costs	2,427	2,427		2,427
6. Maintenance and equipment	Purchase of 3 emergency & maintenance vehicles		1,078	1,078		1,078
7. Implementation support			1,021	1,021		1,021
TOTAL			21,797	19,414	2,384	21,797

F. Vinnytsiamiskteploenergo (VMTE), Vinnytsia

Table A2.11: Basic Indicators for MOTE

Indicator	Value
Customer Base, Heat Sales (2012)	
Population served, #	184,000
Number of budgetary consumers, #	247
Number of industrial and commercial consumers, #	376
Total heat sales, Gcal	724,688
Heat sales to households, Gcal	613,692
Heat sales to budgetary institutions, Gcal	85,735
Heat sales to industrial and commercial consumers, Gcal	25,262
Heat Generation Capacity	
Number of boiler houses	39
Installed capacity, Gcal/h	694
Fuel	Natural gas
Pipeline Network and Heat Load Density	
The total length of the district heating network, km	206.4
The total connected load, Gcal/h	440.4
Space heating	367
Domestic hot water	73.4
The total density of the load, Gcal/h per km	2.13
Technology	
Number of Central Heat Substations (CHSs)	83
Number of Building-level Heat Substations (IHSs)	None
Pre-insulated pipe penetration rate	14.0%
Average age of boiler plants, boilers and networks, years	20
Heat Tariffs, UAH/Gcal (including VAT, as of January 1, 2013)	
Households	234.59
Budgetary consumers	777.77
Industrial and commercial consumers	777.77
Cost Recovery Through Tariff (2012)	
Households	80.0%
Budgetary consumers	92.0%
Industrial and commercial consumers	
Staffing	
Total number of staff	962

80. **General Information.** Vinnytsiamiskteploenergo (VMTE) produces, transports, and sells heat in the city of Vinnytsia. The company was founded in 2002 as a city utility company subordinated to the City Council. VMTE produces about 90 percent of all centrally supplied heat in the city. Two other heat producers, Oblteploenergo and private company Mayak, provide the remaining 10 percent. VMTE is owned by the Vinnytsia Municipality and has full operating management rights for the assets. The assets and their depreciation are included on the company's balance sheet.

81. Most of the operating assets of the company were built during the Soviet era. The main technology and solutions for construction of boiler houses, pipelines, and heating and water service networks in buildings are based on outdated norms and standards.

82. Household consumers are VMTE's main customers (85 percent of total heat sales), followed by budgetary institutions (12 percent) and commercial consumers (3 percent).

83. Under the current tariff policy, the government subsidizes heat energy consumers, including households, from state and local budgets, in part of payments for heat energy. As of January 1, 2013, according to the data provided by Minregion, the level of reimbursement of the actual cost of approved tariffs for thermal energy in the city of Vinnytsia was 66.9 percent on average and 92 percent for commercial customers.¹⁰ However, the Utilities Regulator estimates VMTE's residential tariff to cover 80 percent of the current financial costs.

84. **Technical Information. Boiler houses and CHP:** The company operates 39 boiler houses. Of these, 21 have capacities of up to 3 Gcal/h; 10 have a capacity from 3-20 Gcal/h; 5 have a capacity from 20-120 Gcal/h; and 2 boiler houses and a CHP have a capacity of over 120 Gcal/h. The ages of boilers vary widely, with about half of them 10 years old or less, and about one-third between 20 and 40 years. The average efficiency of the boilers is about 90 percent, but some of the older boilers have efficiencies below 80 percent. Installation of two biomass-fired boilers of 3 MW of installed heat capacity each is planned under a Swiss grant-financed project.

85. CHP-1 has two backpressure steam turbines with installed capacity of 4 MW and 6 MW. In addition, the company has a mini-CHP plant of 0.5 MW. Electricity is used for the company's own needs, and during winter the electricity surplus is sold to the grid.

86. **DH networks and heat substations:** The length of the DH network is 206.4 km; the linear heat load density of VMTE is about 2.1 Gcal/h per km, which is quite acceptable for a DH system to be competitive. Of the total length of DH pipeline network, about 29 km (14 percent) is pre-insulated polyurethane pipe, installed mostly underground in new network segments. However, the remaining 86 percent of the DH network is "Soviet Type" pipes, of which 87 percent are installed underground pipes in concrete channels and 13 percent are above-ground. Old pipes are insulated using glass wool or mineral wool, with coating of bitumen board. Approximately 150 km of pipelines are estimated to require replacement. Heat losses in the company networks in 2012 are reported to be 176,117 Gcal, or about 20 percent of heat produced, and the incidence of leaks and breaks in the network is high.

87. Heat transmission and distribution to end-users is carried out through 83 CHSs or through ejectors in directly connected buildings. Within the next two years, the company intends to install about 100 IHSs (modern type with automation) under the Swiss grant.

88. **Priority Investment Program Financed by the Project.** The agreed investment program focuses on replacement of capacity of an existing CHP (the second largest operated by the utility, which currently serves about 25 percent of its customers) and connecting it to a

¹⁰ <http://minregion.gov.ua/attachments/files/zhkh/162.pdf>

SCADA system already installed by the utility,¹¹ reducing losses in heat transmission networks, and improving the efficiency of DH supply and distribution. Rehabilitation of networks is the largest component. The company will install 220 IHSs with building-level heat meters.

89. Significant savings in gas and O&M costs will be achieved due to replacement of one of the existing CHP's oversized boilers with capacity that matches its actual needs. Connecting the newly renovated CHP to the existing SCADA system will lead to additional savings of gas, electricity, and staff costs. This will be accompanied by replacement of all existing pipeline network connected to the CHP with the new pre-insulated pipes; these investments are expected to generate savings on fuel costs due to drastically reduced network losses. Additionally, the capacity of the existing heat transmission pipe in a suburban neighbourhood will be increased to accommodate the needs of additional customers. The majority of the buildings connected to the renovated CHP will be equipped with IHSs and heat meters, leading to additional gas savings due to reduced building-level heat consumption. VMTE already has experience with IHS installation and is currently in the process of solving regulatory issues concerning installation of additional IHSs with the Municipality.

90. Table A2.12 describes the Vinnytsiamiskteploenerho Priority Investment Program financed by the project.

Table A2.12: Investment Program for Vinnytsiamiskteploenerho

Component	Description	Benefits summary	Total Investment Cost (USD 000)	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
1. Replacing capacity of CHP-4	Replacement of existing oversized boilers based on actual needs; full automation with SCADA	Increased efficiency of heat supply; generation of gas savings and reduction of O&M cost	9,331	9,331		9,331
2. DH network rehabilitation	Rehabilitation of all networks connected to the renovated CHP (37 km); increasing capacity of an existing primary network (2 km) to satisfy heating needs of additional consumers	Savings on fuel costs due to reduced losses in DH networks; fully utilizing benefits of the renovated CHP	19,319	19,319		19,319
3. IHS installation; building-level heat meters	Installation of 220 IHSs with building-level heat meters in all buildings connected to renovated CHP	Savings due to reduced heat consumption by matching building-level heat demand with heat supply	6,749		6,749	6,749

¹¹ Installed with funds provided by the Swiss Agency for Development and Corporation Grant.

Component	Description	Benefits summary	Total Investment Cost	IBRD Financing (USD 000)	CTF Financing (USD 000)	Total Financing (USD 000)
4. Implementation support			1,134	1,134		1,134
TOTAL			36,533	29,784	6,749	36,533

91. Table A2.13 describes additional investments identified based on the discussions of the priority investment programs proposed by the feasibility studies.

Table A2.13: Additional Investments

Utility	Description of Additional Investment	US\$ mln
Miskteplodenerhiya (Kamyanets-Podilsky)	Rehabilitation of 3 boiler houses. This investment will complete the full rehabilitation of all the generation capacity of the utility, thus improving reliability and quality of heat supply to all customers. Moreover, it will allow utilization of the full benefits from closure of a loss-making CHP.	3.1
Kharkivski Teplovi Merezhi (Kharkiv)	Introduction of SCADA to all heating points served by the company. This will allow full utilization of the benefits of system automation and will further improve efficiency of heat supply and distribution. Installation of a mini-CHP in one of the boiler houses will allow coverage of the base load demand (summer load) of the company.	4.1 7.5 TOTAL: 11.6
Khersonteploenergo (Kherson)	Closure of 4 boiler houses; rehabilitation of 4 existing boiler houses so that customers of the closed boiler houses can be connected to the existing boiler houses. These investments will improve reliability and quality of heat supply to a large number of the consumers not covered by the agreed investment program; these investments will also fully utilize the benefits of the network rehabilitation.	3
Mykolayiboblteploenergo (Mykolaiv)	Complete rehabilitation of a large boiler house serving a big district #135, including installation of a mini-CHP. This additional investment will improve reliability and quality of heat supply to all remaining customers not covered by the agreed investment program; the mini-CHP will produce electricity to cover the utility's own electricity use in full.	3.6
Vinnytsiamiskteploenergo (Vinnytsia)	Installation of the gas motor at a CHP whose capacity is being replaced under the project. This additional investment will replace the outdated turbine electric capacity, thus fully completing the CHP capacity replacement.	6.9
TOTAL		28.2

92. The investment programs for the remaining four DH companies are expected to be similar in nature (although different in scale) to the ones already assessed.

93. **Component 2: Technical Assistance and Capacity Building (US\$5.5 million).** This component will finance technical assistance to the Minregion, which will oversee implementation of the project. Technical assistance will support: (i) supervision of project implementation; (ii) guidance and training to the participating DH companies in project implementation, monitoring, and evaluation; (iii) capacity building and knowledge-sharing workshops for participating companies; (iv) annual quality of service surveys among the consumers of participating DH companies; (v) annual project audits; (vi) preparation of case studies, including technical studies; and (vii) incremental operating costs of Minregion related to all eligible expenses.

94. The suggested budget for the Technical Assistance component is shown in Table A2.14:

Table A2.14: Suggested Budget for DHEE Project Component 2

Expenses	US\$ mln
Staff costs	2.4
Operating/ supervision costs	1
PR/ Capacity building costs	1.4
Project-specific costs (customized software for data collection; project audit)	0.7
TOTAL:	5.5

Annex 3: Implementation Arrangements
UKRAINE: District Heating Energy Efficiency Project

Project Institutional and Implementation Arrangements

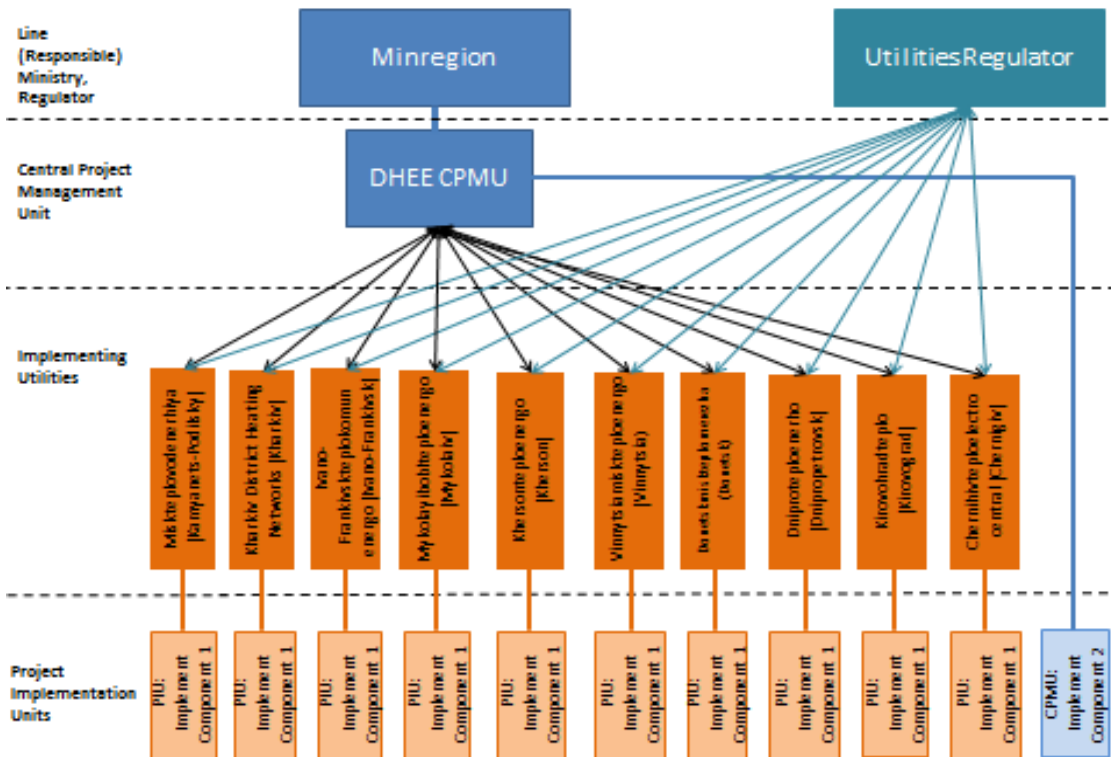
1. The project will be implemented by 10 participating utilities, namely Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), Donetskmiskteplomerezha (Donetsk), Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Kirovohradteplo (Kirovograd), Mykolayiboblteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). Each utility is either of municipal (Kamyanets-Podilsky, Kharkiv, Ivano-Frankovsk, Kherson, Vinnytsia, Donetsk, Chernigiv and Kirovohrad) or oblast ownership (Mykolaiv and Dnipropetrovsk).

2. To participate in the project, DH companies were selected through a screening process managed by Minregion. Minregion developed an application form for the DH utilities, based on the criteria suggested in the World Bank's report "Ukraine: Creditworthiness of District Heating Companies." These criteria, among others, included governance and financial criteria: the cost-recovery level of heating tariffs; the collection rate; the availability of boiler-level heat meters; the prevalence of residential consumption-based billing (i.e., the share of residential heat consumption, which is billed according to readings of building-level meters); and the availability and readiness to install IHSs.

3. Applications received from over 60 Ukrainian DH utilities were independently evaluated. Based on the recommendations of the independent report, GoU recommended six DH companies for participation in the project and preparation of feasibility studies, financed by the CTF Project Preparation Grant: Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkivski Teplovi Merezhi (Kharkiv), Khersonteploenergo (Kherson), Mykolayiboblteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). Donetskmiskteplomerezha (Donetsk) was also included in the project, but the company agreed to consider an option to prepare feasibility studies with its own funds. Upon the request of Minregion and after reviewing the compliance with the original selection criteria, the Bank agreed to include the following companies in the proposed project, conditional on their positive evaluation by the Ministry of Finance: Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), and Kirovohradteplo (Kirovograd).

4. The organizational structure of the entities involved in the project is presented in Figure A3.1, and the responsibilities are described below.

Figure A3.1: Institutional and Implementation Arrangements of DHEE Project



5. **The Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine (Minregion)**, is the line ministry responsible for implementation of projects in the municipal sector, including project preparation, supervision, and monitoring and evaluation as well as for review of projects' evaluation results. Accordingly, Minregion will carry out such functions for this project.

6. Each participating company will present its annual investment programs, financed by the project, to **the National Commission on the Regulation of Communal Services (the Utilities Regulator)** for its review, approval, and inclusion in the investment component of its heating tariffs.

7. **Minregion will supervise project implementation with the help of the Central Project Management Unit (CPMU).** The CPMU was created around an existing PIU in the Ministry that has been implementing the CTF Project Preparation Grant. The responsibilities of the CPMU will include: reporting to the World Bank, providing procurement and FM support to the local PIUs, aggregating data and reports, checking invoices and delivering them to the Ministry of Finance, supervising the quality of service survey, and monitoring and evaluation. The existing CTF PIU capacity will be increased by adding procurement, FM, engineering, safeguards, and accounting specialists. The project CPMU will benefit from the lessons learned and experience of the UIP CPMU in the Ministry that has been supervising the implementation of the Urban Infrastructure Project since 2007.

8. **Each participating DH company has established, using its existing staff, a Project Implementation Unit (PIU)** that consists of: a general manager, a procurement specialist, an FM specialist, a technical supervisor (engineer), and a safeguards specialist. The responsibilities of the local PIUs will include: preparation of the tender documents, preparation of technical specifications, leading procurement process according to the World Bank guidelines, leading FM according to the World Bank guidelines, supervision of physical works, environmental and social assessment, monitoring and evaluation, and preparation of progress reports.

9. Since most of the participating companies have no experience in implementation of World Bank projects, the local PIUs as well as new members of the CPMU participated in a training on Bank procedures conducted by Bank staff and Minregion. The Bank and Minregion will continue to provide regular in-depth trainings on procurement, FM, and safeguards issues to the PIUs during project implementation.

Financial Management, Disbursements and Procurement

Financial Management

10. The FM arrangements for the project are “Satisfactory,” subject to meeting the effectiveness conditions listed below. Minregion will be the main implementing agency and thus will have responsibility to ensure that the FM arrangements are in place. The FM arrangements for the project build on the ongoing Urban Infrastructure Project (UIP) and CTF Project Preparation Grant, taking into account the lessons learned during their implementation. Current FM arrangements in the UIP and CTF Project Preparation Grant were developed to a satisfactory level during project implementation, and the existing capacity, particularly at the UIP CPMU and CTF PIU, is retained for project implementation. The FM assessment of the project covered both Minregion and CTF PIU, and included a capacity assessment of participating DH companies, as they have not been previously involved in implementation of Bank-financed projects. The overall FM risk rating for this project is “Moderate.”

11. FM roles and responsibilities. All participating DH companies have appointed their own financial staff to be part of their PIUs. As participating companies do not have experience in FM of Bank-financed projects, extensive training will be needed prior to project approval and during project implementation. The training program will be developed by the CPMU jointly with the Bank, and will address the continuous learning needs of the local PIU staff. The PIUs at participating DH companies will take responsibility for a substantial portion of FM and disbursement tasks. The role of the financial specialist of the participating utilities will include management of the flow of funds, including preparation of the withdrawal applications and payment orders, maintenance of records of all project transactions, preparation of reports, and facilitation of annual audits.

12. The CPMU has been established for implementation of the project based on the existing CTF PIU. It will be strengthened with staff who will be responsible for the project only, including a financial specialist. (*Appointment of FM staff to CPMU is a condition of effectiveness.*) The CPMU will be responsible for FM and disbursement of the Minregion component, as well as for review of documents submitted by participating utilities, consolidation

of reports, and further coordination with Minregion/Ministry of Finance. The CPMU financial specialist will coordinate and assist the utilities' financial staff. The above-listed roles of CPMU and PIUs will be further detailed in the Project Operational Manual (POM), which is to be developed for the project. *(The development of POM will be an effectiveness condition for the project.)*

13. **Budgeting.** The DH companies will be responsible for planning and budgeting in their respective components. A monthly planning process will be used in the management of flow of funds, and will also serve as input to quarterly reports and as a basis for preparation of the annual budget of the project. The CPMU will be responsible for collection and review of disbursement plans and budgets from utilities and preparation of consolidated budgets as needed. The CPMU, in coordination with Minregion and Ministry of Finance, will also ensure sufficiency of allocation of funds in the State Budget for each fiscal year of project implementation. Should the budget allocation in a fiscal year become insufficient, the CPMU will initiate the procedure of additional budget allocation in coordination with Minregion and the Ministry of Finance.

14. **Project accounting.** Accounting for project funds will be done by each of the participating DH companies, where the appointed financial specialist will keep a record of all project transactions and payments. Accounting records will be maintained in the available automated accounting system, to the extent possible. Further update of the available accounting system may be financed from the Implementation Support component upon the request of companies. Accounting records of all project transactions will be maintained by the companies' accountants in UAH in accordance with the requirements of National Accounting Standards and also including foreign currency equivalents where relevant.

15. The CPMU will keep track of all project-related payments, separately for its own component, and also for each of the participating utilities, separately for IBRD and CTF sources of funding. Accounting records will be kept on a cash basis, with additional disclosure of commitments. CPMU has developed and customized automated accounting software, 1-C, which has wide functionality and allows keeping detailed records of all project transactions by component, by contract, in multiple currencies, etc. A segregated set of accounts will be opened for implementation of the project, including separately for each participating company. Accounting records of DH companies will be reconciled with the CPMU at the time of preparation of quarterly reports, at the time of preparation of Withdrawal applications, and on a need basis. Additionally, the CPMU is in the process of developing a document exchange system, which will enable easy and fast transmission of documents between the CPMU and PIUs.

16. **Reporting.** Quarterly Interim Financial Reports (IFRs) will be submitted during project implementation. Separate consolidated reports will be prepared for IBRD and CTF funds. The sample format will be included in the project POM, and will include forms on the sources and uses of funds, Designated Account statements, as well as information on detailed use of funds. Participating DH utilities will prepare IFRs on their respective components within 30 days from the end of each quarter, and then the CPMU will prepare one consolidated set of IFRs to be submitted to the Bank within 45 days from the end of each quarter. Reconciliations will be done

regularly between the CPMU and PIUs' records, at a minimum during the preparation of withdrawal documents and consolidated IFRs.

17. Internal controls. Key internal controls for project FM and disbursement will be described in the POM. The periodic controls will include, but are not limited to, the following: segregation of duties between CPMU fiduciary staff and also between the CPMU and PIUs; review and authorizations of withdrawal applications and bank payment orders; reconciliation of financial data and reports between the CPMU and PIUs as well as to the World Bank Client Connection data; review and authorization of reports; and technical acceptance of goods and services. Technical supervision will be obligatory in all contracts where specific technical expertise is required, and each company without relevant experts will contract an independent technical supervisor who will review and certify acts of acceptance prior to their payment. The internal controls structure for project implementation will also be reviewed by independent auditors during their annual audits. Key weaknesses, if identified, will be brought forward in the management letter, which will accompany every audit report. Further management actions to address those recommendations will be monitored as part of regular FM monitoring of the project.

18. Audit arrangements: Annual audits of consolidated project financial statements will be required. Such audits will need to be carried out by one of the eligible audit firms in accordance with the Terms of References (TORs) agreed with the Bank following the requirements of International Standards on Auditing (ISA). The project audit report will be due six months from the end of each fiscal year. Separate audit reports will be issued for IBRD and CTF project financial statements, although both audits can be covered by one audit contract, which will be the responsibility of the CPMU. Audits of project financial statements will be financed from loan proceeds. Project audit reports will need to be publicly disclosed by Minregion as well as the Bank on their respective websites, as required by the Information Disclosure Policy of the Bank. Management letters issued by auditors are excluded from this requirement.

19. Annual audits of entity financial statements of each participating DU company will be required. Such audits will be carried out in accordance with ISA by locally licensed audit firms, and also submitted to the Bank within six months from the end of each fiscal year. Auditors of DH company financial statements will be appointed by each respective company. These audits will be required by the project team to enable availability of reliable financial data for the ongoing monitoring of financial performance of the companies, and also as part of capacity-building activities aimed at strengthening the accounting and reporting framework of each company. Audits of entity financial statements may be financed from the loan funds. The DH companies' audit reports (excluding management letters) will also need to be publicly disclosed by each respective DH company as well as by the Bank.

Disbursements

20. Proceeds of IBRD loan and CTF funds will be disbursed in accordance with the traditional disbursement procedures of the Bank, including Advances, Direct Payments, and Special Commitments. Each application will be accompanied by appropriate documentation in

accordance with the procedures described in the Disbursement guidelines and further detailed in the Disbursement letters.

21. Ministry of Finance will open Designated Accounts (Das) for Minregion (for its component) as well as for each of the participating utilities. Designated Accounts in USD will be opened in Ukreximbank, and additional transit accounts in Ukreximbank may be opened as needed for payments in other currencies. Ministry of Finance will delegate management of all DAs to Minregion and to participating companies, but will retain the oversight function. Such disbursement arrangements will enable efficient control over the flow of funds, reconciliation of account balances, and preparation of periodic reports.

Procurement

Applicable Guidelines:

22. 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, published in January 2011;
- Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers, published in January 2011 and
- Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits, dated October 15, 2006 and revised in January, 2011.

Summarized Procurement Plan:

23. A draft Procurement Plan for the entire project and each participating DH company will be developed and will provide information on procurement packages, methods, and the Bank review method. This plan will be agreed between DH companies and the project team and has to be finalized at negotiations. The finalized Procurement Plan will be disclosed on the Bank's external website.

24. During project implementation, the Procurement Plan will be updated, as needed, in agreement with the Bank project team to reflect the actual project implementation needs.

I. General

25. Period covered by this procurement plan: project implementation period.

26. **Reference to Project Operational/Procurement Manual:** The procurement manual will be elaborated as a part of the POM.

27. Based on the results and recommendations of the feasibility studies, the detailed procurement plans have been discussed and agreed with six out of 10 selected DH companies. All six DH companies have in their investment plans such specialized tasks as rehabilitation of boiler houses and installation of IHSs, which requires suitable experience, good track records for contracts implemented in the past, and appropriate financial standings of contractors. The rehabilitation of boiler houses can be conducted only during periods when heat is not supplied

and must be completed by the deadline indicated in the contract implementation schedule. To minimize the risk of possible failures in the contracts' implementation, the bidding documents issued by DH companies will include appropriate wording informing about application of post qualification requirements on accrual basis in case a bidder takes part in several biddings announced by different DH companies. The CPMU will monitor contract awards to ensure that contractors do not sign multiple contracts simultaneously without appropriate resources to implement them. Based on recent experience in implementation of similar contracts in the region, it was decided that procurement of contracts for DS&I and S&I will be done on post-qualification basis. Taking into account county specifics and experience in implementation of contracts with local design companies for provision of design estimates, such companies will be selected following shopping/NCB procedures as technical services.

28. The Operating costs will cover expenses for state expertise/ authorization and other mandatory payments, as required by local construction rules, equipment and consumables for PIUs, remuneration of PIUs' staff and consultants.

29. Procurement plan for Chernihivteploelectrocentral (Chernigiv), Dniproteploenerho (Dnipropetrovsk), Donetskiskteplomerzha (Donetsk) and Kirovohradteplo (Kirovograd) will be finalized soon after Board approval, after their feasibility studies are completed.

II Procurement of Goods

30. Prior Review Threshold:

	Procurement Method	Procurement Method Threshold	Prior Review Threshold	Comment
1.	ICB	US\$500 K for goods US\$5 mln for Works	All	
2.	NCB	<US\$500 K for goods <US\$5 mln for Works	First by each DH company First by each DH company	
3.	Shopping	<US\$100K	First by each DH company	
	Direct Contracting	n/a	n/a	All contracts will be subject to prior review

Ref. No.	Description of Assignment	Estimated Cost US\$ mln. including VAT and contingencies	Procurement Method	Pre-Qualification	Review by Bank (Prior / Post)	Comments
Ivano-Frankivskteplokomunenergo(Ivano-Frankivsk) US\$26.26 mln						
1.	Rehabilitation of boiler house	6.9	ICB	no	Prior	DS&I

Ref. No.	Description of Assignment	Estimated Cost US\$ mln. including VAT and contingencies	Procurement Method	Pre-Qualification	Review by Bank (Prior / Post)	Comments
2.	Rehabilitation of networks (25 km)	10.3	ICB	no	Prior	+design Works
3.	IHS 240	7.3	ICB	no	Prior	DS&I
4.	SCADA	0.6	NCB/IC B	no	Prior	S&I +techSpecs
5.	Design estimates for rehabilitation of networks	0.2	NCB	No	Prior	Technical services
6.	Operating costs	1	n/a	n/a	n/a	Supervision, design estimates
	Total	26.26				
Miskteplovodenerhiya (Kamyanets-Podilsky) \$12.26 mln						
1.	IHSs (83), area heat substations + building-level heat meters	2	ICB	no	Prior	DS&I 2-years contracts
2.	Construction of 2 new boiler houses + SCADA + 1 rehabilitation	7.2	ICB	no	Prior	DS&I SCADA should be compatible with existing system
3.	Rehabilitation of networks 2.2 km	1.7	NCB/IC B	no	Prior	Works Design done by Utility
4.	Technical supervision	0.4	3 ICs	no	Post	
5.	Operating costs	0.9	n/a	n/a	n/a	
	Total	12.26				
Kharkivski Teplovi Merezhi (Kharkiv) US\$107.57 mln						
1.	SCADA	16.6	ICB	no	Prior	DS&I
2.	Rehabilitation of 52 boiler houses + frequency converters for main network pumps	25.8	ICB	no	Prior	DS&I
3.	300 IHSs + building-level heat meters	10.8	ICB	no	Prior	DS&I Contract for 2 years
4.	1,000 heat meters with temperature controls (control systems)	11.7	ICB	no	Prior	DS&I Contract for 2 years
5.	CHP-3 rehabilitation	8.3	ICB	no	Prior	S&I (design is ready)
6.	Rehabilitation of networks	20.9	ICB	yes	Prior	PQ Works (design estimates are ready)
7.	Mini-CHP	7.5	ICB	no	Prior	S&I (design is ready)
8.	Closure of 22 boiler houses and connection pipes	2.4	NCB/IB C	no	prior	Small Works
9.	Operating costs (design, state expertise etc., PIU)	3.5	n/a	n/a	n/a	
	Total	107.6				
Khersonteploenergo (Kherson) US\$21.65 mln						
1.	Rehabilitation of 2 boiler houses + Modernization of	12.7	ICB	no	Prior	DS&I/ S&I Contract for 2 years

Ref. No.	Description of Assignment	Estimated Cost US\$ mln. including VAT and contingencies	Procurement Method	Pre-Qualification	Review by Bank (Prior / Post)	Comments
	4 major CHSs					
2.	SCADA for 26 boiler houses	1.7	ICB	no	Prior	DS&I
3.	Equipment for maintenance (crane, excavator etc.)	0.34	ICB	no	Prior	Goods
4.	21 IHSs+ 200 building-level heat meters	1.6	ICB	no	Prior	Contract for 2 years
5.	Rehabilitation of networks 7.6 km + connection pipes	4.2	ICB	no	Prior	Small works
6.	Design estimates for item 5	0.1	Sh	No	prior	Technical services
7.	Construction supervision	0.1	IC	no	prior	
8.	Operating costs	0.9	n/a	n/a	n/a	
	Total	21.65				
Mykolayiboblteploenergo (Mykolaiv) US\$21.8 mln						
1.	Rehabilitation of 31 boiler houses+4 major CHSs	11.2	ICB	no	Prior	DS&I; Contract for 2 years
2.	Individual Heat Substations (93)	2.4	ICB	no	Prior	DS&I; Contract for 2 years
3.	Rehabilitation of networks 6.7 km +connection pipes	2.4	ICB/NC B	no	Prior	Small Works Contract for 2 years
4.	Insulation of pipes 25.6 km	1.2	ICB/NC B	no	Prior	Small Works Contract for 2 years
5.	SCADA	2.4	ICB/NC B	no	Prior	DS&I
6.	Equipment for maintenance	1.1	ICB	no	Prior	Goods
7.	Design estimates for Item 1	0.4	NCB	no	Prior	Technical services
8.	Operating costs	0.7	n/a	n/a	n/a	
	Total	21.8				
Vinnysiamiskteploenergo (Vinnysia) US\$36.53 mln						
1.	CHP rehabilitation	9.3	ICB	No	Prior	DS&I
2.	Rehabilitation of networks 37 km	19.3	ICB	yes	Prior	Works
3.	300 IHSs + building-level heat meters	6.7	ICB	no	Prior	DS&I Contract for 2 years
4.	Design estimates for Item 2	0.4	NCB	no	Prior	Technical services
5.	operating costs	0.8	n/a	n/a	n/a	
	Total	36.53				
Minregion Technical Assistance and Capacity Building US\$5.5 mln						
1	PR coverage of project implementation	0.24	CQ	n/a	yes	
2	Project-level annual quality surveys	0.6	CQ	n/a	no	Contracts signed on annual basis
3.	Training and conferences	0.6	AP	n/a		Agreed procedures
4.	Automated Statistics	0.3	NCB	n/a		

Ref. No.	Description of Assignment	Estimated Cost US\$ mln. including VAT and contingencies	Procurement Method	Pre-Qualification	Review by Bank (Prior / Post)	Comments
	System					
5.	Project Audit	0.48	LCS	n/a		
6.	PIU staff	2.37	IC	n/a	yes	First 2 contracts and all contracts above US\$50,000 10 contracts& short-term support to CPMU and DH companies
7.	Operating costs	0.97		n/a		
	TOTAL	5.56				

III. Selection of Consultants

31. **Prior Review Threshold:** Selection decisions are subject to Prior Review by Bank as stated in Appendix 1 to the Guidelines Selection and Employment of Consultants:

	Selection Method	Prior Review Threshold	Comment
1.	Competitive Methods (Firms)	>US\$100,000	And first selection by any method irrespective of the size of the contract
2.	Individual Consultants	> US\$50,000	And all individual consultants selected for the project management
3.	Single Source (firms and Individuals)	n/a	All contracts will be subject to prior review

32. **Shortlist comprising entirely national consultants:** A shortlist of consultants for services estimated to cost less than US\$100,000 equivalent per contract may comprise entirely national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

33. **CQ application threshold** < US\$300,000 equivalent per contract.

34. All technical specifications and TORs will be subject to Bank prior review. Detailed procurement documentation will be maintained by each utility in the Project Files. The detailed Procurement Plan, once agreed with utilities, should be published on the Bank's website in accordance with the Guidelines.

35. **Post-review percentages and frequency:** In addition to the prior review to be carried out by the Bank, the project team recommends a post-review of at least 10 percent of the total number of contracts signed that were not subject to prior review. Procurement documents will be kept readily available for the Bank's *ex post* review during supervision missions or at any other point in time. It is expected that post-reviews will be conducted every 12 months. A post-review report will be prepared and filed in the procurement post-review system.

Environmental and Social (including safeguards)

Environmental

36. The project is assigned an environmental screening category “B,” as it is expected to have generally positive impacts on the environment. The minor negative impacts that inevitably occur during civil works will be mitigated by proper planning and adherence to measures described in the POM. A Program-level Environmental and Social Assessment (PLESA) was prepared and publicly disclosed locally and on the Bank’s Infoshop on November 25, 2013. Site specific EMPs for the cities of Ivano-Frankivsk, Kamyanets-Podilskyi, Vinnytsia, Kherson, Mykolaiv and Kharkiv will be finalized and disclosed locally and on the Bank’s Infoshop in early 2014. Site-specific EMPs for sub-projects in Donetsk, Dnipropetrovsk, Chernigiv and Kirovohrad will be prepared and disclosed by the Client at a later stage.

37. In accordance with recommendations of the ECA Safeguards Secretariat, it was agreed that the most appropriate manner to apply the World Bank’s disclosure policy would be to disclose PLESA on Minregion’s website as well as on the websites of participating DH companies (or municipalities of 10 cities). When site-specific EMPs are finalized, they will be disclosed on the websites of participating DH companies (municipalities). On November 26, 2013, the Ukrainian language version of the PLESA was disclosed on Minregion’s website (minregion.gov.ua/).

38. Public consultation meetings on PLESA are taking place in participating municipalities during December 2013. The final English and Ukrainian language versions of the PLESA and the minutes of the public consultation meeting will be disclosed on the Bank’s Infoshop in December, 2013.

39. Minregion and participating DH companies have qualified technical staff for assuring compliance with Ukrainian environmental requirements (each has an Environmental Department subdivided into Chief Engineer and Sanitary Laboratories). However, they have all indicated that they wish additional training to develop their skills to implement any additional requirements of the PLESA and EMPs needed to satisfy the Bank’s environmental policies. These additional responsibilities include: screening in accordance with World Bank criteria; providing sub-borrowers with guidance in EA/EMP preparation; and supervision and reporting activities.

40. The Bank project team conducted safeguards training for representatives of Minregion and participating DH utilities’ environmental experts, including the additional requirements of interest, at a workshop on October 15, 2013. A designated half-day training on disclosure and public consultations on PLESA was organized on October 31, 2013. Depending on training needs, the project team’s environmental specialist will organize more half-day or one-day workshops, an efficient and cost-effective way of training, providing hands-on experience, and building capacity. Given that the potential negative environmental impacts of the project are expected to be limited, these arrangements are considered acceptable.

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

Social

41. The Bank project team will conduct social safeguards orientation to representatives of Minregion and participating utilities' PIU heads and relevant experts, including the additional requirements of interest, during the project launch mission. The initial one-day training was held on October 15, 2013, on the Minregion premises. A one-day workshop was organized on October 31, 2013, to ensure the regional PIUs have relevant understanding and capacity to arrange for meaningful public consultations on PLESA (including RPFs) as well as to continuously monitor the situation on-site and alert CPMU and the Bank's Task Team if there is potential temporary or permanent economic displacement caused by the subprojects. The anticipated subprojects should be selected so as not to cause any physical displacement; therefore, these arrangements are considered acceptable. The Social Development Specialist will join monitoring missions to visit the sites of subprojects where there is a probability that any sort of land acquisition may be required.

42. Customer satisfaction surveys conducted in the framework of the project will be gender disaggregated to see if there are difference in the priorities and issues perceived by men and women.

43. The project-specific inquiries /grievances mechanism will be set at the level of every PIU and CPMU. The information about channels available for inquiries/grievances submission will be placed on the project page of Minregion's website and on the websites of the respective utilities. Grievances will be filed and analyzed to draw lessons for project implementation. The grievance form and register sheet and the process for addressing grievances will be part of the POM.

Monitoring & Evaluation

44. Monitoring of project implementation progress and results indicators, as well as progress towards the achievement of PDOs, will be the responsibility of Minregion as well as participating DH companies. CPMU will collect the data and reports from the PIUs and present

* By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas

the data on progress in achieving the key and intermediate indicators to the Bank bi-annually. This would be followed up in conjunction with the supervision missions of the Bank team.

Annex 4: Operational Risk Assessment Framework (ORAF)
UKRAINE: District Heating Energy Efficiency Project
Stage: Appraisal

1. Project Stakeholder Risks	Rating: Moderate			
Description: Improving energy efficiency in the DH sector is a strategic priority of the Government of Ukraine. However, there is always a risk that government priorities may change, especially given the upcoming 2015 Presidential election.	Risk Management: Several recent strategic documents (update of Energy Strategy, master plan on energy efficiency in the DH sector) confirm the government’s commitment to implementing energy efficiency investments in the DH sector. This commitment is shared by several ministries and agencies and across the broad donor community. A working coordination platform has been established through the E5P grant fund, which can co-finance IFI-financed projects in energy efficiency, including DH. The risk of policy reversal at this stage is therefore limited.			
	Resp: Client	Stage: Implementation	Due Date : Ongoing	Status: In Progress
Description: DH utilities understand the necessity of modernizing their assets and improving the efficiency of their operations. However, not all utilities and municipalities may be convinced that the proposed modernization approach (which includes IHSs, an increased share of consumption-based billing, and cost-recovery tariffs) is the best way to go.	Risk Management: Because of the selection process design that was based on very clear governance and financial criteria recommended by the World Bank reports and further developed by an independent consultant hired by Minregion to conduct the evaluation of companies’ applications, the selected participating DH companies are the most progressive, have better governance structures, and are open to the modernization approach suggested by the Bank. During preparation of the feasibility studies, all DH companies demonstrated interest and willingness to work with the Bank and project preparation consultants. All participating utilities have either solved the regulatory issues regarding IHSs installation or are in the process of solving them.			
	Resp: Bank	Stage: Implementation	Due Date : Ongoing	Status: In Progress
Description: Consumers of the selected DH companies may not support heating tariff increases; they may not believe that the quality of heating service will improve enough to justify tariff increases.	Risk Management: Preparation of the project will be supported by communication strategies developed for participating municipalities; the preparation of communication strategies is financed by the CTF Project Preparation Grant. Specific support will be provided to participating DH companies to develop and launch websites to proactively share information and reinforce customer relations. Changes in service quality will also be documented during project implementation by regular quality of service surveys, conducted by Minregion as a part of the Technical Assistance and Capacity Building component of the project; the results of quality of service surveys will be made public.			
	Resp: Bank, Participating Utilities	Stage: Preparation	Due Date : Ongoing	Status: Not Yet Due
2. Operating Environment Risks (not disclosed) Section to be removed when the PAD is (i) sent to the client for negotiation or (ii) sent to the Board for approval				
2.1. Country (description and rating are not disclosed)	Rating: Substantial			

<p>Description:</p> <p>Weak economic growth. Lack of structural reforms and economic diversification have resulted in Ukraine’s dependence on global commodity markets. As a result, Ukraine saw a decline in growth in the second half of 2012 and its growth prospects for 2013 remain weak due to the continued uncertainty over the sustainability of the economic policy mix conducted by Ukrainian authorities and persistent low external demand.</p> <p>External imbalances. Maintenance of the <i>de facto</i> fixed exchange rate regime and the widening current account deficit (8.2 percent of GDP in 2012) cost Ukraine almost a quarter of its gross international reserves during 2012. Reserves are now below 3 months of imports while external debt refinancing needs have increased and are expected to remain elevated in the medium term.</p> <p>Vulnerability of public finances. Fiscal deficit exceeded 5 percent of GDP in 2012 on the back of an increase in social spending (by over 2 percentage points of GDP) as well as structural deficit of the state-owned company “Naftogaz.” Weak economic performance and slow adjustment of the budget spending envelope will continue to put additional pressure on public finances.</p> <p>Fragility of the banking sector. The balance sheets of the banking sector remain fragile: the share of NPLs is estimated to be as high as 30-40% of total loans; the sector faces limited access to funding, with very high deposit rates and short-term structure of deposits, and very limited access to international markets. These factors continue to constrain lending and bank portfolios were mostly flat in 2012. Some banks, particularly domestic banks, are exposed to foreign currency risk, and are therefore vulnerable to significant movements in the exchange rate.</p>	<p>Risk Management:</p> <p>The Bank has been consistently engaged in dialogue with the GoU on fiscal and economic issues. The Bank and other donors (including the IMF, which is currently negotiating a new Stand-By Arrangement with Ukraine) are in agreement on how to proceed on several priority policy measures that would help the government address critical policy gaps while signaling their commitment to reform.</p>			
	<p>Resp: Bank</p>	<p>Stage: Implementation</p>	<p>Due Date : Ongoing</p>	<p>Status: In Progress</p>
<p>2.2. Sector/multi-sector (description and rating are not disclosed)</p>	<p>Rating: Substantial</p>			
<p>Description: Residential DH tariffs remain below financial cost-recovery levels, and DH companies continue to be dependent on direct budget subsidies to survive. Despite increasing fiscal pressure, there is a risk that no decision will be made on heating tariff increases for residential consumers before the 2015 Presidential election.</p>	<p>Risk Management: The Bank has been actively engaged, in coordination with the IMF, in dialogue on energy reforms with the government. The new IMF Stand-By Arrangement program, currently under negotiation with Ukraine, is consistent with the Bank’s position on energy pricing and social protection reforms. The Bank is in the process of setting up a SIDA-financed technical assistance to the Utilities Regulator to help it transition from “cost+” to incentive-based regulation. The Bank is also preparing a Second Social Safety Net Modernization Project. Upon the request of the government, this project could assist with expanding the Guaranteed Minimum Income (GMI)</p>			

	program coverage to protect the poorest households from the negative impacts of the tariff increases.			
	Resp: Bank	Stage: Implementation	Due Date : Ongoing	Status: In Progress
3. Implementing Agency Risks (including fiduciary)				
3.1. Capacity	Rating: Moderate			
Description: The implementing agencies for the proposed project will be participating DH companies and Minregion. Minregion has a long-standing history of implementing Bank projects, including the CTF Project Preparation Grant, and is working with the Bank and other donors on the preparation of the DH projects. The participating DH companies have strong technical skills (as demonstrated during the selection process and field visits), but have limited experience in working with IFIs, which could potentially delay project implementation.	Risk Management: The Central Project Management Unit (CPMU) has been created around an existing PIU that is implementing the CTF Project Preparation Grant, which has been performing efficiently. The CPMU will provide trainings and necessary guidance to the PIUs in participating DH companies. Moreover, the Technical Assistance and Capacity Building component of the project will finance necessary trainings and capacity-building activities for the PIUs. The first training for the PIUs and new CPMU members was conducted by Minregion and Bank staff on October 15, 2013. Additional training needs in FM, procurement, and safeguards issues will be finalized during appraisal. The technical specifications and bidding documents for participating DH companies are expected to start being prepared with the help of USAID consultants before Board approval. The local PIUs will be closely supervised by the CPMU as well as headquarters- and field-based staff.			
	Resp: Bank, Minregion	Stage: Preparation	Due Date: Ongoing	Status: In Progress
3.2. Governance	Rating: Substantial			
Description: Governance and transparency of the DH sector remains an issue. Because of participating DH companies' lack of experience working with IFIs, fiduciary issues cannot be ruled out.	Risk Management: Because of the selection process design, the utilities selected to participate in the project are those with better transparency and governance structures. All participating DH companies will have installation of building-level heat meters in their investment programs, which will improve transparency. Specific support will be provided to the selected DH companies to develop and launch websites to proactively share information. Regular FM and procurement training will be provided to the PIUs in the companies by Minregion and Bank staff. During implementation, the PIUs will be closely supervised by the CPMU in Minregion and the Bank team. The CPMU will be created around an existing PIU that is implementing the CTF Project Preparation Grant, which has been efficient and has had no fiduciary issues.			
	Resp: Bank, Minregion	Stage: Implementation	Due Date : Ongoing	Status: Not Yet Due
Fraud & Corruption (sub-category of Governance risk) Remove Risk Description and Rating when the PAD is (i) sent to the client for negotiation or (ii) sent to the Board for approval Risk management measures below to be merged with those in 3.2 above.	Rating: Substantial			
Description: Because of low DH tariffs and unreliability of direct subsidies, DH companies have an incentive to overestimate unmetered heat consumption to reduce their financial losses as well as hide their true network losses.	Risk Management: Because of the selection process design, participating DH companies have better governance and transparency structures. All of them have gas meters at boiler houses, almost all of which have heat production meters; those boiler houses that do not have meters are expected to get them by the end of the 2013-2014 heating season. Most commercial consumers of the selected DH companies are metered. In all participating DH companies, the prevalence of consumption-based billing is at least 25% (and in some, over 70%). All participating companies have installation of building-level heat meters in their investment plans financed by the project. DH			

	companies will adopt project reporting standards acceptable to the Bank, including external project auditing. The team will closely supervise the utilities during implementation	Resp: Bank	Stage: Implementation	Due Date: Recurring	Status: Not Yet Due
4. Project Risks					
4.1. Design		Rating: Substantial			
Description: Technical specifications of subprojects do not correspond to international best practice.	Risk Management: Participating DH companies will be supported by international consultants (financed by the project) to ensure that the technical designs and their implementation correspond to international standards. Also, USAID expressed its interest in providing technical assistance to the participating DH companies.				
		Resp: Bank	Stage: Preparation	Due Date: December, 2013	Status: Not Yet Due
Description: Participating DH companies will not receive cost-recovery tariffs.	Risk Management: The Bank has continued to be actively involved in the high-level dialogue on energy tariffs reforms. Financial cost-recovery tariffs are among the conditions of the new Stand-By Arrangement, currently under negotiation with the IMF. The Bank's position on energy tariffs reform is fully coordinated with the IMF. The team has also been working closely with the Utilities Regulator to make sure that participating DH companies get appropriate tariffs estimated and approved. The Utilities Regulator has estimated cost-recovery tariffs for 9 out of 10 of the participating companies.				
		Resp: Bank	Stage: Preparation	Due Date: Ongoing	Status: Ongoing
Description: Slow implementation progress due to implementation arrangements.	Risk Management: The Bank is working closely with USAID to secure necessary implementation support for the local PIUs. Headquarters- and field-based staff will closely supervise the CPMU and local PIUs to ensure proper implementation and coordination. The technical specifications and bidding documents for the first year of implementation for participating DH companies are expected to be prepared before the Board approval date.				
		Resp: Bank	Stage: Preparation	Due Date: December 2013	Status: Not Yet Due
4.2. Social & Environmental		Rating: Moderate			
Description: Identified subprojects violate the Bank's safeguards policies.	Risk Management: The OP 4.12 is triggered by the project. The proposed investments will not cause any permanent physical displacement. Projects causing any permanent or temporary physical displacement will not be selected for support. Acquisition of some municipally-owned land for project purposes is likely to cause economic displacement. The Resettlement Policy Framework (RPF) has been prepared and duly disclosed. The proposed project would use existing DH pipeline routes owned by municipalities. No old or historic buildings/facilities are expected to be included in the proposed project. No substantial land disturbance will occur. An EA for the activities of the project was undertaken and a Program-Level Environmental and Social Assessment (PLESA) was prepared by the Client and properly disclosed.				
		Resp: Bank, Minregion, Participating Utilities	Stage: Implementation	Due Date: November, 2013	Status: Not Yet Due
Description: DH tariffs increased to cost-recovery levels cause unrest in municipalities where participating utilities are located.	Risk Management: The preparation of the project will be supported by communication strategies developed for participating municipalities; the preparation of communication strategies will be financed by the CTF Project Preparation Grant. Participating DH companies will be supported in				

	strengthening their customer relations through the development of websites or improvement of information provided on existing ones. Any tariff increase will be preceded by an information campaign implemented jointly by municipalities and participating utilities. The option of proactive sharing of information on the tariff structure and disclosure/ public hearings on the investment plans and on how the funds collected as the investment component of the tariff would be used will be discussed with DH companies.			
	Resp: Bank, participating utilities, municipalites	Stage: Implementation	Due Date: Ongoing	Status: Not Yet Due
4.3. Program & Donor	Rating: Low			
Description: Uncoordinated donors' position in the sector could negatively affect proposed project preparation and implementation.	Risk Management: The Bank and the other donors (IMF, USAID, EBRD, EIB) are in agreement on priority reforms in the sector. The Bank, USAID, EBRD, and EIB have shown consistent support for Ukraine's DH sector. The CTF Project Preparation Grant to finance feasibility studies and a public awareness campaign have been secured. The Bank is in the process of setting up SIDA-financed technical assistance to the Utilities Regulator to help it transition from "cost+" to incentive-based regulation.			
	Resp: Bank, Donors	Stage: Implementation	Due Date: Ongoing	Status: In Progress
4.4. Delivery Monitoring & Sustainability	Rating: Substantial			
Description: Limited capacity of participating DH companies and Minregion could affect implementation and monitoring of the Project	Risk Management: Minregion is managing several IFI-funded projects and is familiar with IFI monitoring requirements. Participating DH companies will get necessary training and support by the Bank team. A survey tool will be designed to monitor quality of service improvements in participating companies. Baseline indicators will be finalized during appraisal stage. Headquarters- and field-based staff will regularly supervise project implementation.			
	Resp: Bank, Minregion, Participating Utilities	Stage: Implementation	Due Date: Ongoing	Status: Not Yet Due
4.5. Other	Rating:			
Description:	Risk Management :			
	Resp:	Stage:	Due Date:	Status:
4.6. Other	Rating:			
Description:	Risk Management :			
	Resp:	Stage:	Due Date:	Status:
Nondisclosable Information for Management Attention (Optional)				
Section to be removed when the PAD is (i) sent to the client for negotiation or (ii) sent to the Board for approval				
Comments:				
5. Project Team Proposed Rating Before Review				
5.1. Preparation Risk Rating: Substantial		5.2 Implementation Risk Rating: Substantial		
Comments:		Comments:		

6. Risk Team	
6.1. Preparation Risk Rating	6.2 Implementation Risk Rating
Comments:	Comments:
7. Overall Risk Following Review	
7.1. Preparation Risk Rating	7.2 Implementation Risk Rating:
Comments:	Comments:

Note: Include on average no more than 3 Risk Management Measures per Risk Category

Annex 5: Implementation Support Plan
UKRAINE: District Heating Energy Efficiency Project

Strategy and Approach for Implementation Support

1. The Operational Risk Assessment Framework (ORAF) identified the main risks to achieving the PDO and proposed risk management measures for these risks. As described in Annex 4 and summarized in the main text, the Overall Implementation Risk for the project is rated as “Substantial.”
2. Accordingly, the Implementation Support Plan (ISP) has been developed taking into account the following factors:
 - a. Participating DH companies have strong technical skills, but have limited experience in working with IFIs, which could cause implementation delays;
 - b. Minregion has experience implementing the Bank’s municipal projects (UIP);
 - c. Most of the technologies are well proven and widely used in Ukraine, except for the IHSs and SCADA management systems;
 - d. All participating DH utilities as well as the Utilities Regulator understand and agree with the necessity of cost-recovery heating tariffs for residential consumers. A high-level political decision needs to be taken to increase residential heating tariffs to financial cost-recovery levels; those increases need to be accompanied by a reform of social safety nets. Consumers served by participating DH utilities need to understand that the necessary increases in heating tariffs are affordable and will allow participating utilities to implement much-needed investments that will improve the efficiency of DH systems and increase their reliability.
3. Based on the factors mentioned above, the ISP will focus on efforts to:
 - a. Continue regular training of local PIUs and new members of the CPMU on procurement, FM, and safeguards, which started during preparation;
 - b. Continue cooperation with USAID to mobilize consultants to assist local PIUs with the preparation of technical specifications and bidding documents;
 - c. Maximize use of and benefits from the Technical Assistance and Capacity Building component of the project;
 - d. Intensify Bank supervision during the first year of project implementation to provide local PIUs and the CPMU advice and support to ensure the smooth start-up of project implementation; and
 - e. Continue high-level dialogue and hold intensive consultations with relevant stakeholders in municipalities where participating utilities are located.

Implementation Support Plan

4. The Implementation Support Plan is presented in Table A5.1.

Table A5.1: Implementation Support Plan

Time	Focus	Skills Needed/ Functional Specialist	Estimated Staff Weeks/ Year	Partner Role
<i>First 12 months</i>	Support to timely implementation: The immediate priority is to support participating DH companies with procurement activities for the major contracts. All DH companies have an implementation support component as a part of their investment programs. The Bank will continue working with USAID to ensure that procurement documents are being prepared.	Project Management and Procurement	8	USAID to mobilize implementation consultants; Minregion/ CPMU to provide procurement support to the local PIUs.
	Procurement. The Bank will provide review of bidding documents, procurement plans, and bid evaluation reports, and provide <i>ad hoc</i> training to local PIUs.	Bank Procurement Specialist	8	Local PIUs to increasingly lead project implementation, including procurement.
	Training for local PIUs and CPMU. Minregion, together with the Bank, will continue training activities for procurement, FM, and safeguards.	Bank Procurement, FM and Safeguards Specialists	8	Minregion to organize regular trainings for the local PIUs and new members of CPMU.
	Environmental, social and technical. The Bank will focus on implementation quality, improving capacity of participating DH companies and compliance with safeguards policies.	Project Management, Bank Safeguard Specialists, Technical Specialists	n/a	USAID to mobilize implementation consultants
	Project Management and Coordination. The Bank will work with Minregion and participating DH companies to ensure that effective coordination is established between DHEE CPMU and local PIUs as well as participating utilities and the Utilities Regulator. This is important to help strengthen supervision and good governance practices.	Project Management	5	Local PIUs to increasingly lead and coordinate project implementation and provide oversight. Utilities Regulator to review and approve annual investment programs of participating DH companies
	Monitoring and Evaluation. The Bank will work with participating DH companies and CPMU to develop and put in place a template for monitoring project implementation progress, including information collection, data validation, calculation of indicators, and production of reports.	Project Management, M&E Framework Expert	4	Minregion to support participating DH companies in their capacity building

Time	Focus	Skills Needed/ Functional Specialist	Estimated Staff Weeks/ Year	Partner Role
	Tariff dialogue. The Bank will continue high-level dialogue, in coordination with the IMF and other donors, to move forward energy price reforms.	Project Management	5	Utilities Regulator to estimate and approve financial cost-recovery tariffs to DH companies. Minregion to support energy price reform in Ukraine.
	Implementation of communication strategy developed under the CTF Project Preparation Grant. Minregion, with the support of the Bank, will coordinate public awareness campaigns in municipalities where participating DH companies are located.	EXT Specialist	2	Minregion to ensure that municipalities where participating DH companies are located start implementing communication strategies developed under the CTF Project Preparation Grant.
	Support to participating utilities in strengthening their customer relations. The Bank will work with DH companies to assist them with improving their transparency and information-sharing, including development of websites.	Social Safeguards Specialist, EXT Specialist	4	Participating DH companies to strengthen their interaction with users.
12-48 months	Environmental, social and technical. The Bank will strengthen its focus on implementation quality, improving the capacity of participating DH companies and compliance with safeguards policies.	Safeguards Specialists	n/a	Local PIUs, CPMU to strengthen their supervision capacity.
	Project supervision. The Bank will focus on implementation quality, compliance with EMPs (including site safety and material handling), and quality of works.	Technical Specialist	n/a	

Annex 6: Economic and Financial Analysis

UKRAINE: District Heating Energy Efficiency Project

1. Economic and financial analyses were carried out for the subprojects included in the investment programs of the following utilities: Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk), Miskteplovodenerhiya (Kamyanets-Podilsky), Kharkiv District Heating Networks (Kharkiv), Khersonteploenergo (Kherson), Mykolayiboblteploenergo (Mykolaiv), and Vinnytsiamiskteploenergo (Vinnytsia). Since the remaining four DH companies participating in the project are similar to the ones already assessed, their investment programs will be generally similar in nature (although different in scale); consequently, their internal rates of return (EIRRs and FIRRs) are expected to be generally similar and their net present values (NPVs) substantial. The overall project net benefits (benefits less costs) will be aggregated from the respective net benefits of each subcomponent. The relevant reports and analytical files are available in the Project Files. In the following, the main features of the economic and financial analyses are presented first, followed by a summary of the specific features and results for each participating DH company.

A. ECONOMIC ANALYSIS

2. **Relevance of Investments:** The proposed investments under the project are of high relevance for meeting the Project Development Objectives (PDO) of increasing energy efficiency, improving reliability, improving financial viability, reducing emissions, and improving quality of service. Typical investments under the project broadly fall into the following categories:

- Rehabilitation/closure of boiler houses;
- Rehabilitation/reconstruction of networks;
- Installation of mini-CHPs;
- Installation of IHSs;
- Installation of building-level heat meters; and
- Installation of SCADA systems.

3. The composition of the respective investment programs varies between the different participating cities and is tailored to their specific circumstances and needs.

4. **Rationale for Public Sector Investment:** In Ukraine, DH services have traditionally been supplied by public sector companies under municipal/regional ownership. Given the basic essential services nature of the activities, the concerned municipal/regional governments have been closely involved in approving key aspects of the operations, including investments and setting of tariffs. Starting in 2011, the responsibility for regulatory oversight, including tariff-setting, was devolved to a new regulatory agency, the Utilities Regulator. Depending on the progressive experience under this framework, greater interest from the private sector may emerge in the future. However, at present, DH companies remain under municipal/regional ownership and have not attracted much private investment. Because DH utilities continue to be the principal suppliers of essential services to the population, their reliability and efficiency need to be improved.

5. **Rationale for Bank Involvement:** The Bank has been involved in a sector dialogue with GoU for some time. It has provided technical assistance and advice through preparation of specific studies in the sector. DH companies in Ukraine have faced severe financial constraints over the years that have led to progressive deterioration in their heat production and distribution facilities. The necessary investments to increase the operating efficiency of these facilities are large and beyond the financial capacity of the concerned companies unless substantial amounts of funds are made available on a concessional basis to make the investments affordable. In particular, the companies are reluctant to invest in new technology such as ITPs without the availability of concessional financing (e.g., from CTF funds). The involvement of the Bank enables the inclusion of a significant amount of CTF funds to be employed for justifiable investments under the project. Overall, Bank financing continues to be among the most favorable sources of funds for these activities.

6. **Methodology of Selection of the Investments.** Based on the investment program suggested by each company and the results of the relevant feasibility studies, an assessment was made to determine which investments represent the least-cost alternative to delivering the expected benefits, taking into account the specific constraints and other relevant circumstances in each city. Based on relevant experience in the region, it has been established that DH provides an economically sound and often least-cost alternative for providing heating services in urban areas where the density of the heat load exceeds 1 Gcal/h per km of heating pipelines network. All participating utilities assessed met this test. Choice of the priority investments for each utility is discussed in Section C below.

7. **Assessment of Net Economic Benefits of the Investments:** The net economic benefits of the individual investments are estimated on an incremental basis (i.e., as the difference between costs and benefits under the “with project” and “without project” scenarios). Benefits and costs are valued at economic prices. The indicators used are the Economic Net Present Value (ENPV) at a discount rate of 10 percent and the Economic Internal Rate of Return (EIRR). The principal quantifiable benefits under the selected investments come from: (i) operating cost savings, including fuel savings, through improvements in facilities’ operating efficiency; (ii) reduced heat consumption (resulting in lower gas usage in heat production) in buildings through increased installation of IHSs and building-level heat meters; and (iii) reductions in emissions and associated carbon credits. In some cases, there are additional revenues through increased heat or electricity supply, but these are less significant. The economic benefits include increased reliability of supply and decreased risk of collapse of key facilities, and other improvements in the quality of service that are more difficult to quantify.

8. **Summary of Economic Costs and Benefits:** Detailed analyses of the project’s economic costs and benefits, for each participating utility and for the project as a whole, are available in the Project Files. ENPV (at a discount rate of 10 percent) and EIRR estimates of the investment program in each city and overall for the project are given in Table 6.1. Further details are provided in Table A6.3 (at the end of this Annex).

Table A6.1: Indicators of Net Economic Benefits for Each Participating Company

City/Company	Net Present Value (ENPV) (USD million)	Internal Rate of Return (EIRR) (%)	Sensitivity to Gas Prices	
			+20%	-20%
Ivano-Frankivsk- Ivano-Frankivskteplokumunenergo	3.52	14%	16%	12%
Kamyanets-Podilskyi – CE Miskteplovodenerhiya	18.10	44%	50%	37%
Kharkiv – Kharkivski Teplovi Merezhi	122.22	37%	38%	35%
Kherson - Khersonteploenergo	3.14	14%	16%	12%
Mykolaiv - Mykolayiboblteploenergo	17.32	34%	40%	28%
Vinnytsia - Vinnytsiamiskteploenergo	16.42	24%	28%	20%
Overall Project	180.62	27%	30%	25%

9. **Sensitivity Analysis:** The major part (about 62 percent) of the project’s benefits come from fuel (gas) savings through the increased efficiency enabled by project investments. The benefits are therefore sensitive to changes in gas prices; increases in gas prices would increase the net benefits from the project. The main risk is the relatively unlikely event of a decrease in international gas prices. For a 20 percent decrease in gas prices, the EIRRs by component and overall would be as shown in Table 6.1. Changes in the companies’ heat sales tariffs would not have a significant impact on the project’s economic benefits since a relatively small part of the benefits comes from increased heat sales. However, the levels of heat sales tariffs would have a substantial impact on the overall financial well-being of the utilities as discussed below in the relevant sections.

B. FINANCIAL ANALYSIS

10. Financial analyses have been carried out: (i) at the project level, to estimate the financial rate of return (FIRR) for each investment subproject; and (ii) at the entity level, to assess each company’s financial situation and ability to meet its financial obligations in regard to operating expenses and debt service during project implementation and operation periods.

11. Project-level Financial Analysis. Estimates of the FIRRs and NPVs were carried out for two scenarios: (i) natural gas prices for the DH companies remain at the current level (base scenario); and (ii) natural gas prices for all consumer groups are equalized and are at the commercial level starting in 2017 (gas price conversion scenario). At present, the tariffs of natural gas for production of residential heat are significantly lower than those of gas used for heat generation for other consumers. The FIRRs for all investment subprojects range from 6.8–29.6 percent for the base scenario, higher than the estimated weighted average cost of capital (WACC) of 5 percent. The estimates of FIRR and NPV values for participating utilities for both scenarios are presented in Table A6.2.

**Table A6.2: Estimated FIRR and NPV of DH Companies
under Base and Gas Price Conversion Scenarios**

DH Company	FIRR (%)		NPV (MUSD)	
	Base scenario	Gas price conversion scenario	Base scenario	Gas price conversion scenario
Ivano-Frankivskteplokunenergo	6.8%	14.2%	2.5	14.3
Miskteplovodenerhiya	23.7%	37.5%	16.2	33.8
Kharkivski Teplovi Merezhi	27.2%	39.4%	145.8	260.2
Khersonteploenergo	10.8%	14.8%	7.4	13.3
Mykolaivoblteploenerho	16.8%	28.9%	16.0	37.0
Vinnytsiamiskteploenergo	13.4%	22.9%	16.5	39.1
Total project	20.1%	31.0%	205	398

12. Entity-level Financial Analysis. The financial analyses of each investment subproject (DH company) are based on the feasibility studies prepared in 2013 and the companies' historical financial statements for 2010-2012 accounts, as well as their latest financial projections.

13. The major assumptions made to carry out the company-level financial analysis are the following:

- Real terms (2012)
- Heat bill collection rate: 97 percent for the whole the project period
- Heat sales: due to the energy savings achieved by the project and investments undertaken by inhabitants, it is assumed that annual heat sales will decrease 2 percent annually for the first 10 years. After that, heat sales will remain stable until the end of the whole project period
- Finance source: IBRD loan and CTF loan
- Terms of IBRD loan:
 - 20 years including 5-year grace period
 - Interest rate: variable 6-month LIBOR + variable spread
- Terms of CTF loan:
 - 20 years including 10-year grace period
 - Service charge: 0.75 percent
 - Management fee: 0.45 percent of total loan amount
- Depreciation period: 20 years for boilers and substations, 40 years for pipelines, and 10 years for vehicles.

14. The company level financial analysis was carried out for the following residential heat tariff scenarios:

- Heat tariffs will remain at the present levels (base scenario).
- The heat tariff for residential consumers will be increased to the full financial cost-recovery level starting in 2016. The difference in the residential tariff revenues and costs will be paid by the state starting in 2016.

- The heat tariff for residential consumers will be increased to the full financial cost-recovery level gradually over the time period of 2015–2018.

DH Tariff Regulation in Ukraine

15. Heat tariffs of DH companies in Ukraine are regulated by the Utilities Regulator. The tariffs of natural gas for production of residential heat and heat for other consumers are set at different levels. In all six companies of the project, heat is produced from natural gas, which is the largest production cost item. As of June 2013, the tariff of natural gas used for generation of residential heat was 1,309.2 UAH/1000m³; for all other consumers, it was 4,661.74 UAH/1000 m³ (tariffs include VAT). Due to this difference in gas prices, costs and tariffs are calculated separately for residential consumers and other consumers.

16. DH tariffs for residential consumers are usually set below the full financial cost-recovery level by the Utilities Regulator. According to Ukrainian legislation, losses from the generation and supply of heat energy to residential consumers that arise from the difference in the approved tariffs and the actual cost of production and supply of heat energy should be reimbursed by state authorities.

17. Residential consumers are the largest consumer group in all major DH companies in Ukraine. The sales share of heat to residential consumers in the six project companies varies between 75-85 percent. The differences in the residential tariffs and costs are not regularly reimbursed by the state; often the amounts are transferred to DH companies with long delays. Such practice negatively influences their cash inflows, and in some cases leads to increased tax obligations.

18. In some DH companies, the tariffs for other consumer groups (budgetary, commercial) are also set below the full cost-recovery level. No legal mechanism is in place to reimburse this difference between tariffs and costs.

C. PARTICIPATING DH COMPANIES – FEATURES AND RESULTS

Ivano-Frankivsk – Ivano-Frankivskteplokomunenergo

(a) Economic Analysis

19. **Special features:** The company provides both space heating and hot water delivery services. Main facilities include: (i) 35 boiler houses with 140 boilers, the average age of the main boilers is about 27 years; most use natural gas, but some small ones use wooden fuel; (ii) 5 mini-CHPs – the electricity is mainly used for own needs; (iii) 28 central heat substations (CHSs); (iv) DH networks with about 131 km of pipelines; the average age is about 27 years and 60 percent have operated for over 20 years; a low percentage of the overall pipes have modern pre-insulation; heat losses extend up to 27 percent for some of the main pipelines; and (v) pumping stations with 513 pumps. The DH system needs relatively large investments for the extensive rehabilitation required to prevent further deterioration and to improve its efficiency and reliability.

20. **Selection of investments:** Based on an assessment of the situation, it was determined that rehabilitation of networks is the most urgent need together with rehabilitation (including installation of a SCADA system) of a large boiler house serving about 40 percent of the population. The network rehabilitation will include installation of 240 individual heat stations (IHSs), together with building-level heat meters, and closure of all the CHSs connected to the rehabilitated boiler house.

21. **Economic viability of investments:** A summary of the main contributors to economic benefits is provided in Table A6.3. Given the need to prevent further deterioration in the system, which could increase the risk of breakdowns and reduced reliability, the investments are relatively large. For the Ivano-Frankivsk component as a whole, the EIRR and ENPV are estimated at 14 percent and US\$3.52 million respectively.

(b) Financial Analysis

Project-level financial analyses

22. The FIRR and the NPV were calculated for each investment component and for the whole investment program of Ivano-Frankivskteplokcomunenerho. For the base case, the FIRR is 6.8 percent and the NPV is US\$2.5 million. In the gas price conversion scenario, the FIRR is 14.2 percent and the NPV is US\$14.3 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company-level financial analysis

23. Heat sales of Ivano-Frankivskteplokcomunenerho have been reducing in the last few years. Total heat sales in 2012 amounted to 364,000 Gcal in comparison with 447,000 Gcal in 2010 and 404,000 Gcal in 2011. The major reason for the reduction in 2011 was the separation of one boiler house into a separate company. In 2012, the share of heat sales to residential consumers was 75 percent; to budgetary consumers, 21 percent; and to other consumers, 4 percent. Sales revenue from residential consumers is the largest revenue source. Due to the low residential tariffs, the share of this consumer group in 2012 in overall revenues was 48 percent, much lower than its share of sales in Gcal. The respective shares of sales revenues of budgetary and other consumers were 43 percent and 9 percent.

24. In Ivano-Frankivsk, a two-part heat tariff has been applied since 2000. The heat tariff for residential customers is 281.66 UAH/Gcal (converted to a two-component tariff of 161.95 UAH/Gcal and 1.7 UAH/m²). For budgetary consumers, the tariff is 871.63 UAH/Gcal and for other consumers, 895.44 UAH/Gcal (including VAT). The cost-recovery rate of Ivano-Frankivskteplokcomunenerho residential consumers' tariff is about 73 percent. Tariffs for the other two customer groups are around the cost-recovery level: around 99 percent for budgetary consumers and about 101 percent for other consumers. The average cost recovery of heat supply is about 91 percent. The annual amounts of the tariffs and cost differences transferred to Ivano-Frankivskteplokcomunenerho in 2011 and 2012 were UAH 17.3 million and UAH 41.7 million, respectively. In 2010, the company did not receive any compensation for the cost and tariff differences.

25. Production costs in 2012 were UAH 212,941 million. The share of fuel cost was 55 percent. The other largest cost components were salary and social costs (14 percent) and repairs and maintenance (14 percent). The share of depreciation was only 3 percent of the total production cost. Annual gas consumption in 2012 was 64.0 million m³, out of which 74 percent (47.1 million m³) was purchased at the residential tariff and the remaining part at the higher tariff.

26. Financial results. The annual loss in 2010 amounted to UAH 41.4 million and in 2012, UAH 28.9 million. The annual result of 2011 was a profit of UAH 36.8 million. The 2011 result was influenced by the write-off of the bad debt to Gaz Ukrainy in the amount of UAH 59.4 million, which was recorded as other operational revenue. The total amount of the accumulated loss in the balance sheet as of December 31, 2012, was UAH 42.9 million.

27. Ivano-Frankivskteplokomunenerho's invoice collection rates are good, although in recent years the rate has varied quite significantly. The collection rates (the ratio of the annual collection, including the recovery of some arrears to the annual invoicing) for 2010 and 2012 were 101 percent and 106 percent, respectively. The 2011 collection rate was 92 percent, due to low levels of collection among budgetary clients (81 percent) and other customers (84 percent). Collection of residential invoices for 2010-2012 was very good, at 100 percent in 2010 and 102 percent in both 2011 and 2012. Due to good collection rates, receivables have been relatively stable. In 2010 and 2012, the amount of receivables decreased in comparison 2011. The lower collection in 2011 was reflected in the increased amount of receivables. As of December 31, 2012, receivables amounted to UAH 63.1 million (equivalent to 4.6 months' of heat sales). The share of receivables from residential consumers is around 50 percent, whereas receivables from other consumers amount to 36 percent of total receivables.

28. The amount of payables is about two times higher than that of the receivables amount. As of December 31, 2012, payables were nearly UAH 105 million. The largest payable is the payment for natural gas (UAH 89 million, equal to 8.1 months' gas consumption).

29. The project financing plan anticipates a total financing requirement of US\$26.26 million, of which US\$18.94 million will be covered by the IBRD loan and US\$7.31 million by the CTF loan. Projections of financial performance given the base scenario are summarized below. Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Ivano-Frankivskteplokomunenerho	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	446.7	404.2	363.6	363.6	356.6	349.5	342.5	335.6	328.9	322.3	315.9
Residential tariff (UAH/Gcal)	216.8	239.1	238.9	238.9	238.9	238.9	238.9	238.9	238.9	238.9	238.9
Financial Highlights (000 UAH)											
Operating Revenues	137 887	236 001	226 338	180 242	177 762	175 083	172 452	169 875	167 348	164 873	162 447
Net profit/loss	-41 349	36 811	-28 856	-48 007	-37 866	-35 874	-30 781	-26 342	-22 581	-21 212	-19 934
Net Fixed Assets	51 999	49 427	51 012	45 415	39 818	85 426	134 099	160 306	149 029	137 753	126 477
Total Debt Service	0	0	0	0	9	250	902	1 600	1 947	1 865	1 774
	0	0	0	0	0	0	0	0	0	0	0
Financial Ratios											
Debt Service Coverage	n/a	n/a	n/a	n/a	-69.0	-44.7	-25.6	-12.2	-8.0	-1.2	-1.1
Current Ratio	0.6	0.9	0.6	0.4	0.1	-0.1	-0.4	-0.6	-0.8	-1.1	-1.3
Break-even ratio	0.9	1.3	1.1	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9

30. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	216.8	239.1	238.9	238.9	238.9	238.9	481.2	473.0	465.5	459.1	459.0
Debt Service Coverage	n/a	n/a	n/a	n/a	-69.0	-44.7	24.2	16.5	14.8	2.7	2.7
Current Ratio	0.6	0.9	0.6	0.4	0.1	-0.1	0.1	0.3	0.6	0.8	1.1
Break-even ratio	0.9	1.3	1.1	0.8	0.8	0.8	1.1	1.2	1.2	1.2	1.2
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	216.8	239.1	238.9	238.9	238.9	299.7	359.9	413.3	465.5	459.1	459.0
Debt Service Coverage	n/a	n/a	n/a	n/a	-69.0	-24.1	1.5	9.8	14.7	2.7	2.7
Current Ratio	0.6	0.9	0.6	0.4	0.1	0.0	0.0	0.1	0.4	0.6	0.8
Break-even ratio	0.9	1.3	1.1	0.8	0.8	0.9	1.0	1.1	1.2	1.2	1.2

Kamyanets-Podilskyi - CE Miskteplovodenerhiya

(a) Economic Analysis

31. **Special features:** The company provides both space heating and hot water delivery services. Main facilities include: (i) nine boiler houses and a CHP with a total of about 36 boilers; efficiency is about 89 percent; most were installed in the period 1962-2009; all use natural gas; (ii) two mini-CHPs, whose electricity is used for the company’s own consumption; (iii) DH networks with about 117 km of pipelines; heat losses are reported at least 20 percent of the delivered heat; and (iv) 23 CHSs, of which 21 are also used for pumping cold water.

32. **Selection of investments:** Based on an assessment of the situation, it was determined that the priority investments are: (i) closure of a loss-making CHP and reconnection of its customers to two newly constructed boiler houses; (ii) rehabilitation of one boiler house; (iii) connection of new and rehabilitated boiler houses to the existing SCADA system; (iv) DH network rehabilitation to reduce losses; and (v) installation of 83 new IHSs together with building-level heat meters.

33. **Economic viability of investments:** A summary of the main contributors to economic benefits is provided in Table A6.3. For the Kamyanets-Podilskyi component as a whole, the EIRR and ENPV are estimated at 44 percent and US\$18.10 million respectively.

(b) Financial Analysis

Project level financial analyses

34. The FIRR and the NPV were calculated for each investment component and for the whole investment program of Miskteplovodenerhiya. For the base case, the FIRR is 23.7 percent and the NPV is US\$16.2 million. In the gas price conversion scenario, the FIRR is 37.5 percent and the NPV is US\$33.8 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company level financial analysis

35. Heat sales of Miskteplodenerhiya have been increasing to some extent in the last few years. Total heat sales in 2010 amounted to 174,000 Gcal (February-December); in 2011 and 2012, the corresponding heat sale amounts were 200,000 Gcal and 201,000 Gcal. In 2012, the share of heat sales to residential consumers was 82 percent; to budgetary consumers, 17 percent; and to other consumers, 1 percent. Hot water is usually supplied during the whole year; however in 2103, the hot water supply was stopped at the end of the heating season for the first time. Heat sales revenue from residential consumers is the largest revenue source. Due to the low residential tariffs, the share of this consumer group in overall revenues was 52 percent in 2012, much lower than its share of sales in Gcal. Sales to budgetary customers were quite significant, at a share of 44 percent of overall heat sales revenues. Other customers accounted for 4 percent of heat sales.

36. The company uses a one-part heat tariff. Valid heat tariffs for residential consumers have been in force since January 2011 and since autumn of 2011 for other consumers. The heat tariff is 243.37 UAH/Gcal for residential consumers; 962.56 UAH/Gcal for budgetary consumers; and 1045.67 UAH/Gcal (including VAT) for other consumers. The cost-recovery rate of Miskteplodenerhiya's residential consumers' tariff is about 80 percent. The tariffs of the company for budgetary and other consumer groups are above the full cost-recovery level, at about 109 percent and 119 percent, respectively. The amounts of tariff and cost differences transferred to the company in 2010-2012 were as follows: UAH 1.0 million in 2010; UAH 12.0 million in 2011; and UAH 47.4 million in 2012. As of December 31, 2012, the outstanding amount of the difference in tariffs and costs to be received was UAH 21.1 million.

37. In addition to heat supply, Miskteplodenerhiya also provides water and wastewater services. Heat supply provides the major revenue stream to the company. In 2012, total sales revenues were UAH 91.5 million, of which heat revenues accounted for UAH 60.5 million (66 percent of total revenues). The share of water and wastewater revenues was about 25 percent.

38. The production cost of heat production in 2012 was UAH 80.621 million. The share of fuel cost was 64 percent. The other largest cost components were salary and social costs (18 percent) and electricity (5 percent). The share of depreciation was only 3 percent of the total production cost. Annual natural gas consumption in 2012 was 35.9 million m³, of which 82 percent (29.3 million m³) was purchased at the residential tariff and the remaining part at the commercial tariff.

39. Financial results. In 2010 and 2011, the company's financial results were negative, with resulting losses of UAH 20.2 million and UAH 14.4 million, respectively. The net result in 2012 was a profit of UAH 15.3 million due to the large compensation transfer to cover the cost and tariff difference (UAH 49.8 million). As a result, the company was obliged to pay corporate income tax of UAH 2.6 million on the 2012 profit. The total amount of accumulated loss in the balance sheet as of December 31, 2012, was UAH 14.1 million.

40. Miskteplodenerhiya's invoice collection rates were good in the last two years. The overall collection ratio (ratio of the annual collection, including the recovery of some arrears to the annual invoicing) in 2010 was 90 percent. In 2011 and 2012, the respective figures were 99

percent and 96 percent. The high collection rate in 2011 is attributed to a 104 percent collection rate from budgetary and other customer groups on one hand and improved collections from residential customers on the other. The residential collection rate increased from 82 percent in 2010 to 95 percent in 2011; in 2012, the rate further improved to 96 percent. Receivables have been steadily increasing but the total amount is not large. As of December 31, 2012, receivables amounted to UAH 12.6 million (or 2.1 months' heat sales). The share of receivables from residential consumers is around 60 percent, and from budgetary customers, 34 percent.

41. The amount of payables decreased significantly in 2012, from nearly UAH 40 million on December 31, 2011, to UAH 18.7 million on December 31, 2012. Payables by all main categories have improved; most notable is the reduction of the payable for natural gas (payables have decreased due to the receipt of a large payment for the difference in the tariffs and costs). As of the end 2012, the largest payable was for supplied natural gas (UAH 15.9 million, equal to 2.9 months' gas consumption).

42. The project financing plan anticipates a total financing requirement of US\$12.26 million, of which US\$10.26 million will be covered by the IBRD loan and US\$2.0 million by the CTF loan. Projections of financial performance the based on base case scenario are summarized in the table below. Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Miskteplodenerhiya	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	173.0	199.6	200.8	200.8	196.8	192.9	189.0	185.3	181.6	177.9	174.4
Residential tariff (UAH/Gcal)	156.6	192.3	190.6	190.6	190.6	190.6	190.6	190.6	190.6	190.6	190.6
Financial Highlights (000 UAH)											
Operating Revenues	59 784	103 319	141 261	93 825	92 662	91 475	90 311	89 170	88 052	86 956	85 883
Net profit/loss	-20 145	-14 357	15 299	-29 032	-28 190	-28 238	-12 853	-11 841	-11 481	-11 256	-10 980
Net Fixed Assets	40 347	41 338	117 616	122 278	115 243	147 480	147 811	137 286	126 762	116 237	105 713
Total Debt Service	0	0	0	0	45	290	716	906	925	890	844
Financial Ratios	0	0	0	0	0	0	0	0	0	0	0
Debt Service Coverage	n/a	n/a	n/a	n/a	-52.4	-51.9	-9.3	-3.6	-3.1	-0.4	-0.4
Current Ratio	0.5	0.4	0.7	0.6	-0.3	-1.1	-1.7	-2.0	-2.3	-2.8	-3.3
Break-even ratio	0.7	0.9	1.1	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9

43. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	156.6	192.3	190.6	190.6	190.6	190.6	280.9	280.9	278.6	278.2	277.8
Debt Service Coverage	n/a	n/a	n/a	n/a	-52.4	-51.9	7.2	9.4	9.2	1.5	1.5
Current Ratio	0.5	0.4	0.7	0.6	-0.3	-1.1	-1.1	-0.6	-0.2	0.0	0.2
Break-even ratio	0.7	0.9	1.1	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	156.6	192.3	190.6	190.6	190.6	216.0	220.0	240.0	278.6	278.2	277.8
Debt Service Coverage	n/a	n/a	n/a	n/a	-52.4	-41.9	-3.8	3.7	9.1	1.5	1.5
Current Ratio	0.5	0.4	0.7	0.6	-0.3	-1.0	-1.3	-1.2	-0.8	-0.6	-0.4
Break-even ratio	0.7	0.9	1.1	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0

Kharkiv – Kharkivski Teplovi Merezhi

(a) Economic Analysis

44. **Special features:** The company provides both space heating (100 percent of the Kharkiv system) and hot water delivery services. Main facilities include: (i) 251 heat generating facilities with 613 boilers connected to the DH network; all use natural gas; boilers were constructed during 1951 to 1982, the newest boiler is 31 years old; efficiency is about 90 percent for the large boilers; (ii) a CHP plant with eight boilers; (iii) DH networks with 1,594 km in two-pipe equivalent, most of the same age as the boilers; heat losses are reported at about 19%; (iv) 201 CHSs of which 177 provide hot water delivery and 193 space heating; and (v) 90 building-level IHSs.

45. **Selection of investments:** Based on an assessment of the situation, the priority investments include (i) renovation of boiler houses – 22 boiler houses will be closed and 52 other boiler houses will be rehabilitated and upgraded; the loads will be connected to the latter; (ii) installation of SCADA in about 288 of the operated boiler houses; (iii) rehabilitation of the main network pipelines with the introduction of pre-insulated pipes; and (iv) installation of about 300 building-level IHSs with about 1000 heat meters.

46. **Economic viability of investments:** A summary of the main contributors to economic benefits is provided in Table A6.3. For the Kharkiv component as a whole, the EIRR and ENPV are estimated at 37% and US\$122.22 million respectively.

(b) Financial Analysis

Project level financial analyses

47. The FIRR and NPV were calculated for each investment component and for the whole investment program of Kharkivski Teplovi Merezhi. For the base case, the FIRR is 27.2 percent and NPV is US\$145.8 million. In the gas price conversion scenario the FIRR is 39.4 percent and NPV is US\$260.2 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company level financial analysis

48. Kharkivski Teplovi Merezhi's heat sales have been relatively stable in the last few years. Total heat sales in 2012 were 6,167,000 Gcal (compared to 6,253,000 Gcal in 2010 and 6,433,000 Gcal in 2011). In 2012, the share of heat sales to residential consumers was 86 percent; to budgetary consumers, 10 percent; and to other consumers, 5 percent. Sales revenues from residential clients is the largest revenue source for the company. However, due to the low residential tariffs, the share of this consumer group in 2012 in overall revenues was 62 percent (budgetary and other consumers' shares were 26 percent and 12 percent, respectively). Electricity is produced only in the combined heat and power plant No. 3 (CHP-3); other production units generate only heat. In 2012, total electricity sales amounted to 152.8 GWh.

Electricity is sold on the wholesale electricity market. According on the KDHC's calculations, electricity production is profitable, with a profit margin of about 2 percent.

49. The valid heat tariffs are 304.03 UAH/Gcal for residential consumers and 899.94 UAH/Gcal (including VAT) for all other consumers. The cost-recovery rate of Kharkivski Teplovi Merezhi's residential consumers' tariff is about 85 percent; the tariffs for other consumers are at the break-even level. This is causing cash flow problems for the company. In 2010, the company did not receive any reimbursement for the tariff and cost difference. The amounts transferred to the company in 2011 and 2012 were UAH 278.1 million and UAH 393.6 million, respectively.

50. The production cost of heat production in 2012 was UAH 2,029,528 million. The share of fuel cost was 53 percent. The cost of heat purchased outside constituted about 18 percent, and salary and social costs were 14 percent. The share of depreciation was only 2 percent of the total heat production cost. Annual natural gas consumption in 2012 was 35.9 million m³, of which 82 percent (29.3 million m³) was purchased at the residential tariff and the remaining part at the commercial tariff.

51. Financial results. The annual loss in 2010 was UAH 252.4 million and in 2012, UAH 16.7 million. In 2011, the company made a profit of UAH 184.5 million. The financial results of 2011 and 2012 are better due to the receipt of some other operational revenues. The company received compensation for the tariff difference of UAH 278.1 million in 2011 and UAH 393.6 million in 2012. The 2011 result was influenced by the write-off of UAH 353.2 million in receivables, which was recorded as other operational revenue. The accumulated loss in the company's balance sheet as of December 31, 2012, was UAH 304.5 million.

52. Kharkivski Teplovi Merezhi's invoice collection rate is over 90 percent (including the recovery of some arrears). The overall collection ratio (ratio of the annual collection to the annual invoicing) in 2010 was 96 percent; in 2011 and 2012, the collection ratios were 91 percent and 93 percent, respectively. Collection of residential invoices increased from 93 percent in 2010 to 95 percent in both 2011 and 2012. Difficulties in collection have led to a build-up of receivables, which as of December 31, 2012, amounted to UAH 1,008.0 million (equivalent to 5.8 months' heat sale).

53. In parallel with the increase of receivables, the amount of payables increased to UAH 1,832.8 million by December 31, 2012. The largest shares in payables were for natural gas (UAH 907.2 million, equal to 8.5 months' gas consumption) and purchased heat (UAH 577.4 million).

54. The project financing plan anticipates a total financing requirement of US\$107.57 million, of which US\$96.77 million will be covered by the IBRD loan and US\$10.80 million by the CTF loan. Projections of financial performance given the base case scenario are summarized below: Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Kharkivski teplovi merezhi	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	6273.6	6455.5	6188.6	6057.7	5943.1	5824.6	5708.4	5594.5	5482.9	5373.5	5266.3
Residential tariff (UAH/Gcal)	184.9	196.8	204.1	229.8	229.8	229.8	229.8	229.8	229.8	229.8	229.8
Financial Highlights (000 UAH)											
Operating Revenues	1 425 418	2 444 456	2 343 967	2 012 938	1 985 251	1 946 326	1 911 567	1 875 762	1 841 546	1 807 580	1 774 514
Net profit/loss	-252 438	184 493	-16 716	-355 866	-349 135	-320 109	-245 716	-223 093	-200 046	-183 692	-170 852
Net Fixed Assets	385 420	408 613	432 326	495 890	466 198	628 301	704 070	772 245	748 380	722 943	662 096
Total Debt Service	0	0	0	0	424	2 169	4 514	6 214	7 551	7 644	7 470
Financial Ratios	0	0	0	0	0	0	0	0	0	0	0
Debt Service Coverage	n/a	n/a	n/a	n/a	-81.2	-93.4	-43.9	-24.4	-17.5	-2.1	-1.8
Current Ratio	0.6	0.8	1.0	1.0	0.9	0.7	0.6	0.4	0.3	0.2	0.1
Break-even ratio	0.8	1.1	1.0	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9

55. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	184.9	196.8	204.1	229.8	229.8	229.8	280.5	280.5	279.8	307.0	305.7
Debt Service Coverage	n/a	n/a	n/a	n/a	-81.2	-93.4	0.3	8.2	8.8	3.1	3.2
Current Ratio	0.6	0.8	1.0	1.0	0.9	0.7	0.7	0.8	0.8	0.9	1.0
Break-even ratio	0.8	1.1	1.0	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	184.9	196.8	204.1	229.8	229.8	242.3	254.8	267.3	279.8	307.0	305.7
Debt Service Coverage	n/a	n/a	n/a	n/a	-81.2	-73.7	-22.1	0.0	8.8	3.1	3.2
Current Ratio	0.6	0.8	1.0	1.0	0.9	0.8	0.7	0.7	0.7	0.8	0.9
Break-even ratio	0.8	1.1	1.0	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

Kherson – MCE Khersonteploenergo

(a) Economic Analysis

56. **Special features:** The company provides space heating and hot water delivery services. Main facilities include: (i) 40 boiler houses with 169 boilers; the main units were constructed from 1968 to 1997; the average age of the boilers is 20 years; all use natural gas; (ii) distribution networks, on average, are the same age as the boilers; total length of pipelines is about 96 km; only about 5 percent use modern pre-insulation; heat losses are estimated at about 13 percent of the heat delivered; and (iii) 46 CHSs, of which five have been renovated; the remaining need various degrees of renovation/rehabilitation. The company does not have any IHSs at present. The DH system needs relatively large investments for the extensive rehabilitation required to prevent further deterioration and to improve its efficiency and reliability.

57. **Selection of investments:** Based on an assessment of the situation, the priority investments were determined to be: (i) closure of four boiler houses, reconnection of the pipelines to others, and renovation of two large boiler houses; (ii) installation of SCADA in 26 boiler houses; (iii) rehabilitation of four major CHSs connected to the rehabilitated boiler houses; and (iv) installation of 21 IHSs and 200 building-level heat meters.

58. **Economic viability of investments** A summary of the main contributors to economic benefits is provided in Table A6.3. Given the need to prevent further deterioration of the district heating system which could increase the risk of breakdowns and reduced reliability, the investments are relatively large. For the Kherson component as a whole, the EIRR and ENPV are estimated at 14 percent and US\$3.14 million respectively.

(b) Financial Analysis

Project-level financial analyses

59. The FIRR and the NPV were calculated for each investment component and for the whole investment program of Khersonteploenerho. For the base case, the FIRR is 10.8 percent and the NPV is US\$7.4 million. In the gas price conversion scenario, the FIRR is 14.8 percent and the NPV is US\$13.3 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company-level financial analysis

60. Khersonteploenerho's heat sales have been relatively stable over the last few years. Total heat sales in 2012 amounted to 284,000 Gcal (compared to 280,000 Gcal in 2010 and 275,000 Gcal in 2011). In 2012, the share of heat sales to residential consumers was 82 percent; to budgetary consumers, 14 percent; and to other consumers, 4 percent. At present, the company does not supply domestic hot water (DHW – hot water is provided only in one small service area in very limited amounts). Sales revenue from residential consumers is the largest revenue source. Due to the low residential tariffs, the share of this consumer group in overall revenues was 62 percent in 2012, much lower than its share of sales in Gcal. The respective shares of sales revenues of budgetary and other consumers were 31 percent and 7 percent.

61. The valid heat tariff is 314.36 UAH/Gcal for residential consumers; 897.21 UAH/Gcal for budgetary consumers; and 908.77 UAH/Gcal (including VAT) for other consumers. In Kherson, the tariffs for all consumer groups are below the full cost-recovery level. The cost-recovery rate of Khersonteploenerho's residential consumers' tariff is about 72 percent; for budgetary consumers, about 90 percent; and for other consumers, 89 percent. In 2010, the company did not receive any reimbursement for the tariff difference; the amounts transferred to the company in 2011 and 2012 were UAH 9.4 million and UAH 38.2 million, respectively. The amount received in 2012 corresponds to the cumulative tariff and cost difference for 12 months of 2011 and 9 months of 2012.

62. The production cost of heat production in 2012 was UAH 118,916 million. The share of fuel cost was 58 percent. The other largest cost components were salary and social costs (23 percent) and electricity (9 percent). The share of depreciation was 5 percent of the total production cost. Annual gas consumption in 2012 was 44.4 million m³, of which 83 percent (37.0 million m³) was purchased at the residential tariff and the remaining part at the commercial tariff.

63. Financial results. In 2010 and 2011, the company's financial result was negative, with losses of UAH 10.6 million and UAH 16.1 million, respectively. In 2012, the company earned a profit of UAH 11.9 million due to the large compensation transfer (UAH 38.2 million) to cover the tariff difference. This amount includes compensation of the tariff and cost differences for the whole of 2011, which was recorded as income in fiscal year 2012. As a result, the company was obliged to pay corporate income tax on the earned profit in 2012, despite the accumulated losses of recent years.

64. Khersonteploenerho's invoice collection rate has steadily increased in recent years. The overall collection ratio (ratio of the annual collection, including the recovery of some arrears to the annual invoicing) in 2010 was 93 percent. The ratio grew to 94 percent in 2011 and further to 95 percent in 2012. Collection of residential invoices for the same period was as follows: 90 percent in 2010; 97 percent in 2011; and 91 percent in 2012. Despite improved collection rates, the amount of receivables is steadily growing. As of December 31, 2012, receivables amounted to UAH 59.2 million (equivalent to 6.4 months' heat sale). The share of receivables from residential consumers is around 88 percent.

65. In parallel with the increase in receivables, the amount of payables is increasing. As of December 31, 2012, payables amounted to UAH 52.7 million. The largest payable is the payment for natural gas (UAH 40.3 million, equal to 6.1 months' gas consumption).

66. The project financing plan anticipates a total financing requirement of US\$21.65 million, of which US\$20.0 million will be covered by the IBRD loan and US\$1.65 million by the CTF loan. Projections of financial performance based on the base case scenario are summarized below. Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Khersonteploenerho	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	279.5	275.2	284.1	282.8	277.4	271.8	266.4	261.0	255.8	250.7	245.7
Residential tariff (UAH/Gcal)	235.0	234.4	242.6	262.0	262.0	262.0	262.0	262.0	262.0	262.0	262.0
Financial Highlights (000 UAH)											
Operating Revenues	85 289	106 803	144 280	101 053	99 237	97 304	95 407	93 547	91 725	89 940	88 190
Net profit/loss	-15 913	-11 719	8 868	-34 212	-34 847	-35 431	-37 564	-34 257	-33 213	-31 654	-30 342
Net Fixed Assets	50 316	49 961	49 773	49 584	44 540	88 576	129 351	122 143	109 494	96 003	79 648
Total Long Term Debt	4 248	4 432	3 270	0	7 190	33 436	95 110	150 560	168 521	163 332	152 621
Total Debt Service	0	0	0	0	72	327	932	1 475	1 652	1 600	1 493
	0	0	0	0	0	0	0	0	0	0	0
Financial Ratios											
Debt Service Coverage	n/a	n/a	n/a	n/a	-44.7	-47.6	-19.5	-10.0	-7.6	-1.0	-0.9
Current Ratio	1.0	0.9	1.1	0.8	0.2	-0.3	-0.9	-1.4	-1.8	-2.5	-3.2
Break-even ratio	0.8	0.9	1.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

67. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	235.0	234.4	242.6	262.0	262.0	262.0	422.3	431.8	422.0	421.1	417.3
Debt Service Coverage	n/a	n/a	n/a	n/a	-44.7	-47.6	11.3	11.3	10.3	1.6	1.6
Current Ratio	1.0	0.9	1.1	0.8	0.2	-0.3	-0.1	0.3	0.8	1.0	1.2
Break-even ratio	0.8	0.9	1.1	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	235.0	234.4	242.6	262.0	262.0	302.5	344.8	392.2	422.0	421.1	417.3
Debt Service Coverage	n/a	n/a	n/a	n/a	-44.7	-32.0	-3.6	6.5	10.3	1.6	1.6
Current Ratio	1.0	0.9	1.1	0.8	0.2	-0.1	-0.3	-0.1	0.4	0.5	0.8
Break-even ratio	0.8	0.9	1.1	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.0

Mykolaiv – Mykolayivoblteploenergo

(a) Economic Analysis

68. **Special features:** The company provides both space heating and hot water delivery services. Main facilities include: (i) 123 boiler houses with 386 boilers; most were constructed between 1968 and 1977; the average age is about 28 years; all use natural gas; larger boilers have good efficiency (close to 90 percent) but some of the smaller ones have lower efficiency; (ii) the company operates one small mini-CHP plant, whose electricity is used for the company's own needs; the company has no other CHPs but it provides transmission service to a CHP owned by another party; (iii) DH networks are around the same age as the boilers; total pipelines are about 209 km, of which about 17 km are dilapidated; the share of modern pre-insulated pipes is low; heating losses are estimated at about 9 percent by the company but are likely much larger; and (iv) 72 CHSs, most commissioned between 1966-2004; seven have been renovated; others need various degrees of renovation/rehabilitation.

69. **Selection of investments:** Based on an assessment of the situation, the priority investments have been determined to be: (i) closure of 19 small boiler houses and connection of their load to heat supply from the CHP plant (not owned by the company); (ii) renovation of 31 boiler houses; (iii) installation of a SCADA system in 31 boiler houses; (iv) insulation of above-ground pipes connected to 18 boiler houses; (v) modernization of four major CHSs; and (vi) installation of 93 IHSs with building-level heat meters.

70. **Economic viability of investments:** A summary of the main contributors to economic benefits is provided in Table A6.3. For the Mykolaiv component as a whole, the EIRR and ENPV are estimated at 34 percent and US\$17.32 million, respectively.

(a) Financial Analysis

Project-level financial analyses

71. The FIRR and NPV were calculated for each investment component and for the whole investment program of Mykolaivoblteploenergo. For the base case, the FIRR is 16.8 percent and the NPV is US\$16.0 million. In the gas price conversion scenario, the FIRR is 28.9 percent and the NPV is US\$37.0 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company-level financial analysis

72. Mykolaivoblteploenergo's heat sales have increased in the last few years. Total heat sales in 2012 amounted to 536,000 Gcal; in 2010 and 2011, the corresponding heat sales were 581,000 Gcal and 597,000 Gcal. Sales increased as the company merged some smaller DH networks that were earlier operated by other organizations. In 2012, the share of heat sales to residential consumers was 84 percent; to budgetary consumers, 13 percent; and to other consumers, 3 percent. Heat sales revenue from residential consumers is the largest revenue source. Due to the low residential tariffs, the share of this consumer group in 2012 in overall revenues was 63

percent, much lower than its share of sales in Gcal. The respective shares of sales revenues of budgetary consumers and other consumers were 31 percent and 6 percent, respectively.

73. The heat tariff is 245.41 UAH/Gcal for residential consumers; 880.38 UAH/Gcal for budgetary consumers; and 951.62 UAH/Gcal (including VAT) for other consumers. The tariffs for residential consumers as well as budgetary and other consumer groups are below the full cost-recovery levels. The cost-recovery rate of Mykolaivoblteploenerho's residential consumers' tariff is about 82 percent; for budgetary and other consumers, about 79 percent. The average cost-recovery is about 80 percent. The annual amounts of the tariff and cost differences reimbursed in 2010, 2011, and 2012 were UAH 1.6 million, UAH 29.6 million, and UAH 45.7 million, respectively.

74. The production cost of heat production in 2012 was UAH 234.2 million. The share of fuel cost was about 60 percent. The other largest cost components were salary and social costs (21 percent) and electricity (7 percent). The share of depreciation was only 3 percent of the total production cost.

75. Financial results. In 2010 and 2011, the company's financial results were negative, with resulting losses of UAH 8.5 million and UAH 8.9 million, respectively. The net result in 2012 was a profit of UAH 7.0 million due to the large compensation transfer to cover the cost and tariff difference (UAH 45.7 million). In 2012, the company paid a small amount of corporate income tax (UAH 7,000). The total amount of accumulated loss in the balance sheet as of December 31, 2012, was UAH 23.9 million.

76. Mykolaivoblteploenerho's invoice collection rates are good. The overall collection ratio (ratio of the annual collection, including the recovery of some arrears to the annual invoicing) in 2010 was 98 percent; in 2011, the collection rate was 97 percent; and in 2012, it was about 96 percent. Collection rates of residential invoices for 2010, 2011, and 2012 were 97 percent, 96 percent, and 96 percent, respectively. Despite good collection rates, the amount of receivables is steadily growing. As of December 31, 2012, receivables were UAH 56.5 million (equivalent to 3.2 months' heat sale). The share of receivables from residential consumers is around 87 percent.

77. The amount of payables has increased faster than that of receivables. As of December 31, 2012, payables were UAH 64.2 million. The largest payable is for natural gas (UAH 53.7 million, equal to 3.8 months' gas consumption).

78. The project financing plan anticipates a total financing requirement of US\$21.8 million, of which US\$19.42 million will be covered by the IBRD loan and US\$2.38 million by the CTF loan. Projections of financial performance based on the base case scenario are summarized below. Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Mykolaivobltpeploenerho	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	535.7	581.2	597.4	600.8	589.2	577.4	565.9	554.5	543.4	532.6	521.9
Residential tariff (UAH/Gcal)	225.7	230.5	224.5	217.0	217.0	217.0	217.0	217.0	217.0	217.0	217.0
Financial Highlights (000 UAH)											
Operating Revenues	154 688	202 869	232 201	181 631	178 368	174 960	171 617	168 341	165 130	161 983	158 900
Net profit/loss	-8 449	-8 911	6 962	-37 076	-40 394	-37 340	-32 428	-27 903	-25 241	-21 644	-17 840
Net Fixed Assets	93 322	91 698	89 541	94 697	86 602	114 525	131 490	133 586	131 907	133 144	118 437
Total Debt Service	0	0	0	0	166	453	812	1 097	1 310	1 451	1 470
Financial Ratios	0	0	0	0	0	0	0	0	0	0	0
Debt Service Coverage	n/a	n/a	n/a	n/a	-47.2	-37.5	-25.0	-15.1	-10.4	-1.1	-0.7
Current Ratio	1.0	1.0	1.1	0.9	0.5	0.2	-0.2	-0.5	-0.8	-1.2	-1.6
Break-even ratio	1.0	1.0	1.0	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9

79. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	225.7	230.5	224.5	217.0	217.0	217.0	309.3	303.1	297.0	294.0	288.9
Debt Service Coverage	n/a	n/a	n/a	n/a	-47.2	-37.5	15.9	13.7	12.2	1.9	2.0
Current Ratio	1.0	1.0	1.1	0.9	0.5	0.2	0.4	0.7	1.0	1.2	1.4
Break-even ratio	1.0	1.0	1.0	0.8	0.8	0.8	1.0	1.1	1.0	1.1	1.1
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	225.7	230.5	224.5	217.0	217.0	240.9	262.7	280.2	297.0	294.0	288.9
Debt Service Coverage	n/a	n/a	n/a	n/a	-47.2	-23.7	-3.8	7.0	12.1	1.9	2.0
Current Ratio	1.0	1.0	1.1	0.9	0.5	0.3	0.3	0.4	0.7	0.9	1.1
Break-even ratio	1.0	1.0	1.0	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1

Vinnitsia – Vinnitsiamiskteploenergo

(a) Economic Analysis

80. **Special features:** The company provides both space heating and hot water delivery services. Main facilities include: (i) 39 boiler houses with 114 boilers; the main boilers are over 40 years old; average efficiency is about 90 percent; all use natural gas; (ii) CHPs, whose electricity is used for the company’s own needs and for winter sales to the grid; (iii) DH networks with about 206 km of pipelines, of which about 150 km need rehabilitation/replacement; about 15 percent have been replaced with pre-insulated pipes; heat losses are estimated at about 19.6 percent; (iv) 83 CHSs ; and (v) 112 IHSs accounting for about 10 percent of total heat consumption.

81. **Selection of investments:** Based on an assessment of the situation, the priority investments were determined to be: (i) renovation/replacement of the capacity of the second largest CHP operated by the company, connecting it to the existing SCADA, and reconnecting the load; (ii) rehabilitation of networks connected to the renovated CHP and increasing/rehabilitating pipelines to meet additional needs; and (iii) installation of 220 IHSs with building-level heat meters in all buildings connected to the renovated CHP.

82. **Economic viability of investments:** A summary of the main contributors to economic benefits is provided in Table A6.3. For the Vinnitsia component as a whole, the EIRR and ENPV are estimated at 24 percent and US\$16.42 million, respectively.

(b) Financial Analysis

Project-level financial analyses

83. The FIRR and the NPV were calculated for each investment component and for the whole investment program of Vinnytsiamiskteploenerho. For the base case, the FIRR is 13.4 percent and the NPV is US\$16.5 million. In the gas price conversion scenario, the FIRR is 22.9 percent and the NPV is US\$37.1 million. Details of the individual investment component FIRRs and NPVs for both scenarios are presented in the project-level summary tables.

Company-level financial analysis

84. Vinnytsiamiskteploenerho's heat sales have reduced in the last few years. Total heat sales in 2012 amounted to 725,000 Gcal; in 2010 and 2011, the corresponding heat sales were 761,000 Gcal and 738,000 Gcal. In 2012, the share of heat sales to residential consumers was 85 percent; to budgetary consumers, 12 percent; and to other consumers, 3 percent. Sales revenue from residential consumers is the largest revenue source. Due to the low residential tariffs, the share of this consumer group in overall revenues in 2012 was 61 percent, much lower than its share of sales in Gcal. The respective shares of sales revenues of budgetary consumers and other consumers were 29 percent and 10 percent.

85. Vinnytsiamiskteploenerho is using the two-part heating tariff. Average heat tariffs in 2012 were as follows: residential consumers, 272.3 UAH/Gcal; budgetary consumers, 937.7 UAH/Gcal; and other consumers, 1029.7 UAH/Gcal (including VAT). In Vinnytsia, the tariffs of all groups are below the full cost-recovery level. The cost-recovery rate of Vinnytsiamiskteploenerho's residential consumers' tariff is about 70 percent; for budgetary consumers, about 92 percent; and for other consumers, 99 percent. The average heat cost recovery is about 87 percent. The annual calculated amounts of the tariffs and cost differences in 2010, 2011, and 2012 were UAH 44.2 million, UAH 57.1 million, and UAH 44.1 million, respectively. The actual amounts transferred to the company in the same time period were: UAH 6.8 million in 2010; UAH 33.9 million in 2011; and UAH 121.9 million in 2012.

86. The production cost of heat production in 2012 was UAH 308,872 million. The share of fuel cost was 64 percent. The other largest cost components were salary and social costs (17 percent) and electricity (6 percent). The share of depreciation was 5 percent of the total production cost. The annual gas consumption in 2012 was 125.1 million m³, of which 82 percent (102.2 million m³) was purchased at the residential tariff and the remaining part at the higher tariff.

87. Financial results. In 2010 and 2011, the company's financial results were negative, with resulting losses of UAH 41.3 million and UAH 33.5 million, respectively. The annual net result in 2012 was a profit of UAH 27.2 million due to the large compensation transfer to cover the cost and tariff difference (UAH 121.9 million). As a result, the company was obliged to pay corporate income tax of UAH 3.9 million on the 2012 profit. Due to cash flow problems, the company had trouble making this payment; in agreement with the authorities, the tax payment was partially rescheduled. The total amount of accumulated loss in the balance sheet as of

December 31, 2011, was UAH 96.4 million; due to the 2012 profit, the accumulated loss decreased to UAH 69.0 million by December 31, 2012. The total asset value at the end of FY 2012 was UAH 180.0 million.

88. Vinnytsiamiskteploenerho's invoice collection rates are very good. The overall collection ratio (ratio of the annual collection, including the recovery of some arrears to the annual invoicing) in 2010 and 2012 was 100 percent; in 2011, the collection rate was 95 percent, caused by relatively low collections from budgetary and other clients. The collection rates of residential invoices for 2010, 2011, and 2012 were 99 percent, 98 percent, and 97 percent, respectively. The collection rates of budgetary customers have fluctuated: in 2010 and 2012, the collection rates were 102 percent and 110 percent, respectively, whereas in 2011, the collection rate was only 86 percent.

89. Due to good collection rates, receivables have been relatively stable and not particularly high. In 2010 and 2012, receivables decreased in comparison with 2011. Lower collection in 2011 was reflected in the increased receivables. As of December 31, 2012, receivables were UAH 51.0 million (equivalent to 2.2 months' heat sale). The share of receivables of residential consumers is around 84 percent.

90. The amount of payables has increased faster than that of receivables (i.e., payables are twice as large as receivables). As of December 31, 2012, payables amounted to UAH 103.7 million. The largest payable is for natural gas (UAH 97.4 million, equal to 5 months' gas consumption).

91. The project financing plan anticipates a total financing requirement of US\$36.53 million, of which US\$29.78 million will be covered by the IBRD loan and US\$6.73 million by the CTF loan. Projections of financial performance based on base scenario are summarized below. Any possible compensations of the tariff and cost difference are not taken into account in the forecasts.

Vinnytsiamiskteploenerho	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Sales (000 Gcal)	761.0	738.1	724.7	742.6	728.3	713.7	699.4	685.4	671.7	658.3	645.1
Residential tariff (UAH/Gcal)	197.9	219.8	226.9	262.8	262.8	262.8	262.8	262.8	262.8	262.8	262.8
Financial Highlights (000 UAH)											
Operating Revenues	204 484	249 570	354 662	259 443	254 823	249 846	244 960	240 171	235 478	230 879	226 373
Net profit/loss	-41 369	-33 502	27 164	-57 268	-62 373	-59 135	-51 581	-42 497	-26 352	-19 337	-17 652
Net Fixed Assets	85 004	99 048	83 084	67 422	51 144	78 425	159 030	159 864	172 556	188 222	180 584
Total Long Term Debt	0	0	0	0	20 440	59 412	161 168	208 959	241 593	258 212	264 792
Total Debt Service	0	0	0	0	155	474	1 470	1 948	2 274	2 441	2 506
	0	0	0	0	0	0	0	0	0	0	0
Financial Ratios	0	0	0	0	0	0	0	0	0	0	0
Debt Service Coverage	n/a	n/a	n/a	n/a	-35.5	-58.5	-20.6	-11.5	-7.5	-0.8	-0.7
Current Ratio	0.6	0.5	0.7	0.6	0.2	-0.2	-0.5	-0.8	-1.1	-1.5	-1.9
Break-even ratio	0.8	0.9	1.1	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9

92. The sensitivity of the financial performance was tested for two scenarios in which the residential heat tariff increases to the full financial cost-recovery level: (i) starting in 2016; and (ii) gradually over the time period 2015–2018. The results of these scenarios are presented below:

Scenario 2016	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	197.9	219.8	226.9	262.8	262.8	262.8	342.9	336.5	326.7	305.6	297.3
Debt Service Coverage	n/a	n/a	n/a	n/a	-35.5	-58.5	5.7	7.1	5.7	0.4	0.3
Current Ratio	0.6	0.5	0.7	0.6	0.2	-0.2	-0.1	0.1	0.3	0.2	0.0
Break-even ratio	0.8	0.9	1.1	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0
Scenario 2015 - 2018	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential tariff (UAH/Gcal)	197.9	219.8	226.9	262.8	262.8	283.3	302.5	316.7	326.7	305.6	297.3
Debt Service Coverage	n/a	n/a	n/a	n/a	-35.5	-42.8	-7.6	2.1	5.7	0.4	0.3
Current Ratio	0.6	0.5	0.7	0.6	0.2	0.0	-0.2	-0.1	0.0	-0.1	-0.2
Break-even ratio	0.8	0.9	1.1	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.0

Table A6.3: Summary of Main Contributors to Economic Benefits (in USD 000)

Indicator	2014	2015	2016	2017	2018	2019	2020	2021-2033
Ivano-Frankivskteplokomunenergo (Ivano-Frankivsk)								
Annual capital expenditure	77	6459	7095	5011	154	77		
Annual savings in								
- Gas		234	740	1279	1621	1621	1621	1621
- Electricity		26	79	113	123	123	123	123
- Water		28	87	142	174	174	174	174
- O&M expenses		128	388	542	571	571	571	571
- Other expenses		40	125	222	283	283	283	283
Annual net benefits	-77	-6003	-5676	-2714	2617	2694	2771	2771
EIRR = 14%								
ENPV = US\$3.52 million								
Miskteplodenerhiya (Kamyanets-Podilsky)								
Annual capital expenditure	1661	5153	1459	172	172	172	86	
Annual savings in								
- Gas	30	208	2604	2710	2710	2710	2710	2710
- Electricity		4	52	56	56	56	56	56
- Water		1	7	10	10	10	10	10
- O&M expenses		3	576	582	582	582	582	582
- Other expenses	6	60	350	350	350	350	350	350
Annual net benefits	-1625	-4878	2130	3536	3536	3622	3622	3622
EIRR = 44%								
ENPV = US\$18.10 million								
Kharkivski Teplovi Merezhi (Kharkiv)								
Annual capital expenditure	77	6459	7095	5011	154	77		
Annual savings in								
- Gas	441	2631	-3350	533	3341	5100	5972	5972
- Electricity	317	1449	1760	1894	2006	2089	2129	2129
- Water		112	333	554	772	989	1097	1097
- O&M expenses	152	415	560	796	943	951	952	952
- Other expenses	3	449	900	1194	1428	1606	1682	1682
Annual net benefits	859	2576	3435	17897	17897	17897	17897	17897
EIRR = 37%								
ENPV = US\$122.22 million								
Khersonteploenergo (Kherson)								

Indicator	2014	2015	2016	2017	2018	2019	2020	2021-2033
Annual capital expenditure	840	6292	6444	1106	535	474		
Annual savings in								
- Gas	18	229	620	867	906	915	915	915
- Electricity	1	60	175	237	240	240	240	240
- Water		1	1	2	2	2	2	2
- O&M expenses	4	175	511	681	681	681	681	681
- Other expenses		48	137	277	376	475	475	475
Annual net benefits	-817	-5780	-5000	958	1670	1838	2313	2313
EIRR = 14%								
ENPV = US\$3.15 million								
Mykolayiboblteploenergo (Mykolaiv)								
Annual capital expenditure	1856	4723	3585	1905	1530	1961	46	
Annual savings in								
- Gas	94	1058	2255	2436	2570	2870	2870	2870
- Electricity	29	112	197	279	321	407	491	491
- Water								
- O&M expenses	10	89	261	348	391	461	530	530
- Other expenses	7	240	568	812	957	1133	1239	1239
Annual heat purchases		292	584	584	584	584	584	584
Annual net benefits	-1715	-3517	-807	1388	2125	2326	4500	4546
EIRR = 34%								
ENPV = US\$17.32 million								
Vynnytsiamiskteploenergo (Vynnytsia)								
Annual capital expenditure	56	5437	12199	2912	2912	2912	56	
Annual savings in								
- Gas		599	1665	2528	3053	3578	3709	3709
- Electricity		83	309	482	521	559	568	568
- Water		34	129	224	270	316	328	328
- O&M expenses		38	360	666	695	724	731	731
- Other expenses		20	192	359	378	397	401	401
Annual net benefits	-56	-4663	-- 9542	1347	2005	2662	5681	5681
EIRR = 24%								
ENPV = US\$17.42 million								

Annex 7: Clean Technology Fund
UKRAINE: District Heating Energy Efficiency Project

Indicator	CTF/IBRD-funded Project	Scaled-up** Phase
Energy savings [GWh/yr]	560 GWh/yr*	1,960 GWh/yr
Tons of GHG emissions reduced or avoided -Tons per year [tCO _{2eq} /yr] -Tons over lifetime of the project [tCO _{2eq}]***	330,000 tCO _{2eq} /yr* 5,260,000 tCO _{2eq} over lifetime of the Project*	1,160,000 tCO _{2eq} /yr 18,400,000 tCO _{2eq}
Financing leveraged through CTF funding [US\$ million]	US\$382 <ul style="list-style-type: none"> • IBRD US\$332 • CTF US\$50 	US\$1,580 <ul style="list-style-type: none"> • Public US\$50 • Private US\$330 • MDB US\$920 • Bilateral US\$230 • CTF US\$50
CTF leverage ratio [1:X]	1: 7	1 : 30
CTF Investment cost effectiveness [US\$ _{CTF} /tCO _{2eq} avoided]	US\$9 _{CTF} /tCO _{2eq}	US\$3 _{CTF} /tCO _{2eq}
Other co-benefits	<ul style="list-style-type: none"> • Changed nature of district heating systems in participating utilities: from inefficient, supply-driven constant-flow systems to more efficient, demand-driven variable-flow systems • Improved reliability of heat supply/energy security • Lowered cost of heat which particularly benefits low income families which are often headed by women • Improved quality of heat supply most noticeable to women who tend to take care of housekeeping activities • Reduced macro-economic imbalance • Potential technology cost reduction • Development of local IHS service industry • Improved economic competitiveness • Environmental co-benefits: reduced local pollution (SO₂, NO_x) through reductions of energy consumption and heat generation. • Health co-benefits due to reduced emissions 	

* The estimated expected savings/ emission reductions are shown for ten participating companies. The numbers will be adjusted after feasibility studies for the remaining four companies are completed and their investment programs are finalized. The savings/ reductions in emissions are reported jointly for CTF/ IBRD-funded components because of the strong complementarity of the investments. CTF investments (IHSs in particular) change the nature of the district heating systems in the participating companies: from supply-driven, constant flow systems to demand-driven, variable flow systems. CTF-funded investments affect the whole district heating chain: from generation to distribution. Hence, it is not possible to separate energy savings/ CO₂ reductions that are attributable to the CTF-funded component only.

**The Project is working with 10 DH companies which cover about 30% of the heat market in Ukraine. In the scaled up phase, it is assumed that implementation of similar investments will cover the remaining 70% of the market.

***The lifetime of the Project is 20 years. The savings/ reductions are estimated as (i) a sum of annual savings/ reductions from the implemented portions of the Project during its implementation period (the first 6 years), and (ii) adding them to the annual savings of the fully implemented Project for the next 14 years. As a result, the cumulative lifetime savings are not a product of the 20 and the final years' CO₂ emission savings.

Table A7.1: Main Components/ Investments to Be Financed by the Project

Component	Total Cost, US\$ mln	Description of Investments (CTF-financed investments are shown in BOLD)
Component 1: Energy Efficiency Investments		
Ivano-Frankivskteplokcomunenergo (Ivano-Frankivsk)	26.26 (18.93 IBRD/ 7.33 CTF)	Rehabilitation of a boiler house serving about 40 percent of the companies' consumers; rehabilitation of all networks connected to the rehabilitated boiler house; installation of SCADA system; installation of individual heat substations and building-level heat meters
Miskteplovodenerhiya (Kamyans-Podilsky)	12.26 (10.26 IBRD/ 2.00 CTF)	Closure of a loss-making combined heat and power plant (CHP), construction of 2 new boiler houses, rehabilitation of 1 boiler house, network rehabilitation, installation of SCADA system, installation of individual heat substations and building-level heat meters
Kharkivski Teplovi Merezhi (Kharkiv)	107.57 (96.76 IBRD/ 10.81 CTF)	Closure of 22 boiler houses, rehabilitation of 52 boiler houses, rehabilitation of a CHP, rehabilitation of networks, installation of frequency converters for main network pumps, installation of SCADA system, installation of individual heat substations and building-level heat meters with temperature controls
Khersonteploenergo (Kherson)	21.65 (20.00 IBRD/ 1.65 CTF)	Closure of 4 boiler houses, rehabilitation of 2 large boiler houses, rehabilitation of networks, installation of SCADA system, purchase of maintenance equipment, installation of individual heat substations and building-level heat meters
Mykolayiboblteploenergo (Mykolaiv)	21.8 (19.42 IBRD/ 2.38 CTF)	Closure of 19 small boiler houses, rehabilitation of 31 boiler houses, insulation of pipes, installation of SCADA system, purchase of maintenance equipment, installation of individual heat substations and building-level heat meters
Vinnytsiamiskteploenergo (Vinnytsia)	36.53 (29.78 IBRD/ 6.75 CTF)	Replacing capacity of a CHP, network rehabilitation, installation of individual heat substations and building-level heat meters
Additional critical investments for the above DH companies	28.2 (28.2 IBRD/ 0 CTF)	Based on the discussions of the priority investment programs proposed by the feasibility studies, it was identified that for the above DH companies some additional critical investments are needed in order to complement the agreed investment programs and improve their efficiency savings as well as benefit more customers. However, the needs for these investments are above the sub-loan limits suggested by the Ministry of Finance for each company. It was agreed with the Ministry of Finance that the additional critical investments will be included in the project
Chernihivteploelectrocentral (Chernigiv); Dniproteploenerho (Dnipropetrovsk); Kirovohradteplo (Kirovograd); Donetskmiskteplomerezha (Donetsk)	122.21 (103.15 IBRD/ 19.08 CTF)	The size of the investment programs for these DH companies has been discussed and will be finalized before the negotiations; the details of investment programs will be finalized soon after the Board approval. Since these four DH companies are similar to the ones above, their investment programs will be generally similar in nature and expected benefits (although varying in scale)
Component 2: Technical Assistance and Capacity Building		
Technical Assistance and Capacity Building	5.5 (5.5 IBRD/ 0 CTF)	This component will finance technical assistance to the Ministry of Regional Development, Construction, Housing and Communal Services, which will oversee the implementation of the Project. Technical assistance will support, among other things, capacity building and knowledge-sharing workshops to the participating companies thus promoting better quality of implementation and sustainability of the Project investments
TOTAL	382 (332 IBRD/ 50 CTF)	

A. Introduction

1. **Ukraine is one of the 20 largest primary energy consuming nations, and it is one of the top 10 most energy-intensive economies in the world.**¹² Its energy intensity is three times higher than the EU average and is the key driver of GHG emissions in the country.¹³ For example, Ukraine's energy use per unit of purchasing power parity (PPP) adjusted GDP exceeds Germany's by a factor of 4.7 (0.45 kg of oil equivalent in Ukraine vs. 0.12 kg in Germany¹⁴). Ukraine's energy intensity is higher than that of energy-rich Russia, and its CO₂ intensity is considerably above that of Russia. District heating (DH) companies are the third biggest consumers of natural gas in the country (after population and industry). A significant majority of buildings in cities and towns are connected to DH networks. About 80,000 high rise buildings consume 44 percent of the country's heat energy resources.

2. **The carbon intensity of the economy is correspondingly high.** In 2006, Ukraine produced about 450 million tCO_{2eq} of GHG emissions, and CO₂ accounted for 76 percent of the emissions (and methane another 18 percent)¹⁵. The energy sector was responsible for 69 percent of the total emissions. DH accounted for 20 percent of the CO₂ emissions and 81 percent of the methane emissions from fossil fuel combustion in the country. Industrial processes produced another 22 percent. Emissions from the energy sector and industrial processes are expected to grow as the economy recovers. Achieving the GoU's 2050 GHG emissions target and the associated net zero growth in emissions will depend critically on substantially improving the efficiency with which energy is produced and consumed. This will require a shift to cleaner fuels and more efficient technologies.

3. **The Government of Ukraine (GoU) made a strategic commitment to reduce energy intensity (i.e., improve efficiency) 20 percent by 2015 and 50 percent by 2030.** The Government also set a goal to keep GHG emissions 20 percent and 50 percent below 1990 levels by 2020 and 2050 respectively. The Energy Strategy of Ukraine for the Period until 2030 (Energy Strategy), adopted in 2006, provides a platform for supporting this commitment and addressing key challenges in the sector; this platform has been iterated in the recently approved update of the Energy Strategy. GoU plans to improve the efficiency of existing assets with a three-pronged effort: (i) replacing the oldest equipment with new equipment; (ii) upgrading plants with a reasonable remaining operating life (typically more than 10 years); and (iii) decreasing energy production from old plants while investing in new plants. Additionally, GoU set an ambitious target of achieving 6 GW of installed renewable energy capacity by 2030, or 10 percent of total installed capacity. The "Green Tariff" introduced in 2009 has already led to some increase in wind and solar power generation over the last couple of years. As such, the total renewable-based installed generation capacity reached about 576 MW by end of 2012. Not only does GoU need to mobilize substantial resources to accomplish these low carbon growth goals, it particularly needs Clean Technology Fund (CTF) resources to lower the market barriers so that the private sector can participate. Consequently, GoU prepared a CTF Investment Plan.

¹² Measured as amount of primary energy used to produce one unit of GDP (PPP). Source: IEA World Energy Statistics and Balances; World Development Indicators.

¹³ The discussion follows IEA's *Ukraine. Energy Policy Review 2006*. Paris: International Energy Agency, 2006

¹⁴ WDI (2009).

¹⁵ National GHG Inventory Report, 2008

B. Ukraine CTF Investment Plan

4. **The CTF Investment Plan for Ukraine was endorsed by the CTF Trust Fund Committee (TFC) in March 2010.** Under this plan, GoU will use US\$350 million from the CTF to finance and catalyze greater investments in: (i) renewable energy; (ii) energy efficiency in residential and government buildings, DH, and the industrial sector; (iii) introduction of Smart Grid components in the transmission system; and (iv) zero emissions power generation from the gas network. Ukraine updated its investment plan to reflect the reallocation of funds within priority sectors and the impact of proposed changes on achieving the objectives and targets of the investment plan. The updated plan, approved in May 2013, selected four activities for CTF co-financing:

- a. **Ukraine Renewable Energy Financing Facility** (EBRD, IFC): a program to address policy, finance, business, and information barriers to renewable energy market developments as well as to direct financing to private sector generation of 100 MW of large-scale wind power capacity and 80 MW of medium-sized renewable sources;
- b. **Improving Energy Efficiency** (EBRD, IBRD, IFC): an energy efficiency program targeting: (i) reconstruction and refurbishment of municipal and mixed ownership housing stock, (ii) upgrade of government-owned buildings, (iii) decreased losses in DH supply, and (iv) improved industrial energy efficiency;
- c. **Smart Grids** (IBRD): a program for strengthening management and control systems, which would allow loss reduction through demand management and large-scale integration of intermittent renewable sources; and
- d. **Zero Emissions Power from the Gas Network** (EBRD, IBRD): commercial-scale demonstration of zero-emissions power generation from waste heat recovered from compressors in Ukraine's gas network.

5. The indicative financing of the updated Ukraine CTF plan is shown in Table A7.2.

Table A7.2: The Indicative Financing of the Updated Ukraine CTF plan, Million US\$

		Renewable Energy Financing Facility	Improving Energy Efficiency	Smart Grids	Zero Emissions Power from the Gas Network ³	Total	
CTF	EBRD	100	50		TBD	150	350 ⁴
	IBRD		70-100	50-80	TBD	150	
	IFC	35-50 ¹	0-15 ¹			50	
MDB	EBRD	219	200		TBD	419	1,269-1,519
	IBRD		500-650	250-350	TBD	750-1000	
	IFC	40	60			100	
Ukraine Counterpart			105	50	TBD	155	
Other donors		8	100			108	
Private Sector		366	25	200 ²		591	
Total		768-783	1,110-1,305	550-680	TBD	2,473-2,723	

¹ Depending on market demand and speed of project development, the IFC may reallocate the remaining US\$15 million of CTF funds to the Renewable Energy Financing Facility

² Around US\$200 million is expected to be invested by the private sector into renewable energy by 2018 and at least US\$1000 million by 2030

³ Project amounts, including CTF funding and co-financing, will be determined at a later stage

⁴ Smart Grids and Energy Efficiency funds are mutually exclusive; hence total CTF allocation remains US\$350 million (instead of US\$320-380 million). This is also why the horizontal and vertical totals do not add up to the amount in question.

6. The proposed project: Ukraine: District Heating Energy Efficiency Project is part of the *Improving Energy Efficiency* program (highlighted above). GoU prioritized supporting the DH and residential sectors instead of the industrial sector because: (i) the existing market and financial barriers for these sectors are greater than those in the industrial sector; and (ii) these sectors are of higher priority for social reasons. The program is led by the IBRD and EBRD, and its objective is to improve the energy efficiency of selected Ukrainian DH companies and their quality of service. Due to interventions in the DH sector, the proposed program is expected to facilitate the saving of 0.55-0.70 million tons of CO₂ emissions annually (after the program is fully implemented - by 2020), which will translate into 5.5-7 million tons of CO₂ by 2030. The program includes the following components: (i) installing individual heat substations (IHSs) in buildings; (ii) installing building-level heat meters; and (iii) decreasing losses in DH distribution networks. The EE program led by the IFC focuses on residential housing with the goal of encouraging financial intermediaries (FIs) to develop appropriate energy efficiency lending programs. The IBRD Ukraine District Heating Project is further described in the following sections.

C. Project description

7. DH companies are the third biggest consumers of natural gas in the country. A significant majority of buildings in cities and towns (80,000 high rise buildings consume 44 percent of the country's heat energy resources) are connected to DH networks, and DH accounts for 20 percent of the CO₂ emissions. Residential DH tariffs are set below the the cost of supplying heat to households , resulting in significant challenges in the sector:

- a. DH companies are loss making, and can only pay about 60 percent of their gas costs. Since the gas used to produce residential heat is imported from Russia, there is a real possibility that residential heat supply could be cut-off during the peak winter months;
- b. DH companies do not have funds to implement necessary investments to modernize their system and maintain it in decent condition. As a result, about 60 percent of heat is lost within the DH chain, and the largest losses occur during end-use¹⁶;
- c. DH systems are in urgent need of rehabilitation because necessary maintenance investments have been deferred for the last 25-30 years. DH companies cannot borrow from local banks for investment projects to improve their efficiency and quality of service because of their poor financial state;
- d. The deferred maintenance and lack of funds for investment have in turn lead to higher-than-necessary operating costs. Maintenance and investments are made on

¹⁶ Ukraine Energy Policy Review, IEA, 2006

an *ad hoc* basis to deal with emergency situations rather than in a planned manner designed to reduce operating costs;

- e. The common use of two-pipe technology, with direct supply from the boiler house to consumers and of four-pipe connection through group substations (CHSs) leads to higher losses, lower quality of service, and higher CO₂ emissions than more modern systems based on building-level substations (IHSs)..

8. The vast experience from Central and Eastern Europe demonstrates that modernizing DH systems is critical for solving these challenges. Removal of gas and heat subsidies is extremely challenging because they are politically popular. The District Heating Energy Efficiency Project (US\$332 million of the IBRD loan; US\$50 million of the CTF loan) is part of the World Bank's comprehensive sector strategy to modernize DH systems and address the significant challenges in Ukraine's DH sector. It will finance investments including the rehabilitation of boiler houses and rehabilitation of networks (replacement of old pipes with pre-insulated pipes) as well as installation of IHSs, building-level heat meters, and SCADA management systems. These investments are expected to improve the efficiency of heat production and delivery, reduce network losses, and decrease building-level heat consumption, thereby reducing CO₂ emissions. **The CTF financing will support the installation of IHSs and building-level heat meters in ten participating DH companies in Ukraine (in Chernigiv, Dnipropetrovsk, Donetsk, Ivano-Frankivsk, Kam'yanets-Podilsky, Kharkiv, Kherson, Kirovograd, Mykolaiv and Vinnytsia).**

Barriers hindering penetration of IHS and building-level meters in Ukraine

9. While the benefits of IHSs, such as improved quality of service and better efficiency of heat consumption, are well known, Ukraine's DH sector has been resistant to switching to IHSs. This can partly be explained by historical reasons (CHSs were invented in Ukraine), and the prevalence of the old Soviet mentality among Ukrainian DH professionals who still believe in the superiority of supply-driven DH systems. Additionally, installing IHSs is complicated in a regulatory sense. According to the Law of Ukraine on Heat Supply (No. 2633-IV), DH companies are responsible for generation, transmission and distribution of heat up to a building wall. Regulation of heat distribution within a building, which includes servicing and maintenance of building pipes and IHSs (they are commonly installed inside buildings), is left to municipalities. Homeowners' associations in Ukraine are still rare; residential building ownership is predominantly mixed – building residents own their individual apartments, while municipalities own the common spaces. DH companies need to get authorization from some municipalities (and in some cases residents as well) to install IHSs. Without this authorization, which also grants access for IHS servicing and maintenance, IHS investments will not be included in the regulated DH utilities' investments plans and, consequently, in tariffs. Thus, installation of IHSs requires the will, commitment, and determination of both DH companies and municipalities. Moreover, as IHS benefits accrue to residents, not DH companies, the financial rate of return on these investments is low. As a result, the companies are less inclined to install IHSs. Some more progressive municipalities in Ukraine have started solving regulatory obstacles to IHS installation either by outsourcing servicing and maintenance of the internal building infrastructure to DH companies or by leasing space inside buildings to DH companies for IHS

installation. However, even in these municipalities, the lack of funds prevents installation of IHSs on a large scale.

10. **Low residential heat tariffs as well as limited resources and borrowing capacity have stalled penetration of building-level heat meters and consumption-based billing in Ukraine's DH sector as well.** About 70 percent of residential heat consumption is not metered.¹⁷ Below-cost-recovery residential heating tariffs discourage DH companies from investing in building-level heat meters and moving to consumption-based billing.¹⁸ On the contrary, DH companies have an incentive to overestimate residential heat consumption and overcharge residential consumers to reduce their financial losses. The CTF resources will provide funds to move participating DH companies towards 100 percent consumption-based billing. Building-level heat metering will provide incentives to implement end-user energy efficiency measures as well as improve transparency and governance of the sector.

Proposed CTF-Financed Project

11. **Given these barriers, the concessional CTF loan will be used to encourage the DH companies and municipalities to address the above barriers and install IHSs and building-level meters.** Concessional financing will improve financial attractiveness of IHS investments to DH companies and encourage them to start solving existing regulator issues, thus increasing IHSs' penetration rate in Ukraine. Introducing more efficient technology in companies that cover about 30 percent of heat market in Ukraine and are located in different parts of Ukraine will increase its demonstration effect and help reaching the tipping point when other DH companies start investing in IHSs installation. Thus, the CTF-financed project will lower market barriers for improving energy efficiency in the Ukrainian DH sector. IHSs will transform a constant-flow DH system (i.e., where the quantity of heat delivered to consumers is controlled by supply temperature of the heat source) into a variable-flow system (i.e., when the quantity delivered to consumers is determined by heat demand of a building). IHSs have temperature controls and are installed together with building-level heat meters.

12. **Based on experience of other Eastern European countries, IHSs will reduce heat consumption of residential buildings by about 20 percent, decreasing heat generation and hence gas needs of DH companies.** Building-level heat meters are instruments which allow measuring heat consumption of a building; the heat consumption is then divided among apartments in the building proportional to their living space. Building-level heat meters are essential for introducing consumption-based billing in the sector, thus providing incentives to improve end-user energy efficiency as well as bringing transparency and better governance to the sector. Without the CTF investment, the investments in IHSs and building level meters would not happen at a large scale (as it has been the case so far – IHSs are still rare; building-level heat meters cover about 30 percent of all residential building in Ukraine) .

¹⁷ According to Ukrainian State Building Norm B.2.2-9-99 of 1999, all newly constructed buildings that are connected to DH networks are to have building-level heat meters. In some older buildings, residents self-organize to install building-level heat meters.

¹⁸ In most high-rise buildings, apartment-level heat meters cannot be installed for technical reasons.

13. **The CTF investments will build off IBRD investments in the DH companies participating in the Project.** There is strong complementarity between the investments financed by CTF and IBRD under the Project. The CTF-financed investments will change the nature of the district heating systems in the participating companies: from supply-driven to demand-driven systems. Thus, CTF-funded investments affect the whole district heating chain: from generation to distribution. Combined with traditional energy efficiency investment financed by IBRD (rehabilitation of the boiler houses, rehabilitation of the DH networks, installation of CHPs, etc.), CTF-financed installation of IHSs will enhance energy savings, and consequently CO₂ emissions reduction along the whole district heating chain. Without CTF financing, the impact of the project would have been much more limited.

14. **Improving efficiency of DH systems and transforming them from supply- to demand-driven systems will generate significant savings in operating costs for the DH companies, thus potentially decreasing cost-recovery residential heating tariffs in medium-term.** Financial analysis of participating DH companies has shown that after energy efficiency gains from the implemented investments have fully accrued, the financial state of participating DH companies will improve. After all project investments are implemented, and if current level of residential heating tariffs remains unchanged, the ratio of total revenues to total operating costs (including debt service)¹⁹ of participating utilities will improve from 0.8 to 0.9 on average. This implies that the cost-recovery residential heating tariffs could be lower with the project investments than without them. The detailed descriptions of the investments in each sector, and component break down are shown in Annex 2.

15. **With the installation of IHSs and building level meters combined with the IBRD investments, the CTF investments will have transformational impact on the DH sector in Ukraine.** The investments will transform the nature of the DH systems of participating companies, reduce their gas consumption while improving the quality of district heating services provided. This will improve the financial standing of participating DH companies, enable them to make necessary investments and meet financial obligations to suppliers and in medium term charge lower residential tariffs to the households compared to other similar DH companies that did not modernize their systems. Demonstration of such success in the 10 DH companies in the program will help with providing an example and push other DH companies in the sector to a tipping point so that they start making similar investments.

16. **In consultation with the EC, EIB, EBRD, USAID, and SIDA, the Bank designed technical assistance to the Utilities Regulator** to support its long-term sector reform strategy. The proposed technical assistance, expected to commence in January 2014, will support: (i) development of incentive-based methodologies and auditing principles to improve the Regulator's capacity for setting cost-recovery tariffs; and (ii) introduction of a sector-wide benchmarking exercise that will enable the Utilities Regulator to assess DH companies' performance over time and incentivize them to improve their efficiency. The proposed technical assistance will be implemented over two years, through a recipient-executed trust fund financed

¹⁹ Total revenues are defined as the sum of total operating revenues and net non-operating income. Net non-operating income is the difference between revenues from all sources other than those related to operations, and expenses, including taxes. Total operating expenses are defined as all expenses related to operations and provision for depreciation. Debt service requirements are defined as the aggregate amount of repayments of debt, including interest and other charges.

by SIDA. Successful implementation of this activity will stimulate improved efficiency and quality of service of DH companies and move them toward financial viability. The proposed activity has been closely coordinated with USAID and EBRD. This activity will become a part of the Integrated Approach to Reform in the Ukrainian District Heating Sector of the development partners. It will also create incentives for the companies to be more efficient; hence most likely invest in IHSs and building-level meters beyond the CTF concessional loan.

2. Assessment of the proposed CTF-financed project with CTF criteria

A. Potential for GHG emission Savings

17. The potential GHG emission reductions for the ten utilities are shown in Table A7.3 below. The emissions are calculated from summing up avoided emissions from each city as shown in Table A7.4:

Table A7.3: Potential GHG Emission Reductions of CTF Investments

	CTF/IBRD-funded Project	Scaled-up Phase
-Tons per year [tCO _{2eq} /yr]	330,000 tCO _{2eq} /yr	1,160,000 tCO _{2eq} /yr
-Tons over lifetime of the project [tCO _{2eq}]	5,260,000 tCO _{2eq} over lifetime of the Project	18,400,000 tCO _{2eq}

Table A7.4: Potential GHG Emissions Avoided due to CTF/ IBRD Investments in Each Participating DH Company*

CO ₂ Emission Avoided (tCO _{2eq})	Cumulative							
	2015	2016	2017	2018	2019	2020	...	2034
Ivano-Frankivskteplokunenergo (Ivano-Frankivsk)	850	2,379	3,908	5,437	6,966	8,496		135,931
Miskteplovodenerhiya (Kamyanets-Podilsky)	1,578	4,417	7,257	10,097	12,936	15,776		252,419
Kharkivski Teplovi Merezhi (Kharkiv)	18,897	52,913	86,928	120,944	154,959	188,974		3,023,592
Khersonteploenergo (Kherson)	488	1,367	2,246	3,126	4,005	4,884		78,138
Mykolayiboblteploenergo (Mykolaiv)	1,082	3,029	4,976	6,922	8,869	10,816		173,062
Vinnysiamiskteploenergo (Vinnysia)	1,789	5,009	8,229	11,449	14,670	17,890		286,235
Remaining 4 utilities**	8,228	23,038	37,848	52,658	67,469	82,279		1,316,459
Total	32,911	92,152	151,393	210,633	269,874	329,115		5,265,836

* The baseline of avoided GHG emissions is zero. Specific values of gas and electricity savings are based on the results of the feasibility studies. Energy savings and avoided CO₂ emissions of the companies are estimated as avoided gas-based heat generation (due to improved efficiency of heat generation, decreased network losses and decreased residential heat consumption) as well as decreased/avoided electricity use. The avoided electricity use is assumed to be coal-based base-load electricity. For each company, energy savings and reduction of CO₂ emissions are estimated as a sum of energy savings and emission reductions generated by each component of their investment programs.

** Six DH companies have been appraised and their specific avoided emissions are indicated above. For the remaining four participating DH companies, their investment programs will be finalized soon after Board approval, after their feasibility studies are completed. Since the remaining companies are similar to the ones already assessed, their investments programs are expected also to be similar in nature, though different in scale. We conservatively assume that the remaining four DH companies would add about 25 percent to the total Project avoided emissions.

18. The savings/ reductions in emissions are reported jointly for CTF/ IBRD-funded components because of the strong complementarity of the investments. CTF investments will change the nature of the DH systems in the participating companies and affect their whole district heating chain: from generation to distribution. Hence, it is not possible to separate energy savings/ CO₂ reductions that are attributable to the CTF-funded component only. Without CTF investments, the energy/ CO₂ savings as a result of the Project would be smaller.

- i) **The emissions were calculated by converting the natural gas and electricity savings from implementing CTF/ IBRD-funded investments into avoided CO₂ emissions.** The emission factor of natural gas in Ukraine is assumed to be 234gCO₂/kcal²⁰, and boiler efficiency in converting the gas into heat is assumed to be 90 percent. The emission factor of electricity is 857gCO₂/kWh²¹ since avoided electricity is base load electricity which is coal-based in Ukraine. The avoided CO₂ emissions of the companies are estimated as avoided gas-based heat generation as well as decreased/avoided electricity use. The gas and electricity savings result from improved efficiency of heat generation, installation of CHPs, decreased network losses, closure of CHSs and

²⁰ Source: allocation guidelines for investment grants from the eastern Europe Energy Efficiency And Environment Partnership (annex no2, version 30 April 2010)

²¹ Source: ibid

decreased residential heat consumption. Residential heat consumption is decreased because IHSs match building-level heat demand with supply. In old DH systems, buildings close to boiler houses are usually overheated, and residents have to open windows to keep their apartments comfortable; at the same time, buildings distant from boiler houses are cold. The net effect is excessive heat consumption as the systems are optimized to keep buildings furthest away from boiler house somewhat comfortable. Consumption-based billing enabled by building-level meters is also expected to reduce heat consumption in medium term as residents would try to reduce consumption in their buildings to reduce their heating bills. Without the CTF investments, the efficiency, and hence economic, effect of the project would be smaller, and GHG emission reductions of the project investment would be at lower levels.

- ii) **Technology development status. Though the technology is fully developed and commercial in many other countries, the barriers in Ukraine are significant.** IHSs are new to the market, which is dominated by CHSs which were invented in Ukraine; installing IHSs is complicated in a regulatory sense; DH companies are financially constrained, so cannot raise the resources to invest; and most of the benefits of installing IHSs and building-level heat meters accrue to residents. These strong barriers have derailed investments in IHSs in Ukraine. The CTF investments are needed to overcome these barriers and introduce innovative technologies to the DH sector in Ukraine. Without the CTF investment, the technologies would not otherwise be implemented in the sector at a large scale.

B. Cost effectiveness

Table A7.5: CTF Investments Cost-Effectiveness

	CTF/IBRD-funded Project	Scaled-up Phase
CTF Investment cost effectiveness [\$ _{CTF} /tCO _{2eq} avoided]	US\$9 _{CTF} /tCO _{2eq} avoided	US\$3 _{CTF} /tCO _{2eq} avoided

- i) The cost-effectiveness was estimated by dividing the investments by the GHG emission avoided at each phase of the project.
- ii) **Expected cost reduction of IHSs. While the cost of IHSs themselves is unlikely to change, the cost of installing IHSs is likely to decrease over time as the country gains experience with the technology.** Because the technology is new to the country, only a handful of contractors have experience with it; hence, they can command higher prices in the market. As the penetration of IHSs increases, the number of available contractors will increase and the prices will likely decrease as well.

C. Demonstrational Potential at Scale

- i) **At scale²², the emissions reductions would be 1.160 million tons of CO₂ equivalents annually.** Assuming a 20 year technology lifespan, the cumulative reductions would be a substantial 18.4 million tons of CO₂ equivalent per year. The participating companies cover about 30 percent of the heat market in Ukraine; if the project is successful, IBRD and other development banks are likely to invest more resources in the sector. The private sector would potentially be interested in making the investments if the project proves financially successful, perhaps using public private partnership models. Bilateral development agencies are likely to participate as well. Moreover, the anticipated shift to incentive-based pricing (vs. the current cost-plus pricing), and the inclusion of CTF investments in calculating the tariffs by the Utilities Regulator will encourage more utilities to invest in IHSs and other more efficient technologies.

- ii) **The CTF investments will allow for transformational changes in the DH sector** given the historical, financial and principal-agent barriers explained above. Although DH companies install IHSs, residents get most of the financial returns; as a result, the IRRs of these investments from the companies' perspective are low. Concessional CTF financing will improve the financial returns of investments in IHSs. The successful implementation of CTF-funded investments in the 10 participating DH companies that cover about 30 percent of the heat market in Ukraine (including three larger DH companies: Kharkiv, Donetsk and Dnepropetrovsk) will have a strong demonstration effect. The effect is expected to influence other DH companies in Ukraine to install IHSs and building-level heat meters. These investments will in turn speed up the process of introducing more efficient technologies into the market in a number of municipalities in different parts of Ukraine. IHSs will reduce building-level heat consumption, lowering DH companies losses and operating costs, and lead to avoided CO₂ emissions that could not otherwise be achieved. Combining these investments with the rest of the investments supported by the IBRD will have a significant transformative impact on DH companies and their customers.

D. Development Impact

- i) **DH companies and especially their customers will directly benefit from the Project.** DH companies will particularly benefit from an improved financial condition (more efficient heat production and delivery and reduced losses), improved overall efficiency, and the introduction of newer technology in the market. The investments will also reduce their operation and maintenance costs. As a result, in medium term the participating companies would have lower cost-recovery residential tariffs compared to other similar DH companies that have not overtaken modernization of their systems and introduced new technology. Overall, the investments will significantly improve quality of service of the companies and have positive effect on their finances turning them from loss-making entities to financially healthy companies delivering cost-effective services.

²² The Project is working with ten utilities which cover about 30% of the market. In the scaled up phase, we assume that the implementation of similar investments will cover the remaining 70% of the market; hence we have multiplied the Project savings by 3.5 to get the indicators at scale.

DH companies' customers will benefit from improved quality of service and in medium term – lower heating tariffs. Households would experience more comfortable temperature in apartments during the heating season, minimized service disruptions, and reduced worries about service disruption. The ability to regulate temperature at a building-level depending on outside conditions usually leads to about 20 percent reduction in building-level heat consumption and thus smaller heating bills. Consumption-based billing will ensure that customers are not overcharged as is the current common practice. In medium term, because of the reduced operating costs, households of participating companies would also have lower cost-recovery heating tariffs compared to customers of other similar companies that have not undertaken modernization.

Gender aspects. In many households women are responsible for paying the municipal bills. Therefore, after building-level heat meters are installed they will benefit from being able to monitor and manage heating expenditure. Moreover, women are more likely to be heads of single person and single parent households, which have the lowest income and are particularly likely to benefit from the investments. The design of the Project applies systematically a gender lens to ensure the Project will not lead to unintended negative gender impacts and account for possible unexpected positive gender impacts. To ensure that any potential gender disparities in Project impact are captured and addressed, the Project will (i) make sure that both men and women will be included in consultations on interventions in the district heating sector, and women's voice is not missing from policy dialogue; (ii) integrate gender aspect into Project quality of service surveys and data collection where relevant with an objective to obtain gender-disaggregated information with minimum costs.

At a national level, the project is expected to have a substantial development impact via the reduced gas consumption, which will lead to less reliance on imported natural gas. This will allow the country to improve its energy security and improve its balance of payment. Consumption-based billing will encourage both DH companies and households to implement energy efficiency measures, and will improve transparency and governance in the sector. These are significant improvements from the current scenario.

Environmentally, the CTF/ IBRD-funded Project will reduce GHG emissions by 330,000 tons of CO₂ per year or is 5.3 million tons of CO₂ emissions for the life of the project. The Project will also have positive environmental benefits in the elimination of local pollutants such as sulfur dioxide (SO₂) and nitrogen oxide (NO_x) through reduction of energy consumption and avoided heat generation. This reduction in GHG emissions will also result in additional health benefits.

E. Implementation Potential and Readiness

- i) **The implementation potential of these investments is very high.** GoU is committed to improving the efficiency of the DH sector. In July 2010, the Parliament passed the Law on State Regulation in the Area of Communal Services in Ukraine, which states that tariffs for communal services need to cover economically justifiable costs and planned profit. In July 2011, the President of Ukraine signed a decree creating the National

Commission on the Regulation of Communal Services to regulate the DH natural monopolies. In 2012, GoU approved a master plan to improve energy efficiency in the DH sector based on the findings of the World Bank Report “Modernization of the District Heating Systems in Ukraine: Heat Metering and Consumption – Based Billing.” While these accomplishments do not create an environment perfect for investments in heat meters and IHSs, they do create an environment in which the investments can be made despite the remaining difficulties.

Additionally, key stakeholders are supportive of the CTF investments in IHSs and building-level heat meters. As the Utilities Regulator is supportive of the investments, DH companies will potentially be able to recoup their investments through tariffs; and many residents are supportive of the investments as they will lead to improved quality of service, better service reliability, improved comfort level, and lower heating bills.

The implementation readiness of the CTF investments is also high as they have been included in the project preparation work. All participating DH companies have installation of IHSs and installation of building-level heat meters in their investment programs, to be implemented during the first three-four years of project implementation. The Central Project Management Unit (CPMU) within the Ministry of Regional Development, Construction, Housing and Communal Services (Minregion), and the local Project Implementation Units (PIUs) in the participating DH companies have all participated in a capacity building program offered by the Bank. Minregion has experience with implementing IBRD-financed municipal projects: it has been implementing Urban Infrastructure Project (UIP) since 2007. The Ministry of Finance is setting up the financial arrangements for the CTF investment, as it also set up the arrangement for the IBRD investments. Barring unforeseen circumstances, the CTF investments can be made alongside IBRD investments when the project becomes effective.

- ii) **Leverage.** The CTF investment is leveraging an additional US\$332 million of IBRD funds for the current Project, showing a financial leverage ratio of 1 to 7. In the scaled-up phase, which assumes that the implementation of similar investments will cover 100 percent of the market, the CTF would contribute to unlocking approximately US\$1.5 billion. A tentative breakdown of financing sources for the scaled-up phase includes public/DH companies (US\$50 million), private (US\$330 million), MDBs (US\$920 million), and bilateral (US\$230 million).

Since the sector has witnessed very little investment over the past decades due to the Government’s financial constraints, it might witness some nominal investments from the Government when the macroeconomic situation improves. The private sector might be interested if they see current investments yielding positive results, but that will depend on the likely success of public private partnership in the sector. MDBs are likely to have a continued strong interest in Ukraine as well bilateral development agencies.

3. CTF Additionality

Given the historical, financial, and institutional barriers hindering the implementation of energy efficiency technologies in the DH sector in Ukraine, the introduction of IHSs and building-level heat meters seem unlikely. The support from the CTF is therefore essential to kick start the deployment of a demonstrational phase of IHSs and building-level heat meters in 10 participating DH companies that cover about 30 percent of the heat market in Ukraine. Concessional funding provided by the CTF is fundamental to improve financial returns of IHS investments and thus encourage DH companies to address existing barriers and enable the deployment of the aforementioned technologies, which would not otherwise be realized.

In addition, the CTF-funded investments are highly complementary to technologies being financed by IBRD in the ten participating DH companies. In the absence of the CTF-funded investments, the US\$332 million IBRD loan would have otherwise focused on more traditional investments such as pipes, boilers, and CHPs and would not have addressed the nature of DH systems in the participating companies. Thus, the effect of those investments would have been smaller. Therefore, the CTF becomes crucial to effectively deploy a demonstration phase of IHSs and building-level heat meters, as well as inspiring the introduction of other types of non-traditional and efficient technologies in the overall DH sector.

**Annex 8: Assistance to the National Commission for Regulation of Communal Services:
District Heating Regulatory Reform Support Program**

UKRAINE: District Heating Energy Efficiency Project

1. In July 2010, the Parliament passed a law on the State Regulation in the Area of Communal Services in Ukraine. In July 2011, the President of Ukraine signed a decree creating a utilities regulator - the National Commission for Regulation of Communal Services (district heating and water supply sectors); and the Law on Heat Supply was amended accordingly. The newly created National Commission for Regulation of Communal Services (Utilities Regulator) issues licenses, regulates the licensees and approves tariffs for DH companies that operate boiler houses with a total capacity of over 20 Gcal/h and/or supply over 18,000 Gcal annually. Currently the utilities regulator has over 290 licensees that supply over 90 per cent of the total heat in Ukraine.

2. The Utilities Regulator is a newly established institution with typical start-up problems. It is not yet fully staffed (maximum number of staff of 412 are authorized), not fully organized internally, and lacks a number of procedures, methodologies, and rules and regulations. Despite all that, the Utilities Regulator is charged to develop and monitor the application of full cost-recovery district heating sector tariffs for its licensees, who are undergoing the regulatory process for the first time.

3. In order for the Utilities Regulator to perform its functions effectively, it needs clear internal operating procedures and capacity (knowledge) to adequately monitor, analyze, and approve tariff applications. Many legal, regulatory, and capacity building actions are required to render the Utility Regulator fully operational. A number of sub-legislative actions and measures are required by the Law “On the National Commission of Communal Services Market Regulation of Ukraine”, and many additional rules, regulations, procedures, and related directives will need to be drafted and implemented in order to establish and operationalize the Utility Regulator. In addition, communal services regulatory capacity, knowledge, and experience does not currently exist in Ukraine. The Utilities Regulator aims to understand the real costs of operation and requires a lot of data to be submitted for tariff calculations by its inexperienced in the process licensees. The Utilities Regulator intends to analyze and verify all data received – which requires a significant increase in qualified specialists to achieve reliable results. The capacity of the regional offices of the Utilities Regulator is taken up mainly with the control of the licensees.

4. The Utilities Regulator needs new methodologies, pieces of secondary legislation, operational rules and tools to work efficiently. Some methodologies and other pieces of secondary legislation were prepared earlier by the Ministry of Regional Development, Construction, Housing and Communal Services of Ukraine (Minregion) or by the National Electricity Regulator Commission (NERC), including the district heating tariff setting methodology. However, new approaches, new rules and tools are necessary. Many of the existing legal acts are outdated as new laws were passed and new principles were established. For example, the Law on Natural Monopolies was amended on 21 July 2012, and now requires the usage of incentive pricing principles instead of a simple “cost plus” principle when setting

the tariffs for the natural monopolies' services, though the Utilities Regulator may decide when to move to the new pricing principles.

5. The role of the regulator needs to be well understood not only by the Utilities Regulator itself, but by all governmental agencies, local governments, regulated companies and, last but not least, by the consumers. Clear definition and separation of roles of the different stakeholders would help avoid duplication and increase efficiency of the Commission. So far the transfer of tariff-setting responsibilities to the newly formed Utilities Regulator has resulted in a period of instability and delayed tariff approvals with no consideration of investment programs. However, the establishment of a sector Regulator enables the separation of the tariff setting from local politics and establishes a focal point for policy dialogue.

6. The proposed Technical Assistance will support the long-term reform strategy of the Utilities Regulator and the Government of Ukraine. The Utilities Regulator aims to move from cost-plus to incentive-based regulation which would stimulate improving efficiency of the district heating utilities, improving their quality of service, decreasing production costs, moving utilities towards financial viability as well as making district heating services of better quality and affordable to the population.

7. The Technical Assistance will assist the Ukrainian Utilities Regulator with transitioning from "cost plus" to "incentive-based" district heating regulation. The Technical Assistance will be implemented over two years, through a recipient-executed trust fund, financed by the Swedish International Development Cooperation Agency (SIDA), to the Government of Ukraine. The implementing agency of the activity will be Utilities Regulator. This activity has been closely coordinated with USAID that has been supporting the Utilities Regulator over the past several years as a part of its Municipal Heating Reform project; USAID's new Energy Project, commenced in early October 2013, also contains technical assistance component to the Utilities Regulator. It was agreed with the USAID that the SIDA-World Bank activity would address transitioning of the Utilities Regulator from cost-plus to incentive based regulation, while USAID will create information platform to support this transition as well as provide additional necessary capacity building to the Utilities regulator and its licensees.

8. In order to ensure that the proposed activity would not overlap with the work of other donors, including USAID, a special coordination platform will be established to oversee the activity. It has been discussed and agreed with other IFIs and donors, including EBRD, EIB and USAID, that a Steering Committee will be created. The Steering Committee will include representative of the Utilities Regulator, the World Bank, EBRD, EIB and USAID. It will meet regularly to discuss the progress of the proposed activity and related technical assistance provided by the USAID and other donors.

9. The SIDA-World-Bank Technical Assistance will consist of the following components:

10. **Component 1:** *Support with development of secondary legislation documents covering transformation of the communal services sector to long-term (3-5 years) full operating and investment cost-recovery tariffs, with creation of incentives for reduction of operation expenses.* This component will support the following tasks:

- **Update of existing heat tariff methodology:** development of a transitional (from “cost plus” to “incentive-based”) methodology for calculation of the heat production, transportation and supply tariffs based on the existing primary and secondary legislation and replacing the old ones. The recently prepared draft methodology using the incentive pricing principles developed by the Utilities Regulator would be taken into account. The draft transition methodology would assure a smooth transition from the existing pricing principles towards the incentive principles. The proposed transitional methodology would be accompanied by an implementation action plan.
- **Review of existing tariff setting practices:** reviewing existing tariff setting practices and other documents in use or considered by the Utilities Regulator and providing analysis and recommendations considering (1) international best practices, (2) day to day regulatory procedures necessary to implement the methodologies, (3) desirability and short-comings of various tariff approaches and (4) data needed for tariff calculations.
- **Support in applying recommended transitional methodology:** providing the main recommendations as for the regulatory asset base (RAB) calculation, regulatory treatment of assets in different ownership, calculation of regulatory depreciation, definition of return, etc., i.e. all the issues that are to be solved before moving to an incentive regulation.
- **Update of existing methodology for domestic hot water tariff calculation:** developing proposals for the amendments in the current legislation as for regulation of the hot water supply as a separate activity of the district heating utility, taking into account ownership of the hot water preparation facilities (including individual heat substations), based on experience of the Central and Eastern European countries. Hot water could be supplied in several ways: from the individual heat substation, from the group substation or even from the boiler house; in some cases there is different ownership of some facilities. This issue is not adequately addressed in the Ukrainian legislation.
- **Update of regulatory accounting and reporting forms:** developing the regulatory accounting and reporting forms on heat production, transportation and supply for the licensees, taking into account international principles and experience together with guidelines how to implement them. The Utilities Regulator currently requires too much data and too detailed information. The current practice is ineffective and the Utilities Regulator needs to develop leaner means of setting tariffs that are not derived from *de facto* regulatory management of regulated companies.
- **Introduce new procedures and regulations:** developing of procedures and regulations on the treatment of the investment component of expenses in tariffs and the place and role of planned investments in the calculation and setting of tariffs. This will include preparation of detailed requirements for the investment programs (long-term business plans) to be submitted by the licensees as a basis for approval of long-term investment programs as well as detailed guidelines and suggested regulatory rights and obligations related to the approval of investment programs.
- **Introduce guidelines for regulatory auditors:** developing guidelines for the regulatory auditors to analyze the data supplied by the licensees. This should help the control arm of the Utilities Regulator to improve its efficiency in implementing its tasks.

- **Develop draft standard heat and domestic hot water supply public contracts:** developing of standard contracts for provision of utility services based on international standards. Consequently, templates of the uniform standard contracts between the consumers and suppliers would be drafted and broadly discussed.
- **Deploy cost-reflective tariff setting methodology:** assisting the Utilities Regulator in deploying the new tariff setting methodology (covering both operating and investment cost recovery).
- **Provide training:** assisting the Utilities Regulator with the application of the new methodology, regulations and procedure to pilot district heating companies. The companies will be agreed with the Utilities Regulator, the Bank and other IFIs. The Bank is currently conducting an impact assessment of district heating tariffs increases on Ukrainian households; the pilot municipalities will be selected taking into account the results of the impact assessment in order to mitigate the potential negative social impact on the most vulnerable households. Organizing trainings and workshops for the Utilities Regulator and the selected licensee companies covering the practical use of the developed methodological recommendations.

11. **Component 2: Introduction of a sector –wide benchmarking exercise.** Benchmarking is a useful way of measuring performance in order to identify companies that demonstrate better performance most likely as a result of better management and organization. Benefits of benchmarking include an understanding of how to achieve an improved performance and how to show it to other companies in a mature way. The benchmarking process consists of the grouping all companies into certain sets (similar in the output volumes, technologies, etc.), specification of the data to be collected, data collection, determination of the differences among the analyzed companies (competition gaps) and setting targets for the companies. The benchmarking results can be used not only for the comparative analysis of efficiency of different companies but as a replacement of the existing system of norms used in tariff setting. A number of the benchmarking models and methodologies exist, but regulators usually apply the performance frontier methods (non-parametric, econometric, stochastic or deterministic).

12. This component will support the following tasks:

- **Preparation a desk study** on the best international practices of benchmarking in communal (heating and water) sector. Input from existing studies will be used where available.
- **Assisting in selecting and developing a benchmarking methodology** and adequate implementation tools based on best international practices.
- **Providing guidance on performing a benchmarking analysis** for heat transportation and distribution and water supply.
- **Assisting in developing a Benchmarking manual** with the principal goal of using benchmarking as a tool to deliver efficiency improvements over time and across utilities and streamline the regulatory process.
- **Conducting a training** on benchmarking for the Utilities Regulator.

13. **Component 3: Capacity building of the Utilities Regulator.** This component will finance an expert working full time in Kyiv and inside the Utilities Regulator. The expert will provide in-house training for the Utilities Regulator staff on every item of the Component 1 and 2 and also organize wider trainings for licensees on the application, accounting, and reporting under the new methodologies, regulation and procedures. This consists of the training of the concrete responsible persons who are carrying a certain specific function at the Utilities Regulator with hands-on consultation and answering ad-hoc questions. In addition, the expert will provide seminars and workshops for the broader audience. In some cases representatives of the licensed companies should be invited to take part at such seminars and workshops.

14. **Component 4: Miscellaneous regulation tools.** Implementation of the Component 1 and 2 requires corresponding process tools including tailor-made software to be provided to the utilities Regulator. This includes the following:

- **Software for on-line data collection and processing.** A software would need to be developed for the implementation and practical use of the above methodologies and tools; such software would need to be tailored to the adopted tariff methodology and accounting and reporting formats and would include:
 - a. Software for the on-line data collection from the licensees and its statistical analysis;
 - b. Computer program for the heat tariffs' calculation for the model developed under Component 1;
 - c. Computer program for the benchmarking model developed under Component 2; and
 - d. Special software for regulatory accounting forms administration, including the analysis of completeness and accuracy of data submitted by licensees.

9. **Component 5: Project implementation assistance and annual audit.** This component will finance the Project Implementation Unit (PIU) in the Utilities regulator as well as annual audit of the activity. The PIU will include Project Manager/ Procurement Specialist and Financial Management Specialist. There expected to be two annual audits of the activity.