THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: March 26, 2001

TO: Mr. Ken King, Assistant CEO, GEF Secretariat
Att: GEF PROGRAM COORDINATION

FROM: Lars Vidaeus, GEF Executive Coordinator

EXTENSION: 3-4188

SUBJECT: **Lithuania: Vilnius District Heating Project**
Re-Submission for Work Program Inclusion

Please find enclosed the electronic attachment of the above mentioned project brief for work program inclusion.

The proposal is consistent with the *Criteria for Review of GEF Projects* as presented in the following sections of the project brief:

- **Country Drivenness**. Government commitment has been demonstrated during all parts of project development. The Government initiated the request for the project and assisted in arranging for Swedish Government co-financing. The Ministry of Economy officials have supported the project concept, and the Ministry of Finance has agreed, in principle, to provide a sovereign guarantee for the IBRD loan. In its endorsement of the associated GEF project, the Ministry of Environment has emphasized the consistency of the Project with the national priorities of Lithuania and expressed interest in close involvement in the Project through a Steering Committee. In the Project Brief (PB), country commitment and ownership are discussed in Sections B.2 and D.4. Section B.3 makes reference to energy efficiency in district heating, which is specified as a key priority in Lithuania's first National Communication to the UNFCCC.
- **Endorsement**. The Letter of Endorsement, signed by both the GEF Focal Point and the Minister of the Environment on January 26, 2001, is attached. Prior to providing the endorsement, the Environment Ministry has requested a confirmation of commitment to the Project by the Vilnius Municipality, which has been provided as well.
- **Program Designation & Conformity**. As stated in Section B.1a of the PB, the project is consistent with the objectives of GEF OP-5 "Removal of Barriers to Energy Efficiency and Energy Conservation" as it supports "win-win" energy efficiency investments through removal of barriers. The major barriers include, on one hand, the reluctance of the district heating utility VDHC to embrace demand-side energy conservation measures and, on the

other hand, the fear of a heating bill increase on the part of the population whose heat exchanger substations are being replaced by VDHC. This creates a stalemate that prevents the economically optimal solution (with an economic IRR of about 20% on the incremental investment when barrier removal costs are not counted) from realization. Sections B.3, D.3, and Annex 2 describe the barriers targeted for removal under the Project. Annex 1 also makes reference to the barriers and to the Operational Program fit.

- **Project Design**. Section C describes the overall Project design, its components, implementation and lending modalities. Annex 1 provides the Project's logical framework. The major elements of the incremental GEF project are: a) creating an Energy Conservation Fund (US$7.5 million) to support upgrading the existing building-level substations to modern consumer-controlled technology and apartment-level DSM measures; b) marketing, public outreach, and information dissemination program (US$1.2 million)[1]; c) technical assistance for market analysis and training in utility-based DSM for the district heating company (US$0.2 million); and d) monitoring and evaluation of the global environmental benefits (US$0.3 million).
- **Sustainability**. Section F.1 and Table 3 of Annex 2 discuss aspects relating to sustainability of the Project and its medium to long-term impacts. The key factors of sustainability of the Project's results are:
  - ✓ The Energy Conservation Fund (ECF) would not depend on grant support once it is established. The lending/leasing account of the fund would have a sufficient rate of return to attract other financing and a large market to penetrate;
  - ✓ Paying the full cost per GJ of heat received from the DH company would be more feasible once the introduction of building-level substations (BLS) removes the technical barrier for the customers to choose the desired level of their heat consumption;
  - ✓ The energy savings would provide a sustainable benefit to the households, contributing to their well-being and thus mitigating the affordability barrier;
  - ✓ With broad introduction of building-level substations and client control over heat consumption, the level of customer satisfaction would increase, and the customer base of VDHC would stabilize;
  - ✓ At a minimum, the impact of the planned substation modernization program would last for the operating life of the BLS installed through the program. The energy savings of client-controlled operation would create a lasting incentive for the customers to keep the substations and continue related energy saving measures;
  - ✓ Specific activities within the project would assist the government to develop income-based subsidy policies for energy efficiency. These policies would be expected to lead to sustainability of the grant/subsidy fund of the ECF from government contributions.
- **Replicability** is stated as a specific objective of the Project (Section A.2), which would be demonstrated by the ability of the ECF to attract cofinancing by the end of the Project or

[1] The demonstration program would also include an additional US$ 1.2 million Demonstration Project component financed by SIDA, focusing on demonstrating the benefits of the modern building-level substation technology.

during its implementation. The potential for replication of the Project's overall approach is considered high throughout the ECA region, where many district heating systems as well as the housing stock are in need of a fundamental modernization to improve energy efficiency, and where awareness of energy saving opportunities at the customer level is lacking (Section D.1). The provision of financial resources for substation investments and DSM is replicable without resort to GEF once it is established that demand-side improvements can benefit the DH companies themselves and/or other participants in the emerging energy efficiency market (Section D.1, and Table 3 of Annex 2). For the DH utility, this is due not only to the consolidating impact of the DSM measures on the customer base, but also to reduced losses and costs of supply – especially, during peak demand periods. Section D.1 discusses the rationales for replicating the ECF model. The project design matrix (Annex 1) provides details of monitoring the downstream replication benefits from the project. Table 3 of Annex 2 contains a summary of key aspects of the Project's replicability.

- **Stakeholder Involvement**. Section C.3 discusses the general benefits and the beneficiaries of the Project. Section E.6 deals specifically with social impacts as related to low-income households. The involvement of homeowners through homeowner associations is discussed in Sections C.1, C.4, D.3, Box 2 of Section E.6, and Box 1 of Annex 2.
- **Monitoring & Evaluation**. Section A.3 describes the approach to M&E and identifies key monitoring indicators:
  - ✓ The monitoring and evaluation of the achievement of the global environmental objective would focus on quantifying the energy savings and associated GHG savings. The key indicators would be the GHG emission savings and costs of abatement relative to the baseline, incorporating indirect/downstream savings to the extent possible. To be able to estimate the achievement of these key outcomes, certain auxiliary indicators would be monitored such as the fuel consumption by type and the level of penetration of energy saving technology (building-level substations, heat meters and valves, energy-efficient windows, etc.) over time.
  - ✓ The performance of the Energy Conservation Fund would be measured primarily on the basis of the volume of loans/leases for energy efficiency investments, the number of borrowers taking the loans/leases, rates of return on the investments made, volume of co-financing attracted, and sustainability of the fund's operation in light of the emerging repayment patterns. With respect to the grant or subsidy element of the ECF's activities, the performance would be rated on the basis of the fund management's ability to reduce the subsidies to the level necessary to support energy efficiency investments for lower-income households, with the government gradually taking over the subsidy inputs.

- ✓ The success of the demonstration, public outreach, and information dissemination efforts would be assessed based on the information about similar project emerging elsewhere in Lithuania as well as in other countries of the ECA Region (Annex 1 specifies the criteria defining a "similar project").

Annex 1 gives additional details. Section C.1 describes a TA component involving M&E. Section C.4 makes reference to the related implementation arrangements.

- **Financing Plan**. The table in Section C.1 presents the financing plan with a breakdown by project component. The total project cost is estimated to be about $65.3 million. The World Bank would fund the upgrade of the CHP plant and improvement to the heat-only-boilers (HOBs), estimated to cost $17.1 million, while it is expected that SIDA would contribute another $16.8 million (of which $3.8 million would be grant) to the funding of substations and technical assistance. VDHC is expected to fund about $21.2 million of project costs from its internal resources. The GEF is requested to provide $10 million. Of this, $7.5 million would be used to help fund substation replacement and related DSM measures through the Energy Conservation Fund. The remaining $2.5 million would finance the institutional components including ECF management, marketing and public outreach, training for market analysis, and M&E of global environmental benefits. Finally, the proposed twinning arrangement (estimated to cost $0.24 million) is expected to be funded from a combination of Finnish government and EU grants and by the contributions of the DH companies of Helsinki and Vilnius.
- **Cost-effectiveness**. Annex 2 provides the indicators of economic effectiveness of the proposed GEF incremental project. Without consideration of the barrier removal costs, an economic return of about 20% is possible on a marginal investment in building-level substations. Taking account of the barrier removal and transaction costs reduces the EIRR for the incremental GEF project to 11-14%. The unit abatement cost for the GEF (assuming a US$ 10 million overall size of the GEF contribution) is about US$ 15 per ton of carbon equivalent. The economic analysis of the overall project is summarized in Section E.1.
- **Core Commitments and Linkages**. Section B.1 describes the linkages of the Project with the CAS for Lithuania and EU accession agenda. Section B.3 describes linkages within the Bank's work program and collaboration with the EU and bilaterals (twinning arrangement with Finland). Section D.3 relates the Project to other projects within the sector.
- **Consultation, Coordination and Collaboration between IAs**. In Section B.2, reference is made to a UNDP GEF renewable (wind) energy project for the Baltic region. There are no known UNDP initiatives on energy efficiency in Lithuania. Advice has been received from the UNDP Regional Office in Bratislava on the approaches used by UNDP to address some similar barriers in Russia, as well as on the available demonstration and replication opportunities.

- **Response to Reviews.** The STAP reviews and responses to them are given in Annex 3. The first review was made on the basis of the initial Project Concept Note. The second review, received on March 7, 2001, is based on the current PB. Favorable comments from UNDP have been received at the time of pipeline inclusion. Additional UNDP comments were received on January 19 and March 19, 2001 and responded to on January 27 and March 20, 2001, respectively. Comments from EBRD were received on March 15 and responded to on March 20, 2001. Comments from Senior Social Scientist Ms. Maria Cruz (GEF) were received on March 16 and responded to on March 19, 2001.
- **GEFSEC's comments at pipeline entry** have been addressed as follows:
  - ✓ Several of GEFSEC's concerns stemmed from using grant financing to partially buy down the investment costs of "win-win" measures (such as replacement of block substations). In the updated Project Brief, it is clarified that: (i) no GEF resources will be used to cover the costs of block substation replacements, and the expected market penetration expansion for this "win-win" investment is due exclusively to the barrier removal activities pursued under the Project; (ii) the grant component of the ECF ($2.5 million out of the total $7.5 capitalization of the fund) would play an important role in introducing changes to the existing policy framework. This part of the ECF would be used to demonstrate to the Government that well-targeted subsidies aimed at energy efficiency investments are preferable to the continuation of the existing policy of subsidizing households for the recurring and unnecessarily high costs of heat consumption. It is envisaged that the Government (rather than the GEF) would be the source of such investment subsidies once the subsidy account of the ECF is fully disbursed. The role and modalities of the Energy Conservation Fund (ECF) are described in Sections A.1, A.2, A.3, C.1, C.2, C.4, D.1, F.1, as well as in Annexes 1 and 2.
  - ✓ The issues of sustainability of the ECF and the objective of attracting co-financing over the course of ECF's operation are described in Sections A.2, A.3, C.4, D.1, F.1, and Annex 1.
  - ✓ The *matching funds* approach to cost-sharing with the district heating utility (VDHC) has been considered. However, in the updated project concept, the matching of resources between the GEF (through the ECF) and the utility is done by breaking the investment program into distinct segments of the market financed each by a separate source. Specifically, the replacement of block substations will be done by the utility, while the upgrading of the old-type building-level substations to modern technology would be supported through the ECF. The project team intends to document the commitment of VDHC to cover the cost of replacing block substations using borrowed resources (such as the SIDA loan) and/or its own operating cashflow. A letter to this effect will be obtained by the time of CEO Endorsement.
  - ✓ Regarding GEFSEC's request for specific activities directed to demonstration and replication, the specific activities dedicated to this purpose are the Marketing, Outreach, and Information Dissemination Component ($1.2m) and the SIDA-financed

Demonstration Project ($1.2 m) as mentioned in Section C-1. The updated PB contains: (i) a specific description of the components aimed at demonstration and information dissemination in Section C.1, (ii) description of the implementation arrangements for these activities in Section C.4, and the rationale for implementing them in Section D.1. Annex 1 includes related monitoring indicators. The lessons learned from the application of the ECF model would be shared throughout Lithuania by making use of the existing network of Energy Efficiency Advisory Centers (of which there are at least five). Replication outside Lithuania would be enabled by disseminating the information through the existing networks of experts and agencies engaged in energy efficiency projects – e.g., the Demonstration Zones established within the framework of the Energy Efficiency 2000 program of UNECE.

- ✓ Consideration has been given to potential contingent-finance mechanisms. Risks and uncertainties specific to the determination of the need for VDHC to resort to variable amounts of grant resources through the ECF are outlined in the table of Section F.2a. We understand that the concept of contingent finance can be applied even though the GEF contribution to capitalize the ECF is a grant.
- ✓ GEFSEC's comments on incorporating lessons learned from other projects have been addressed in Section D.3, where Box1 has been specifically added with these comments in mind. The project references in Sections D.2 and D.3 have been expanded.

Please let me know if you require any additional information to complete your review prior to inclusion in the work program. Many thanks.

Distribution:

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cc: Messrs./Mmes. Stuggins, Busz, Hossein, Schreiber, Loksha, (ECSEG); Shepardson (ECSSD); Draugelis (ECSIN); Sharma, Khanna, Aryal (ENV); ENVGC ISC; ECSEG Unit Files; ECSSD Imaging ; Kennedyw@ebrd.com

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PROJECT BRIEF

1. IDENTIFIERS:

PROJECT NUMBER	P063656
PROJECT NAME	**Lithuania: Vilnius District Heating Project**
DURATION	4 Years
IMPLEMENTING AGENCY	The World Bank
EXECUTING AGENCY	Vilnius District Heating Company
REQUESTING COUNTRIES	Lithuania
ELIGIBILITY	Lithuania ratified UNFCCC on 23 February 1995
GEF FOCAL AREA	Climate Change
GEF PROGRAMMING FRAMEWORK	Operational Program No. 5: Removal of Barriers to Energy Efficiency and Energy Conservation

2. SUMMARY:

The proposed project would enable Vilnius District Heating Company (VDHC) to compete more effectively in the heating market, supporting the development of heating supply at least cost while improving customer satisfaction. The project would also reduce the emissions of greenhouse gases from the Vilnius District Heating System through a targeted effort to remove the existing barriers to energy conservation. This would be achieved by means of expanding the market penetration of the building-level substation (BLS) technology and demand-side measures to a larger number of households while ensuring the full degree of ownership and operation of the substations by the homeowners. The project would promote broader and deeper penetration of energy efficiency markets, identify the barriers to sustainability in energy conservation and demonstrate the possibilities for achieving the benefits of energy conservation on a financially sustainable basis.

The elements of the project are: a) replacement of block sub-stations with some 1,800 building-level substations in residential buildings; b) creating an Energy Conservation Fund to support upgrading the existing building-level substations to modern consumer-controlled technology and investments in apartment-level DSM measures such as better insulation, thermostatically-controlled valves and window replacement; c) rehabilitation of combined heat and power plant (CHP) # 3; upgrading of 4 of the 5 heat-only boilers (HOBs); d) technical assistance on project implementation, MIS, privatization, twinning arrangements with Helsinki Energy, and market analysis and outreach; and e) monitoring and evaluation of the global environmental benefits.

3. COST AND FINANCING (MILLION US$)

GEF	10.0
IBRD	17.1
SIDA	16.8
VDHC	21.2
FINLAND/EU	0.2
PROPOSED PROJECT COST:	**65.3**

4. OPERATIONAL FOCAL POINT ENDORSEMENT:

Endorsement Letter signed on January 26, 2001.	GEF Focal Point: Ms. Indre Venckunaite Chief Consultant, Projects and Programs Management Unit Ministry of Environment, Lithuania.

5. IMPLEMENTING AGENCY CONTACT:

Karin Shepardson, Regional GEF Coordinator, Europe and Central Asia Region
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A. Project Development Objective

1. Project development objective: (see Annex 1)

Background

Vilnius, which is Lithuania's capital and largest city, has a population of 579,000, and a residential housing stock of 5,700 buildings, of which 85% are supplied with heat by the district heating system. The average year-round outdoor temperature is 6.4 degrees Celsius, making heat supply an essential service. Energy consumption for heating purposes is higher than that of western countries with similar climates due to the relatively poor condition of the housing stock.

In the past, the Vilnius District Heating Company (VDHC) has supplied district heating both to the city of Vilnius and to communities in eight other cities in the Vilnius area. It has been decided to legally separate the heating systems in these eight cities (which are physically remote from the system in the city of Vilnius) from VDHC, and to establish them as separate entities in each municipality. Such separation provides the framework for incentives to develop heat supply in each location on a least cost basis. This Project is exclusively focused on the remaining VDHC, that is the district heating system of the city of Vilnius. The future heating needs of the eight outlying communities are being addressed by a parallel study with ESMAP funding. All references in this Document to the Project or to the company VDHC are to be understood to refer to the situation applying after the separation of the eight cities.

Heat demand in the service area of VDHC was 2,471 GWh in 1999, with a peak demand of 1,130 MW. To meet this demand, VDHC uses a combination of Combined Heat and Power Plants (CHPs) and Heat only Boilers (HOBs). VDHC owns and operates two combined heat and power plants, CHP#2 and CHP#3. CHP #2 was built in the 1950s. It has an electricity capacity of 24 MW and a thermal capacity of 960 MW. It is operating beyond its economic life and thus is expected to be taken out of service in the next 2-3 years. CHP #3 was built in the mid-1980s and is the primary source of energy in the VDHC system, producing 79% of the heat in the 1998 heating season. It has an electrical capacity of 360 MW and thermal capacity of 570 MW. During the heating season, CHP #3 is the least cost source of energy as it supplies electricity to the grid and heat to the district heating network. Five HOBs are currently in operation in Vilnius. Two of these HOBs service isolated loads in the outskirts of Vilnius. The remaining three HOBs have a thermal supply capacity of 624 MW.

The construction of the district heating network in Vilnius started in the mid-1950s, with most of the system expansion taking place in the 1965-1988 period. Because of the general economic circumstances, expansion was halted in 1989 and maintenance has been limited. There are about 460 km of pipeline in the existing system, most of which is between 20 and 35 years old, but is quite well maintained. Corrosion is relatively low due to good water quality. The failure rate per km of pipeline is high by Western European standards, largely due to the age of the network. VDHC plans to continue maintaining the network using its own resources.

There are two types of consumer connections: block (or group) substations and building-level substations, of which there are 161 and 2,311, respectively. The block substations, in turn, supply 2,513 building substations, for a total of 4,824. Block substations provide heat to roughly 60% of district heat consumers living on 8.4 million square meters of floor space. The other 40% occupying

3.1 million square meters are using heat from substations in their buildings. The average age of the substations is 22 years. The control valves in these substations are manually operated.

In the existing block substations, the domestic hot water (DHW) pipelines are often blocked due to corrosion, thus causing reliability problems for customers and a maintenance problem for VDHC. Temperature control at the building level is not possible with the existing equipment. Replacing most of the group substations with building level heat substations including meters and temperature controls is designed to solve these problems.

District heating systems in the Former Soviet Union were generally overextended, providing heat in areas where it was not economically viable. Furthermore, the District Heating Companies were insulated from the market as they were given monopoly powers in designated areas. In particular, temperature was controlled centrally, not by the customer, resulting in excessive fuel use. The district heating systems were originally run as a department of a municipality, with few incentives for improvement and limited availability of funds to maintain the assets. As markets opened to reforms, the financial viability of these companies deteriorated further as most suffered from institutional inertia carried over from their former roles. The poor financial condition of the district heating companies during the 1990s resulted in a worsening of the quality of service provided. The primary assets have been reasonably well maintained but are now operating beyond their design life, decreasing reliability. The wealthier segments of the population were able to cope by seeking out alternative sources of heat supply. The current situation in Vilnius is typical of this post-Soviet environment.

VDHC is losing about 3% of its customer base per year, as consumers are driven to alternative sources of supply by the problems outlined above. This not only causes the revenue base to contract, but also damages the competitiveness of district heating which relies on dense heating loads to be cost effective. Furthermore, the corporate culture tends to be more supply than customer focused. The financial problems result in a burden on the government for three reasons. First, low-income households receive income support if district heating and hot water bills exceed 25% of household income. Secondly, profit taxes are negligible because of the low profitability of VDHC. However, the greatest potential fiscal threat is posed by the probability that VDHC will be unable to service its existing debt to the Government and make even basic investments if present trends in sales and costs continue for more than a few years.

All but 7% of residences in Vilnius are privately owned. Legislation enacted during 2000 provides for the establishment of Home Owners' Associations (HOAs) in each apartment building, or, in default of the establishment of such an association, the appointment by the Municipality of an Administrator to represent the residents. Common property rights have been clarified in recently enacted legislation, but these rights and the corresponding responsibilities are not yet well understood by homeowners and utilities. There are significant social learning costs associated with the formation of HOAs which need to be overcome. It should also be noted that constitutional constraints do not allow for legislation to mandate membership of homeowners in HOAs as is the practice in some other countries.

There are about 176,000 family apartments in Vilnius, of which some 50,000 belong to families organized into HOAs. Many buildings are old and energy inefficient. However, heat meters at the building level have been installed in virtually all residential buildings by 1999, which has allowed VDHC to switch to billing for heat based on metering. The HOAs are the only group of heat consumers that self-manage the heat supply to their buildings (if the technology of the substations allows for customer-controlled operation). The DH company favors the HOAs as they take some of the

administrative burden of bill collection away from the company. For the rest of the customers, the company maintains heat supply contracts on a family-by-family basis. On the apartment level, heat meters are typically not available.

The Project

The Project would focus on district heating investments in areas where VDHC has a competitive advantage, and decentralized gas boiler investments elsewhere (primarily two industrial areas of the city) as well as related energy efficiency investments in households. A fundamental design change in heat supply would be facilitated by investments in substations designed to improve the quality of district heating supply by enabling temperature control at the consumer level. Such investments would also reduce the cost of supply by decreasing heat and water losses as well as fuel usage. The Project would also support demand-side investments to enable decreases in heat losses and further improvements in temperature control. Thus, the Project would enable VDHC to compete more effectively in the heating market, supporting the development of heating supply at least cost while improving customer satisfaction. The elements of the project are:

- The replacement of more than 100 block sub-stations with some 1,800 building-level substations in residential buildings;

- Creating an Energy Conservation Fund (ECF) to support upgrading the existing building-level substations to modern consumer-controlled technology and apartment-level DSM measures; the ECF would include two separate funds (accounts): (i) the revolving lending/leasing fund; and (ii) the grant/subsidy fund for targeted supports to low-income households for energy efficiency investments;

- The rehabilitation of CHP-3;

- The upgrading of 4 of the 5 HOBs;

- Technical assistance, including consultancy assistance on project implementation and on the development of management information systems, privatization consultancy, twinning arrangements with Helsinki Energy, technical assistance and training for market analysis and outreach.

Project Objectives

The Project's objectives are to:

- reduce the cost of district heat supply in Vilnius, with benefits to consumers and to the current account deficit as a result of reduced fuel consumption;

- improve the quality of district heating supply, both in terms of reliability and responsiveness to customers needs;

- yield fiscal benefits to the Government by increasing the taxable profits of VDHC and by reducing the number of households which qualify for the heat and hot water subsidies aimed at low income families; and,

- support the commercial viability and possible future privatization of the Vilnius District Heating Company (VDHC).

2. Global objective: (see Annex 1)

The global environment objective of the project is to reduce the emissions of GHG from the Vilnius District Heating System through a targeted effort to remove the existing barriers to energy conservation. This would be achieved by means of expanding the market penetration of the building-level substation (BLS) technology and demand-side measures to a larger number of households while ensuring the full degree of ownership and operation of the substations by the homeowners.

The project would promote broader and deeper penetration of energy efficiency markets, identify the barriers to sustainability in energy conservation and test the possibilities for achieving the benefits of energy conservation on a financially sustainable basis through the Energy Conservation Fund (ECF). A related objective specific to the operation of the ECF is to attract cofinancing by the end of the project in order to demonstrate its commercial viability and ensure replicability. In addition, a significant demonstration effect is expected to come from the implementation of the concept of a demand-side management program in the district heating sector, with the heat supplier itself playing an active part in the DSM measures.

3. Key performance indicators: (see Annex 1)

The key performance indicators that will be monitored focus on the project's ability to meet the development objectives and include: (a) decreasing fuel consumption for heat related use; (b) measuring levels of customer satisfaction with a focus on the impact of the substation replacements and DSM measures on the heat bill; (c) increasing net financial transfers from VDHC to the Government; (d) decreasing air pollution; and, (e) improving VDHC's profitability. Heat consumption in buildings (adjusted for ambient temperature variations) should decrease during the spring and autumn as a result of temperature controls implemented in the substations. VDHC should also be able to meet demand during the summer when the project is implemented.

The monitoring and evaluation of the achievement of the global environmental objective would focus on quantifying the energy savings and associated GHG savings. The key indicators would be the GHG emission savings and costs of abatement relative to the baseline, incorporating indirect/downstream savings to the extent possible. To be able to estimate the achievement of these key outcomes, certain auxiliary indicators would be monitored such as the fuel consumption by type and the level of penetration of energy saving technology (building-level substations, heat meters and valves, energy-efficient windows, etc.) over time.

The performance of the Energy Conservation Fund would be measured primarily on the basis of the volume of loans/leases for energy efficiency investments, the number of borrowers taking the loans/leases, rates of return on the investments made, volume of co-financing attracted, and sustainability of the fund's operation in light of the emerging repayment patterns. With respect to the grant or subsidy element of the ECF's activities, the performance would be rated on the basis of the fund management's ability to reduce the subsidies to the level necessary to support energy efficiency investments for lower-income households, with the government gradually taking over the subsidy inputs.

The success of the marketing, demonstration, public outreach, and information dissemination efforts would be assessed based on the information about similar projects emerging elsewhere in Lithuania as well as in other countries of the ECA Region.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

CAS Document number: 19135 **Date of latest CAS discussion:** 04/19/99

The Bank's Country Assistance Strategy for Lithuania is designed to deepen the reforms with a view to EU Accession, to build capacity in municipal and local institutions and to support the social areas which are not a part of the immediate requirements for accession. This project largely focuses on capacity building at the local level through commercialization of the district heating functions in Vilnius. Improving the financial viability and decreasing the cost of heat supply will help residents in Vilnius by helping to decrease the fiscal burden and will reduce the impact of heat supply costs on the Municipality's budget as well as reducing the current account deficit by reducing fuel consumption. The project will also provide support regarding EU Accession issues by decreasing the impact of the district heating system on air pollution levels.

1a. Global Operational strategy/Program objective addressed by the project:

The project is consistent with the objectives of GEF Operational Program 5 Removal of Barriers to Energy Efficiency and Energy Conservation. Section 5.7 of OP-5 includes support for activities that lead to sustainable "win-win" results that demonstrate local, national, and global benefits through removal of barriers.

2. Main sector issues and Government strategy:

The Seimas approved the Government's revised National Energy Strategy (NES) on October 15, 1999. The primary objectives of the NES are: the reliable and safe supply of energy at least cost; increased

energy efficiency; improvement of energy sector management and implementation of market principles in the energy sector; reduction of the negative impact on the environment; meeting nuclear safety requirements; integration of the Lithuanian energy sector into the energy systems of the EU; and, regional cooperation.

The strategic development of the energy sector is largely driven by Lithuania's desire to accelerate its EU Accession program, requiring a liberalization of the gas and electricity markets. The Government has prepared a plan for restructuring the electricity sector, which has been codified in an Electricity Law approved by the Seimas in August 2000. A draft Gas Law was sent to the Seimas in July 2000 and a Heating Law is under preparation. The preparation of all three energy laws have been supported by EU-funded consultants.

Price setting rests with the Energy Pricing Commission (EPC), an independent regulatory body, which is fulfilling its role in a professional manner.

The dominating issues in the energy sector over the past year have been the privatization of the Mazeikiai Refinery, the proposed dates for the closure of the two units of the Ignalina Nuclear Power Plant and market liberalization for electricity and gas. The Government's approach to privatization has evolved and become more open and competitive. The Government has decided to close one of two Ignalina units by 2005 (passing a law to this effect) and has announced that, in 2004, they will establish a date for closure of the second unit.

The Government has taken an aggressive position in adopting EU Directives on market liberalization for electricity and gas. The Seimas has approved a law on restructuring the electricity sector which would enable the legal separation of generation, transmission and distribution. A new Electricity Law was passed, providing for nondiscriminatory access to the transmission and distribution networks with the price regulated using incentive-based principles. The gas sector is among the most liberalized in Europe. Customers with annual gas use exceeding 15 million m3 are free to contract directly with suppliers. Open access to the gas transmission and distribution network has been established as well as network service prices. The Government is in the process of engaging advisors to assist in the further divestiture of its ownership in the gas sector.

Government policy in the energy sector emphasizes economic pricing, the fostering of competitive markets and the commercialization of energy companies, in order to achieve both reliable supply and economy in the use of energy resources. Within this policy envelope, the district heating sub-sector has long been a source of concern since meeting district heating losses has been the largest single element of fiscal support to the energy sector. Heat prices have, until recently, not been cost-based. Consumers, dissatisfied with the service provided by district heating utilities, have been turning to alternative forms of heat which are in many cases less desirable from the point of view of the national economy and the environment.

Lithuania has been trying to move away from broad-based price subsidies for heat consumption toward better targeted income-based subsidies. Currently, if heat supply costs more than 25% of a household’s monthly income, a subsidy from the government covers part of the district heating bill. The hot water subsidy starts when the hot water bill exceeds 5% of monthly income. While this policy introduces less distortion than broader subsidization schemes of the past, it still presents a considerable burden to the municipalities, especially when the heat tariffs have to increase to make the heat suppliers more financially viable.

At the same time, at least some of the upward pressure on the tariffs comes from the high losses in the district heating system and thermal losses in the buildings. Currently, as much as 28% of heat produced by the Vilnius District Heating Company is lost in the heat distribution network. The economic and environmental gains to be achieved through network modernization and introduction of building-level substations are quite large. The outdated housing stock of Vilnius provides opportunities for similar gains through measures such as better insulation, introduction of thermostatic valves and heat meters in apartments, etc.

The Government has demonstrated its strong commitment to energy efficiency objectives both in theory, through the published National Energy Plan, and in practice, through the establishment of five Energy Efficiency Centers in major cities, with support of the donor community. As the donors are gradually withdrawing support, the Government must confront ways in which the program can become sustainable without becoming a major drain on its limited budget resources. The size of funding required under the existing heating subsidy schemes are sensitive to price changes, with 10% price increases resulting in subsidy increases of as much as 40-50%. The Government would like to reduce these subsidies, without abandoning the needs of the poor. The proposed project is designed to help improve the effectiveness of subsidies by decreasing energy use, particularly by the poor, in a sustainable manner.

VDHC has been seeking the support of the Municipality for the replacement of block substations with building-level substations (BLS). Under a recent VDHC initiative, the Vilnius City Council was requested to approve a raise in the fixed cost component of the heat tariff to cover VDHC's losses in the domestic hot water network. This would mean a net increase in the heating bill for about 60% of the DH customers (i.e., all customers currently served from block substations). Simultaneously, a 5% discount on the tariff would be given to those households whose hot water is prepared inside the building, which is the case only when the building has a BLS. This would set the stage for VDHC's replacement of block substations by BLS. With the introduction of BLS, the heat bill would be based on the full cost of heat supply incorporating the metered data on the amount of heat used for DHW preparation. Thus, after the replacement of block substations with BLS (and even earlier, if the Municipality approves the tariff raise), the customers are likely to get a higher heating bill, unless DSM measures are implemented.

Implementation of the United Nations Climate Change Convention. Lithuania ratified the Kyoto Protocol of the UNFCCC on 21 September 1998. Lithuania thus allied itself with members of the international community to curb carbon dioxide emissions to the environment. Under the Kyoto Protocol, the three Baltic states are obliged to reduce their GHG emissions by 8.0 percent from the 1990 level. Lithuania has been assisted by international experts in developing a National Implementation Strategy for the Climate Change Convention.

Among other multilateral agencies, UNDP is actively promoting sustainable development in Lithuania and has a US$ 264,600 renewable (wind) energy project for the Baltic region. However, UNDP is much less involved in the area of energy efficiency.

3. Sector issues to be addressed by the project and strategic choices:

Safe and reliable supply of energy at least cost

Lithuania has virtually no primary energy resources apart from wood and thus relies heavily on imports of oil and gas from Russia for its energy needs. Although commercial energy use has decreased nearly 50% during the 1990s, the energy intensity of the Lithuanian economy remains high at 2.6 $/kgoe, which is 40% of the average for EU countries and 60% of the average for Scandinavian countries. With world oil prices running at unusually high levels over the past year, oil imports will exacerbate a current account deficit which has exceeded 10% of GDP in the recent past (the sharp rise in oil prices in the latter part of 2000 would, if sustained, increase the current account deficit by a further 2% of GDP). Part of this problem will be addressed as structural changes continue to take place in the economy as well as sustained economic growth. However, a more immediate impact can be established by focused energy efficiency measures. A clear candidate for this approach is finding ways to reduce the energy required to heat buildings.

District heating systems, when well designed and run efficiently, can help reduce energy consumption considerably. Power plants have efficiencies of about 40% when used just for electricity, but can be 80-90% efficient when run as combined heat and power (CHP) plants in district heating systems. District heating, when provided from such plants, is economically attractive in locations with a high heat density. Typically, larger cities in colder climates, like Vilnius, are ideally suited for district heating. However, energy markets in Lithuania suffer from a number of distortions that make district heating less competitive in the near term, principally because of the relatively small part played in heat generation by CHP plants, which in other countries are able to spread their fixed costs over electricity as well as heat. The Lithuanian electricity market, in its turn, is distorted by the fact that installed capacity is more than three times peak demand. This situation is primarily a problem associated with the Ignalina Nuclear Power Plant (INPP) which was originally designed to meet the electricity needs of the Baltic region, including Belarus. As demand in the Baltics has dropped by about 40% during the 1990s and supply to Belarus has been cut off due to non-payments, the existing supply capacity in the Baltics is expected to meet demand through most of the next decade. As a result, the CHP plants are currently underutilized relative to the role they will play when the power supply is in better balance with demand. The prospective establishment of a Common Baltic Electricity Market in which markets in Latvia and Estonia would be open to electricity trade based on EU principles, will underpin this positive trend.

In this regard, the Government has passed a law committing to the closure of Unit 1 of the Ignalina Nuclear Power Plant by 2005. This may occur earlier as rechanneling could necessitate accelerating the proposed closure date. Furthermore, Ignalina Unit 2 is scheduled to be taken out of service, for about one year, prior to 2003 to upgrade its safety systems. As a result, there is a possibility of a considerable electricity capacity reduction in the next few years. The rehabilitation of existing assets prior to 2003 will be needed to help address this situation. The proposed rehabilitation of CHP-3, as part of this project, supports such a new power market paradigm.

Increased Energy Efficiency

The energy intensity of Lithuania's economy is excessive by the standards of its northern European neighbors. While factors such as past dependence by industry on cheap Soviet energy and the structure of the economy are significant contributory factors, the poor design of district heating

facilities and a lack of investment in energy efficiency on the part of residents are considered to be major causes of this problem.

The project addresses these issues by providing residents with greater control over their consumption of heat and hot water, which should be supplemented by the application of a multi-part tariff regime. Energy efficiency investments will be further supported through the Energy Conservation Fund that will target investments which would enable heating requirements to decrease and improve the quality of supply through targeted temperature control. Additionally, the improvements in CHP-3 and the rehabilitation of HOBs will result in reduced fuel (and water) consumption.

Despite potentially high economic returns, measures to improve energy efficiency in the district heating system and in the housing sector are facing substantial challenges. Lithuania's First National Communication (NC) on Climate Change characterizes the district heating sector as an area of focus with respect to increasing energy efficiency and bringing down emissions of greenhouse gases (GHG). As the NC notes, it takes 450 kWh/year to heat one square meter of residential space, which is twice as much as in Denmark. The main reason is poor insulation and heat losses in the network, as well as lack of possibility for consumers to control heating.

The barriers to be addressed within the context of this project, through GEF assistance, are both on the demand and supply side. On the supply side, the main barrier is the absence of appropriate marketing capabilities and insufficient client orientation of the VDHC leading it away from participating in demand-side energy conservation measures unless a quick pay-off can be expected through reduced losses on the supply side. On the demand side, the main barriers are the lack of attention of homeowners to the common areas and equipment (such as heating substations) in their buildings, lack of motivation to take responsibility for common property, and lack of information about the benefits of energy conservation. The inability of many low-income consumers to pay the full price of heat also presents a barrier, as does the lack of commercial credit for many customers who have no collateral against the risk of default. The barriers on the interface of supply and demand are the lack of effective coordination between the two sides on energy conservation. The decentralized structure of ownership and decision-making lead to high transaction costs of obtaining the agreement to implement the needed investments. This barrier would be addressed through creating a collaborative engagement of public authorities and private participants in the market with the VDHC's substation replacement program. Finally, the legal uncertainty about the ownership status of the substations installed by the VDHC in residential buildings is a substantial regulatory barrier that would need to be removed – through amendments to relevant legislation as necessary.

Improved Energy Sector Management

Management practices inherited from Soviet times, despite notable improvements, continue to affect Lithuanian energy utilities. Inadequate information systems, insufficient attention to customer care, and poor structures of governance, all contribute to poor cost control and poor revenue maximization.

The project directly addresses these issues in VDHC by providing for consulting assistance in project implementation and in the development of management information systems. It also provides for a twinning arrangement with Helsinki Energy (Helsinki Energy is a district heating company in Finland that has similar CHP assets, market size and staff size at VDHC), which will allow the management of VDHC to benefit from the experience and knowledge of an advanced energy company in a comparable

city. The Bank's experience in improving District Heating Company management in other countries will also be applied to this project.

Implementation of Market Principles

Energy provision in Lithuania has in the past been supply-led, with a consequent lack of attention to consumer preferences or to the use of price as a determinant of supply and investment. This has led to economically sub-optimal decisions both by energy providers and energy consumers.

The project is designed to support the provision of heat on a competitive basis. Consumer choice is a fundamental to this design, removing barriers to their choice of supply. However, disequilibrium in pricing, system design, environmental externalities and management focus put district heating at a false disadvantage. The project will support fundamental design changes, installation of building-level substations, increase consumers' control over their consumption of energy and make them more aware of the cost of heat consumed. This will be further supported by the development of multi-part tariff structures and management reforms.

Regional Co-Operation and Integration of Energy Sector with the EU

The rehabilitation of CHP-3 will increase the flexibility of Lithuania's electricity sector and thereby contribute to the development of the proposed Common Baltic Electricity Market. In the longer term, this will strengthen Lithuania's position in wider European integration of electricity markets, while the reduction of emissions from CHP-3 will materially assist Lithuania to meet EU environmental standards.

C. Project Description Summary

1. Project components

The VDHC owns and operates two CHP plants, CHP-2 and -3, 458 kilometers of pipeline network (over 1,000 km of pipe in 2 and 4 pipe configurations), five separate heat only boiler plants, and 161 block substations serving 2,513 buildings. Moreover, there are 2,311 individual consumer substations in the network, of which 93% are owned by residents and the rest by the municipality. In practice, CHP-2 functions as a peak-load boiler plant since the steam turbines are small and old, but CHP-3 with two large condensing-extraction steam turbines is the main heat and power source.

The primary components of the project are: (a) building-level substations, including metering and temperature controls, and new inlet pipes replacing group substations and 4-pipe systems, as well as apartment-level DSM measures; (b) heat-only-boiler (HOB) equipment replacement; (c) rehabilitation of combined heat and power (CHP) plant equipment which has reached the end of its economic life (burner replacement, instrumentation and control system replacement and various ancillary service upgrades); and (d) technical assistance and institutional support for VDHC.

The proposed GEF financing would cover the apartment-level DSM and part of the building-level substation component through the Energy Conservation Fund (US$7.5 million), which would be created for this purpose. In addition, the GEF would finance the institutional components (US$2.5 million) including the ECF management; marketing and public outreach, training for market analysis, and M&E of global environmental benefits from the project.

Component	Costs				Financing					
	Local Direct	Taxes & duties	Foreign	Total	VDHC local	WB loan	SIDA lo&gr	GEF grant	Other grants	Total
A. Substations and DSM (SIDA and ECF)	**10.0**	**5.6**	**20.5**	**36.0**	**15.5**	**-**	**13.0**	**7.5**	**-**	**36.0**
Substations and pipes	7.0	4.6	18.0	29.7	11.6		13.0	5.0		29.7
Apartment-level DSM	2.9	1.0	2.5	6.4	3.9			2.5		6.4
B. Heat-only-boilers	**0.4**	**0.5**	**2.4**	**3.4**	**1.0**	**2.4**				**3.4**
C. CHP Plant	**1.7**	**2.9**	**14.2**	**18.9**	**4.7**	**14.2**				**18.9**
D. Technical Assistance	**-**		**7.2**	**7.2**	**-**	**0.3**	**3.8**	**2.5**	**0.6**	**7.2**
Consulting for VDHC Privatization			0.3	0.3		0.3				0.3
MIS Implementation			0.5	0.5			0.5			0.5
Project Implementation Consulting			2.1	2.1			2.1			2.1

Demonstration Project			1.2				1.2			1.2
Twinning Arrangements			0.2	0.2					0.2	0.2
ECF Management			0.8	0.8				0.8		0.8
Marketing, Outreach, and Information Dissemination			1.2	1.2				1.2		1.2
Training for Market Analysis			0.2	0.2				0.2		0.2
M&E of Global Environmental Benefits			0.3	0.3				0.3		0.3
Total Project Costs	**12.2**	**9.1**	**43.9**	**65.1**	**21.2**	**16.9**	**16.8**	**10.0**	**0.2**	**65.1**
Front-end Fee			0.2	0.2		0.2				0.2
Total Financing Required	**12.2**	**9.1**	**44.1**	**65.3**	**21.2**	**17.1**	**16.8**	**10.0**	**0.2**	**65.3**

Substations and DSM

This component would support the energy efficiency objectives of the project through implementing high-priority investments of the VDHC such as the replacement of block substations with building-level substations and other investments in equipment that would rationalize heat consumption and reduce losses. VDHC's plan is install some 1,400-1,800 building-level substations over four years (2001-2004) in buildings currently served from block substations. For this purpose, the company is willing to borrow a loan from SIDA. To supplement and strengthen VDHC's own investment program, an Energy Conservation Fund (ECF) would be established with GEF assistance to support the replacement of substations in another group of buildings equipped with old-type building-level substations without temperature control at the consumer's end. Currently, there are some 2,300 substations of this type, some of them serving more than one building. The ECF would provide financing to the homeowners wishing to upgrade these old substations to modern BLS technology. In addition to the substation upgrades, the homeowners would be offered financial and technical assistance to implement some DSM measures in their apartments.

The ECF would provide both a fund to further penetrate these markets and a program that includes marketing and public outreach capability. It is expected that, with GEF support coming through the ECF over the first four years, the market penetration under this component would reach about 350-400 buildings currently having old-type BLS. Subsequently, the ECF would continue providing financing to expand the penetration of this market.

The ECF component would consist of two sub-components. The first sub-component would support the substation replacements (upgrades). The second sub-component would promote demand-side energy conservation measures at an apartment level.

It is envisaged that there would be several options (packages) offered to the homeowners. At a minimum, this would include the replacement of the substation (the required part of the deal in all

cases) and additional options such as the installation of thermostatic valves and heat allocators, and energy-efficient windows. Reflows from repayments are expected to be used for similar investments.

The ECF Management component would provide the resources necessary to cover the incremental operating costs to VDHC associated with the management of the Energy Conservation Fund during the four years of project implementation. This would ensure that the ongoing corporate restructuring within VDHC results in adequate staffing for effective cooperation with the entity hired to operate the ECF.

Marketing, Public Outreach, and Information Dissemination will be conducted in close connection with the implementation of the activities under the ECF. Consultants with experience working with homeowners at the grassroots level would be providing assistance (including energy audits) to help homeowners make informed decisions. Special emphasis would be placed on the benefits of energy conservation and opportunities offered by the modern BLS technology. Assistance to VDHC would include brand development, positioning and public relations strategy. This component would also play an important role in disseminating the information about the project in order to realize its replication potential. Lithuania would be the initial target area for replication, where the information dissemination can be facilitated through the existing network of Energy Efficiency Advisory Centers (of which there are at least five). Replication outside Lithuania would be achieved through disseminating the information through the existing networks of experts and agencies engaged in energy efficiency projects – e.g., the network of energy efficiency demonstration zones established within the framework of the Energy Efficiency 2000 program of the United Nations Economic Commission for Europe (UNECE), which is coordinating activities among similar zones throughout Eastern Europe and the former Soviet Union.

Technical Assistance for Market Analysis. This component would consist of a detailed study using a multi-perspective financial and economic analysis (from the utility's, customer's, societal, and global environmental perspectives) of implementing demand-side energy conservation measures – specifically, the building-level substations component. Such an analysis would seek to demonstrate that demand-side energy conservation may benefit not only the consumer, but the district heating utility itself. The TA component, combined with the experience gained during the first years of the program, would be aimed at convincing the district heating suppliers that participation in demand-side conservation measures pays off and needs to be supported. This would be coordinated with studies prepared under the Lithuania-wide Energy Efficiency Housing Pilot Project (EEHPP) and with the development of the new Housing loan to try to maximize the effects of both demand and supply side measures. The vision is to establish a first-year program with financing and technical assistance at a level expected to yield desired first-year conversions. Data will be obtained on the paybacks and heat costs as percent of income for the conversions that are achieved. Second-year financing terms and incentives could then be altered depending on whether the first-year targets are reached. The intent is to trace demand curves that can be used for subsequent determination of needed assistance. It will also provide for the costs of technical assistance in estimating the market penetrations that can be expected for different levels of financing. The component would inform further programs by engaging in market research designed to evaluate the performance of the program, develop lessons learned from the ECF and related projects to improve financial sustainability and maximize market penetration of energy conservation measures in the district heating sector.

Heat-only-boilers (HOB) Replacement

To facilitate a reduction in fuel consumption and to increase system reliability, four HOBs will be rehabilitated and one HOB will be replaced. New burners, pumps and new boiler units would be installed to reduce fuel consumption in the new peak-load operation mode and to lengthen the economic life of the existing assets in high priority cases. These investments would help reduce costs by lowering fuel consumption and, for the rehabilitated boilers, help avoid the considerable capital required for new replacement capacity if these units were shut down.

The feasibility study indicated that in one region, consisting mainly of industrial customers, district heating is not least-cost. Therefore, the project will fund the replacement of the existing district heating system with 14 small decentralized gas boilers located near the industrial customers. Thus, the cost of supply in this district, as well as the overall system costs, should decrease.

Combined Heat and Power Plant (CHP) Rehabilitation

The CHP-3 plant is about 15 years old and thus some of the equipment is due to be replaced. Due to dated instrumentation, the overall plant efficiency is about 76% whereas the modern plants would be at around 90%. The proposed investments would result in a reduction in fuel consumption, thus lowering the cost of supply. Design changes would enable the introduction of a revised operating strategy for the district heating network to better enable the system to respond to the customers' demands. The proposed investments will also help improve plant reliability as outages become more frequent with plant age. This issue is expected to become increasingly important once the Ignalina nuclear units are taken out of service. The project will also fund: the replacement of existing burners with low-NOx burners; an upgrade of the instrumentation and control system; replacement of the ancillary systems that are operating beyond their design life; and, an upgrade of pumps from fixed to variable flow.

Management Information System - MIS

The VDHC will procure a Management Information System that includes a modern Billing and Collection System, a Financial Management System and a Customer Database. This component is a key element to support VDHC's commitment to commercialization. The MIS will be designed as a managerial tool which focuses on key characteristics of the district heating system to reduce costs and improve customer service.

Consulting Services for Privatization

The Municipality of Vilnius is considering alternative methods of increasing private sector participation, including leasing, concession arrangements and divestiture of its ownership stake. In addition, the possible spin-off of some non-core services will be considered. The study will draw on the limited international experience in private provision of district heating as well as private sector experience in related municipal services. The loan proceeds will provide funding to analyze the options and to assist in the preparation of the subsequent stage.

Twinning Arrangements

VDHC and Helsinki Energy plan to establish a twinning arrangement covering operation, customer relations, preventive maintenance, financial management, environmental issues and modern

management practices. It is proposed that the twinning will be jointly financed by the two companies, the Government of Finland, and the EU/PHARE program.

Consulting Services for Implementation Assistance

Implementation assistance covering engineering, procurement, project management and implementation monitoring will be provided from a Swedish government grant.

Monitoring and Evaluation of Global Environmental Benefits

The monitoring and evaluation of the achievement of the global environmental objective would focus on quantifying the energy savings and associated GHG savings, the performance of the ECF, and the success of the marketing, outreach, and information dissemination components (see Section A-3 above for key monitoring indicators).

2. Key policy and institutional reforms supported by the project:

This project is designed to implement many of the Government's national objectives in the energy field at the local level, using Vilnius to set the example as it is the largest city and has the requisite implementation capacity. The project will assist VDHC to make the transition from being part of a centrally-directed monopoly to being a commercial provider of heat in a competitive marketplace. VDHC is expected to reduce the dependence of the heating sector on subsidies and become a profitable operation under municipal, mixed or private ownership. It will improve energy efficiency, provide the appropriate economic incentives for the consumers to limit heat consumption, reduce costs, and provide an exit strategy from areas where district heating does not have an economic advantage over other sources of supply. In those areas where district heating is the optimal economic alternative, the project will assist in a fundamental shift from a Soviet-designed system to a more market-focused system based on best practice in Western European countries.

The project would therefore build on the existing pricing policy framework and introduce a new emphasis on the policies that provide incentives for energy conservation. This includes phasing out broad-based consumer price subsidies, ensuring full cost recovery of heating and hot water services, removing remaining barriers to billing for heat based on metered data, etc.

The ECF would play an important role in introducing changes to the existing policy framework – in particular, with respect to its subsidy component. This part of the ECF would be used to demonstrate to the Government that well-targeted subsidies aimed at energy efficiency investments – particularly, those increasing access to consumer-controlled technology (such as building-level substations, thermostatic valves in apartments, etc.) are preferable to the continuation of the existing policy of compensating households for the recurring and often unnecessarily high costs of heat consumption. It is envisaged that the Government (rather than the GEF) would be the source of such investment subsidies once the subsidy account of the ECF is fully disbursed. Low-income households would still remain the primary target group for the supports, but the fundamental basis for the subsidies would change. Instead of being subsidies just for district heating, they would become incentives for energy efficiency investments, thus benefiting both the consumer and the Government.

The project also supports a reduced role of the Municipality in price adjustments by depoliticizing the membership of the Board, thus focusing the role of the Municipality on policy and strategic issues.

3. Benefits and target population:

The primary project benefits will be through the reduction of the cost of supply, reduced air pollution and improved quality of supply. An improvement in the financial viability of VDHC will benefit both the Municipality (as the shareholder and provider of income support subsidies for the provision of heat) and the Government (through increased profit tax revenues). The building level substations will support a decrease in energy consumption and improve the quality of supply through improved temperature control in buildings. Pipe replacement in secondary systems will help improve the reliability of supply and decrease maintenance costs and related operating expenditures of VDHC.

Decreasing heat supply costs will have a larger impact on the poor than on other segments of the population as heat costs represent a disproportionately large component of their income (based on a Social Assessment undertaken during project design). In addition, the poor have less disposable income available to improve the energy efficiency of their apartments, resulting in disproportionately high heat consumption. Income limitations also restrict their ability to switch to other sources of heat supply as the investment costs of new equipment are prohibitive. The Bank-financed components of the project will focus primarily on supply-side issues, while the GEF-financed components address the demand-side management measures and expand the benefits of energy conservation into low-income families, where ability to pay for such equipment is an issue despite attractive economic returns. The GHG emission reduction from the Vilnius district heating system is a direct global environmental benefit from the project. It is estimated that this can reach as much as 2.4 million tons of CO_2 over the 20-year life cycle of the investments made under the project. Further indirect/downstream GHG emission reductions would be expected due to the demonstration and replication effect of the project.

A separate study of the impact on the poor indicated that the primary disbenefit of district heating was caused by the drain on the limited financial resources of the Municipalities' budgets. The financial support required for the heating system diverted funds that could be otherwise used to help provide income support and services for the poor. By improving the profitability of VDHC, increased funds would be made available to both the central Government and the Municipality to service the needs of the poor. This problem is of even greater significance in smaller communities, where incomes are generally lower and the cost of supply is higher.

4. Institutional and implementation arrangements:

Financing Plan

The total project cost is estimated at $65.3 million. The World Bank would fund the upgrade of the CHP plant and improvement to the HOBs, estimated to cost $17.1 million, while it is expected that SIDA would contribute another $16.8 million (of which about $3.8 million would be grant) to the funding of substations and the Technical Assistance component. The VDHC is expected to fund about $21.2 million of project costs from its internal resources. The GEF is requested to provide $10 million. Of this, $7.5 million would be used to help fund substation replacement and related DSM measures through the Energy Conservation Fund. The remaining $2.5 million would finance the institutional components including ECF management; marketing and public outreach, training for market analysis, and M&E of global environmental benefits. Finally, the proposed twinning arrangement (estimated to cost $0.24 million) is expected to be funded from a combination of Finnish government and EU grants and by the contributions of the DH companies of Helsinki and Vilnius.

Lending Arrangements

The World Bank loan is proposed to be provided directly to VDHC with a guarantee from the Government of Lithuania. The borrower is expected to select a fixed spread loan; other details would be discussed during loan negotiations. The foreign exchange risk would be borne by VDHC. A guarantee fee of about 10% of the Bank's interest rate is proposed to be charged by the government. The GEF grant would be provided directly to VDHC. The option of providing it to the Government of Lithuania for forwarding to VDHC will also be considered during appraisal.

The Government of Sweden would provide about $13 million equivalent in cofinancing on terms similar to those of the Bank to finance the substation component of the loan. VDHC would finance the block substation replacement program from this SIDA loan and implement the installation of building-level substations, expecting a sufficient return on this investment through the heating bill charged to the customers. In addition, the Government of Sweden would provide about $3.8 million equivalent of grant financing to VDHC for project implementation support and the management information system component of institutional capacity strengthening.

The Government of Finland, together with the EU, would support a twinning arrangement between Helsinki Energy and VDHC. This component is expected to require only about $240,000 of grant funding as labor costs would be funded by the respective entities.

The ECF would be administered by an entity hired by VDHC and funded from the GEF grant. The fund would finance substations in buildings currently receiving heat from building-level substations of the old type. For these buildings, hire-purchase financing would be made available to Home Owners' Associations with the title in the equipment passing immediately to residents, who would repay over a period of ten years at an interest rate of 10-13%. On this basis, the annual repayments would be approximately $1,700 per substation. Repayments would be credited to the ECF managed by an operator hired by VDHC and would supplement the funds available to the ECF for the financing of apartment-level and building-level energy saving investments, as well as continued support for substation replacements. The flow of funds from loan repayments would allow ECF financing activity to continue after project implementation is complete, thus enabling a sustainable energy efficiency program.

Within the ECF, two separate funds (accounts) would be set up as follows:

Lending/leasing fund. The GEF would capitalize this fund initially, but the long-term goal of the fund would be to demonstrate sufficient rate of return to attract other investment during and/or after the project. A goal of the project would be to have other investment in the fund by the project's completion.

Grant/subsidy fund. The GEF would capitalize this fund initially, but the long-term goal of the fund would be to sustain the subsidy element of the ECF for targeted lower-income households (as defined by municipal or national heating assistance policy). The streamlined subsidy mechanism demonstrated in the process of ECF operation would be presented to the Government as a possible replacement for the existing set of subsidies for district heat and domestic hot water.

The GEF capitalization of the lending/leasing and grant/subsidy funds would be at a 2:1 ratio – specifically, US$ 5 million for the former and US$ 2.5 million for the latter. The use of the

grant/subsidy fund would be limited by eligibility criteria for support to low-income households. For any particular investment, disbursements from the ECF would utilize one or both of the funds in proportions depending on market response and in a way compatible with income-based eligibility criteria.

Implementation

VDHC would be responsible for implementing the project drawing on its own staff, assisted by local and foreign consultants. A Project Manager has been selected and has been working closely with the consultants preparing the feasibility study as well as the Bank team. The Chief Engineer for the networks has been selected to be responsible for the network and HOB components. The Chief Engineer for the CHP plant would be responsible for implementing the CHP plant component. The existing financial and accounting staff will be responsible for preparing the project management reports, corporate accounts, project accounts and auditing. A consultant will be engaged to assist in establishing financial systems and procedures. Two VDHC procurement experts have been selected to work on the project. They will be trained in Bank procedures and will be assisted by independent consultants. The implementation of the Environmental Mitigation Plan will be the responsibility of the Chief of the Construction Department. VDHC would be responsible for implementing the Energy Conservation Fund with assistance from consultants and related training to ensure sustainability.

The investment program of VDHC until year 2004 covers replacement of block substations with about 1,800 individual substations. Upgrading of existing individual substations was initially proposed to be a minor component of this program. However, with the support from GEF through the Energy Conservation Fund, this component was scaled up to some 350 substation upgrades, with the prospect of eventually covering the greater part of all the 2,300 substation requiring upgrades as the ECF would continue lending to homeowners after the GEF project's closing date in 2005. An agreement would be reached with the Home Owners Association (HOA) for each of these installations or through a joint agreement with all apartment owners (for small buildings) or by an administrator when a Home Owners' Association does not exist (consistent with the amendments made to the Home Owners' Association Law June, 2000).

During the initial stages of the project, the participation of experienced international and local consultants will be important for successful project implementation. These should include engineers and procurement specialists who will be required to supplement VDHC staff with detailed design and procurement. Consultants would be engaged to assist in establishing a management information system to meet the need to control costs, improve customer service and develop markets.

The entity to manage the ECF on behalf of the VDHC will be hired through a competitive tender.

The fund lending/leasing fund would be managed by a financially astute manager who would set effective interest rates at levels that would account for expected default rates, ensure fund growth, entice customers to take leases, and gain a rate of return sufficient to attract other capital. The fund manager's performance would be based on how well he balanced these aspects of the fund by dynamically changing effective interest rates.

The grant/subsidy fund would be managed to maximize substation replacements by those lower-income households that would eventually be covered under government subsidies, conserve subsidies until the government takes over, initially spur the market, and demonstrate to policy-makers how

targeted subsidies might work and be effective. Subsidy rates could change over the course of the project, but maximum amounts would be established as part of the project. During appraisal, an agreement will be sought with the Government on the policy framework allowing to sustain the income-based subsidies for energy efficiency investments as a follow-up to the grant/subsidy fund's operation under the project.

The activities aimed at the ***replication*** of the project's concept, approach, and delivery mechanisms would be carried out through the GEF-funded Marketing, Outreach, and Information Dissemination Component (see Section C-1) as well as through the SIDA-funded Demonstration Project aimed specifically at demonstrating the benefits of the BLS technology.

The information disseminated through these activities would include: (i) the role of the ECF in supporting VDHC's evolution from its historical role of a supply-driven heat provider to the new role of provider of energy services and DSM to meet the comfort needs of the customer; (ii) technical performance of the substation measures and DSM; (iii) commercial viability and institutional sustainability of the revolving fund component of the ECF model; (iv) the role of the subsidy fund as a tool leading the government toward a more streamlined and focused regime of providing support to low-income heat consumers; (vi) the role of the local energy experts and public outreach consultants in engaging the local community in making decisions about their energy saving options.

The specific arrangements for the delivery of this information would include: (i) producing fact sheets on VDHC and the project; (ii) presenting the experience of VDHC at a workshop for government officials, community leaders, private sector interests, NGOs, etc.; and (iii) developing a published case study in English, Lithuanian, and Russian, to use with municipal governments, ministries of energy and communal services, etc. As a possible forum, one of the regular meetings under the Energy Efficiency Demonstration Zones Program of the UNECE could be used to present the case. UNECE's website could be utilized for electronic publication (in addition to the World Bank's standard press releases).

Supervision, Monitoring and Reporting

The assessment carried out by the Bank indicates that VDHC is evolving into a well-managed company which is working to overcome the deficiencies of the past and is capable of implementing the proposed project with the support of foreign and local consultants. A significant supervision effort will be required, particularly during the first two years when procurement and disbursement practices and coordination systems with the co-financier would be established. It is expected that about 17 staff-weeks of effort each year for the first two years and about 13 staff-weeks each year thereafter would be required for supervision by the Bank.

Project monitoring would focus on a set of key technical, financial, institutional and social data to ensure that the project meets its priority goals. The technical information focuses on the implementation aspects that are designed to generate benefits. The financial information required reflects key issues that need to be addressed to ensure financial viability of the company and counterpart funding for the project. The institutional issues reflect the reforms necessary for effective management while the social assessment data focuses on the impact on the poor.

The Bank would carry out a mid-term review of the project not later than June 30, 2003. In addition to the topics covered under the Project Management Reports, the mid-term review would

include an in-depth review of the economic viability of the project components, based on actual costs and benefits achieved to date, and of the overall institutional and financial viability of VDHC. Based on the outcome of the mid-term review, measures would be taken to ensure the efficient completion of the project.

The monitoring of the global environmental benefits from the project (CO2 emission reduction) would be carried out by VDHC (likely, the newly established Marketing Department) in collaboration with an independent third party, which would be selected competitively shortly after the project's effectiveness. The mid-term review would place a special emphasis on the performance of the ECF from the perspective of market penetration and financial sustainability and would evaluate: (i) fund performance; (ii) subsidy trends/needs; and (iii) market development trends/needs.

D. Project Rationale

1. Project alternatives considered and reasons for rejection:

The consultant advising VDHC undertook an analysis of district heating supply versus gas-fired individual boilers. In a few districts of Vilnius, where the heat demand density is low, gas-based individual boilers are least cost. VDHC has worked out an exit strategy from these locations and will focus on areas where it has a competitive advantage. The characteristics of Vilnius - high density, long heating season and nearby low-cost Combined Heat and Power Plants - make district heating the least cost option in most parts of the city.

The economic merits of both centralized and decentralized heating were assessed in the main network supplied by a combination of CHPs and HOBs as well as in each of the HOB-only supplied subsystems. Rehabilitation of the existing centralized heating system is the least cost solution in all cases but one: the industrial boiler area supplied by HOB plant RK4 (A. Paneriai). This district became a candidate for decentralization, as the heat load has dropped from 329 GWh in 1990 to 25 GWh in 1998, due to closure of industries. The RK4 district will be equipped with 14 local gas-fired HOBs (5.5 MW in total) and connecting gas and heating pipelines replacing the existing older boilers (192 MW capacity) in order to meet the stabilized level of heat demand. This conversion is included in the HOB component of the project.

For the integrated district heating system two major alternatives were reviewed: (i) fully-integrated pooled operation where full-scale load dispatch would be possible between the CHP and the existing isolated HOBs; and, (ii) loosely integrated sub-systems (the current arrangement). Due to the high cost of the investments in transmission pipes and pumping arrangements to support the fully-integrated system proposal and the risks associated with electricity sales (both price and volume), this alternative was rejected. The high incremental costs would result in a return below the opportunity cost of capital. Thus the loosely integrated design option including HOB and CHP rehabilitation was selected as the least cost approach.

For the next three years, the heat transmission pipeline investments will focus on repairs and maintenance, minimizing investment costs. In recent years, VDHC has replaced 4 km of transmission pipeline per annum (out of a total of about 1,000 km), funded from internal cash generation. This is not sufficient to renew the fixed assets in the long term, but no major problems have been observed to date. Thus, finance is not allocated for transmission pipe replacement as part of this project.

The GEF-supported components of the project seek to promote energy efficiency of both supply (the DH networks and substations) and demand sides (the consumption of heat in the residential buildings of Vilnius). Only with the inclusion of the demand-side efficiencies into the scope of the project, can its full economic and environmental benefits be achieved utilizing the synergies between the two sides of the process. This approach is highly replicable throughout Eastern Europe and the Former Soviet Union where many district heating systems as well as the housing stock are in need of a fundamental modernization to improve energy efficiency, and where awareness of energy saving opportunities at the customer level has been lacking.

The deals with the homeowners would be structured to utilize the end-user's willingness to pay for energy conservation measures and avoid subsidies for investments that are economically viable from the domestic economic perspective. At the same time, support from the GEF would enable partial grant funding for those types of equipment which help reduce energy consumption and associated CO2 remissions, but do not bring a sufficient payback to the domestic economy.

For the buildings with existing (old-type) building-level substations, the domestic benefits of replacing the substation with a new BLS mostly belong to the homeowners, whose heating bill is likely to decrease due to the possibility of customer-controlled operation. However, the payback for the consumer is not fast enough to justify the expectation that the homeowners would fund the full amount of the investment themselves. Other kinds of barriers separating the individual consumers from their common property also apply. The global benefits of reduced CO2 emissions due to the expected reduction of heat consumption would justify partial grant support from the GEF. On this basis, the cost of upgrading these substations would be shared between the lending/leasing and the grant/subsidy accounts of the ECF capitalized by the GEF. The exact proportions of funding from the grant account of the ECF would be established during appraisal and would be subject to revision at the time of the mid-term review. The review is expected to make adjustments depending on the demonstrated financial sustainability of the ECF and on the initial market response to its operations. One objective of the project is that by the end of the project, the delivery mechanism for the grant/subsidy element demonstrated by the ECF would be continued by one or more government agencies.

For apartment-level demand-side management (DSM) measures such as the installation of thermostatic valves and heat allocators, energy-efficient windows, etc., a similar logic applies. The domestic benefits of these measures mostly accrue to the consumer, whose heating bill is likely to decrease. The global benefits of reduced CO2 emissions due to the expected reduction of heat consumption justify the support from the GEF. The price of supply and installation would be shared between the lending/leasing and the grant/subsidy accounts of the ECF. It is envisaged that the proportion of funding from the grant account would be decreased starting from the second or third year of the program.

The provision of financial resources for partial grant financing to the consumers is potentially replicable without resort to GEF once it is established that demand side improvements can eventually benefit the DH companies and/or other participants in the emerging energy efficiency market (see Table 3 of Annex 2 for more on the replication potential of the project). This is due not only to the consolidating impact on the customer base, but also due to reduced losses and costs of supply – especially, during periods of peak demand.

Already at present, there are clear signs that that the Vilnius DH company appreciates the benefits of reduced network losses due to the introduction of BLS. Without additional incentives from the GEF, VDHC is willing finance the **replacement of block substations** with BLS using the $13 million SIDA loan. Calculations of both economic and financial rates of return indicate that the replacement of block substations with BLS is quite profitable for VDHC, and the net revenues resulting from it would enable VDHC to repay the SIDA loan and remain with a profit. Thus, no GEF resources will be used to cover the costs of block substation replacements, although the market penetration of this "win-win" investment is expected to be expanded by the barrier removal activities pursued under the project.

The rationale for separating the lending/leasing fund from the grant/subsidy fund within the ECF is based mostly on considerations of replicability and demonstration. The replication potential of both funds would depend on their demonstrated performance according to the relevant criteria. If both funds prove viable, the replication potential is large. The demonstration of the long-term financial viability of the lending/leasing fund could be a powerful lesson for replicating the same type of investments elsewhere. The other reason for transparently separating loans/leases and subsidies is to make sure that each fund demonstrates clearly what is required to sustain different aspects of the problem – financing versus affordability, private versus public. If the subsidy fund fails to support energy efficiency measures in its respective segment of the market, it will be demonstrated that leasing works for wealthy households only. If the leasing fund fails, it will be demonstrated that the public burden is greater than expected.

The rationale for publicizing the project's results outside Lithuania is that the project would aim at creating a replicable model demonstrating how government agencies and other stakeholders could: i) support the emerging commercial energy service sector and local NGO's by creating a favorable framework for energy efficiency investments; ii) prioritize infrastructure improvements; and iii) save taxpayer money by lowering energy use.

Ultimately, awareness of the potential for reducing heat losses in the networks and in the buildings is expected to replace calls for new generating capacity. This has particularly immediate relevance for Lithuania (given international discussions with the Government on direct and indirect costs associated with the Ignalina closure), but also for other ECA countries where the replacement of the outdated energy stock is imminent.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned)

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)

Bank-financed		**Implementation Progress (IP)**	**Development Objective (DO)**
Building-level and Apartment-level Energy Efficiency	Lithuania: Energy Efficiency/Housing Pilot Project	S	S
Improve Efficiency and Safety	Power Rehabilitation Project	S	S
Cost of supply and demand-side investments	Estonia District Heating Project	S	S
Cost of Supply and demand-side investments	Latvia: Riga District Heating Project		
Efficiency and Cost of Supply	Poland – District Heating Restructuring and Energy Conservation Project (Gdansk, Gdynia, Krakow, Warsaw)	HS	HS
Efficiency and Costs of Supply	Katowice District Heating Project	S	S
Efficiency of Heat Production and Supply	Ukraine- Kiev District Heating Improvement Project	S	S
Efficiency and Cost of Supply and Demand	Bulgaria – District Heating Project 1 mainly in Sofia and Pernik (Sofia with EBRD)	NR	NR
Retrofitting and replacement of group substations, switch from 4-pipe to 2-pipe system, heat metering at the building level	Russia - Municipal Heating Project	NR	NR
Demand-side energy efficiency in schools and hospitals, retrofitting of boilers and group substations	Belarus – Social Infrastructure Retrofitting Project	NR	NR
Other development agencies			
EBRD	Kaunas District Heating Project		

EBRD	Sofia District Heating Project (with WB)		
UNDP	Russia - Capacity Building to Reduce Barriers to Energy Efficiency		
USAID	Gabrovo Pilot Project for DSM of heat consumption		

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory); NR (Not Rated)

The Projects in the four cities of Poland and in Tallinn, Estonia are in the completion phase, the projects in Katowice and Kiev are under implementation, the Riga Project was recently approved by the Board, and the project in Sofia is in advanced preparation stages. The EU/Save project for Energy Service Companies in Lithuania has recently started. In about a year, some results and recommendations can be expected.

3. Lessons learned and reflected in the project design:

Within the heating sector, the Bank has drawn on its growing experience in similar projects completed in other countries. In particular, the Bank has helped guide a process of closing district heating systems in areas where it is not viable and supporting the transition to efficient operation in the remaining areas. Based on experience in district heating projects in Poland, Estonia, Latvia, Bosnia and Ukraine, the focus of the Bank support has been on loss reduction, decreasing fuel consumption and system design changes to improve supply quality.

The Bank's District Heating Projects in other countries have, to a large extent, been successful. Targets for reductions in energy consumption and system improvements have been achieved, or exceeded, giving confidence in the project design. Any problems that have arisen were typically associated with instances when the project design has exceeded the implementation capacity of the borrower. The size of the staff, their past implementation performance and lessons learned from similar projects were used to size this project. Based on this review, the project size was scaled back considerably (roughly 15%) from that recommended by the consultant.

Some of the key lessons learned from past projects include: (a) a focus on efficiency improvements in consumer substation and heat source rehabilitation has provided the highest economic and environmental benefits; (b) strong ownership of the project objectives is demonstrated by improved maintenance; and, (c) optimization of CHP/DH system is easier under single ownership than with separate ownership of CHP and DH systems since heat supply from the CHP plant has a substantial impact on successful operation of the district heating network.

Heat demand forecasts have been too high in some of the past projects, many of which were designed at the beginning of the economic transition and hence could not anticipate the breadth and depth of market collapse. A social assessment undertaken during project preparation has helped deal with this issue by taking into account the limitations on affordability. As a result, the demand forecast for this

project has been lowered and is believed to be realistic. Furthermore, much of the structural reform in the industrial sector has already taken place, limiting the impact from such problems.

The district heating modernization projects in Russia and Belarus are in preparatory stages. Both include measures focusing on heat exchanger substations, demand-side management measures, and heat metering. The approach to heat exchanger substations is somewhat different from that taken in Lithuania in that many block substations are only rehabilitated rather than replaced with building-level substations, while many buildings are still missing heat meters. The potential experience under the proposed Vilnius DH project with respect to large-scale introduction of BLS and demand-side management measures at the apartment level could be valuable to these countries.

The Bank's Energy Efficiency and Housing Pilot Project (EEHPP) in Lithuania (scheduled to close in 2001) was very helpful in guiding the design of the Energy Conservation Fund. The project helped design the incentives, the project implementation plan and helped estimate the potential for market penetration. It also focused on institutional reform such as the establishment of Homeowner's Associations and the promotion of private sector participating in the financing and supply of renovation services. The Pilot is planned to be followed up with a second loan emphasizing Housing policy in addition to energy efficiency.

The EEHPP demonstrated that homeowners are able and willing to invest in energy retrofitting in their buildings if provided with a support package addressing legal, institutional, technical and financial barriers (see the Box below). However, the project languished until the Government grant-financed 30 % of the costs. Under the current proposal, the possibility of a partial subsidy or a similar inducement is proposed at the initial stage of the project.

The EEHPP also demonstrated that significant educational and advisory support is required to bring homeowners to the decision making point. The VDHC would engage consultants to help conduct outreach to assist homeowners with these investment decisions. In order to improve returns on the funds invested, the VDHC would engage consultants to conduct economic analysis of the effectiveness of barrier removal efforts and proposed solutions to market penetration. The marketing staff of VDHC would be responsible for the implementation of the ECF and would receive training as well through the outreach program. Building on the experience with the ECF, consultants would be engaged to assist VDHC with establishing its communications strategy that would help to improve the marketability of district heat in areas where it is least cost and environmentally beneficial.

Box 1. Energy Efficiency/Housing Pilot Project
Summary of Lessons Learned

Lessons Learned – Project Beneficiaries (Homeowners/Homeowners' Associations)

· HOAs are able and willing to renovate common property if provided with institutional support, technical support and financial incentives.
· HOA take debt seriously and are repaying loans, often faster than required.
· Case stories and examples have an important demonstration effect when communicated directly to homeowners.

Lessons learned - Legal Barriers

· Proper legal and regulatory framework is mandatory to facilitate formation of HOAs and energy efficiency investments.
· Lack of wider educational program regarding HOAs leads to a poor understanding of laws and regulations.

Lessons learned - Institutional Barriers

· Significant institutional support and financial incentives are needed to reduce the transaction costs associated with addressing barriers to the formation of HOAs and to private initiative in maintenance of residential buildings.
· HOAs are hesitant to invest in project preparation (energy audit and preparation of investment proposal); however, they are willing to cover some expenses for design, procurement and supervision of consultant services.
· Privatization of municipal maintenance companies would help to facilitate formation of HOAs by removing artificial pricing of maintenance services, opening the door to competition in the sector and offering homeowners choices in maintenance services.

Lessons learned - Energy Efficiency and Energy Savings

· The main motivations for homeowners when they decide to take the loan are (in order of importance): (i) to improve their own apartment, e.g. improved indoor climate, better windows; (ii) to carry out urgent repairs of the building (leaking roofs, etc.); (iii) to obtain energy savings.
· After project implementation, homeowners become more interested in energy savings and some start planning new projects.
· Once payment for heat is based on building level metering and size of apartments, the actual energy savings – reduced consumption – varies significantly from building to building and can be negative due to increased consumption in some buildings.
· Metering in individual apartments with thermostatic valves and heat cost allocators on the radiators have demonstrated high energy savings and satisfaction.

Lessons learned – Financial Barriers

· Homeowners are willing to invest in energy efficiency and renovation if supported with financial incentives, i.e. tax benefits and grant elements. Public outreach alone will not convince homeowners.
· Lack of collateral and high transaction costs are serious obstacles to private sector lending to HOAs.

4. Indications of borrower and recipient commitment and ownership:

Government commitment has been demonstrated during all parts of project development. The Government initiated the request for the project and assisted in arranging for Swedish Government funding of project preparation. Periodic updates to the project have been discussed with the Government during project preparation to ensure their continued support. The Ministry of Economy officials have supported the project concept and the Ministry of Finance representatives have agreed, in principle, to a provide a sovereign guarantee for the loan. The loan is proposed to be included in the Government's 2001 public investment program.

The VDHC management has assigned a broad range of their technical and financial staff to work closely with the Swedish-funded consultants, AF International, to prepare the project. The General Director has been personally involved from the early stages of project development, as well as his senior staff. This has resulted in a high degree of ownership of the project by VDHC. Project design is clearly a reflection of the borrower's commitment to the project as it not only presents a change in strategic outlook, but will also be the focal point of their corporate activities over the life of the project.

The new Mayor of Vilnius has expressed a keen interest in the speedy implementation of the project, which he sees as a critical step toward fundamental re-orientation of VDHC toward commercial operation. The Mayor has already indicated his willingness to support the privatization of municipal maintenance companies, which would increase competition and open up new opportunities for the commercial operators including the emerging energy service companies.

5. Value added of Bank and Global support in this project:

The primary value of the Bank's involvement to date has been to ensure that the project is consistent with the broader economic reform agenda, to help focus the project and to ensure that issues of affordability and financial viability are adequately addressed. The primary focus of project preparation was a program of actions that needed to be taken to enable financial viability without price subsidies to the energy producer or increases in real tariff levels, with particular focus on the near-term problem of debt servicing capacity. The Bank's broader policy guidance, as a component of the ongoing structural adjustment loan, is designed to support a framework in which entities in the energy sector can operate in a commercially sustainable manner. This project preparation effort has focused on getting the legal and regulatory (particularly pricing) framework right and enabling a fair competitive environment among energy suppliers.

The Bank team has also helped VDHC devise a plan to remain financially viable without Government support. Without the project, VDHC would soon be in the position of needing continued Government subsidies or debt relief or both. With the project there would be a positive cash flow to the Republican budget and a reduced burden of subsidy to low-income families.

The Bank has also helped address the issue of cross-subsidies for both gas and heat. As natural gas is both the primary supplier of fuel and the primary competitor to district heating, the structure of gas prices is important. The current practice of cross-subsidizing household gas consumption by large customers is being addressed by the Government and the regulator.

Cross-subsidies within the district heating sub-sector are also being addressed by the legal separation of the eight small communities from Vilnius. This change should provide an incentive to decrease the

economic cost of supply, better address affordable ways of delivering heat and reduce the impact of the sector on government budgets.

Finally, as an Implementing Agency of the GEF, the Bank is well placed to introduce the environmental dimension into the project and ensure that the environmental externalities are part of its economic justification.

E. Summary Project Analysis

1. Economic (see Annex 2 for GEF Incremental Cost Analysis):

Cost benefit NPV=US$17 million; ERR = 13 %

Least Cost Analysis. District heating options were considered relative to individual gas-fired boilers and electricity-based heat supply. Generally, district heating is economically viable if the density of heat demand is high (above 5 MWh/year per meter of pipe) and if heat as a by-product from a power plant is used to meet part of the supply. Vilnius has two CHP plants that can be used a source of low cost heat, thus meeting one of the criteria. Most of Vilnius meets the heat density criterion, but not all. Consultants undertook an analysis of each of the 24 districts within Vilnius to assess which districts should be retained as market areas for district heat. Of the 24 districts, 15 met the criteria with the remaining nine requiring a detailed analysis. Of these nine, one district (A. Paneriai) is proposed to be disconnected from the centralized heat supply system. In three other districts, some design changes and limited disconnection would make district heating supply economically viable. The remaining five districts are least cost due to their proximity to a transit pipe to neighboring districts.

Part of the problem with the financial viability of district heating stems from cross-subsidies in gas prices. Household gas prices remain below their economic levels while larger customers pay relatively high prices than can be economically justified. The Energy Pricing Commission (EPC) has been gradually eliminating these cross-subsidies, but further adjustments need to take place. This issue is of particular importance to district heating companies as gas is both their primary supplier and primary competitor (at the household level). As a result, their input price subsidizes the price paid for the primary competitor to VDHC's market - individual boilers. This issue was addressed with the VDHC, EPC and the Ministry of Economy at the time of preappraisal at which time it was agreed that it would be addressed through the regulatory process. VDHC will to engage a consultant to help them state their case.

Project Analysis: The economic analysis of the project focused on the returns that could be achieved based on tariffs as a proxy for valuing benefits. This would underestimate the economic returns, but a conservative approach is believed to be warranted due the financial constraints imposed by having to compete with other sources of supply. Hence, the binding criterion on selecting project components is the financial return. The project benefits consist of the following: decreased fuel consumption from energy savings caused by improved temperature control at consumer substations; decreased fuel consumption from CHP and HOB upgrades; improved supply reliability from equipment replacement at the CHP and HOBs; decreased water losses as a result of new substations; decreased electricity consumption by lowering pumping loads; decreased maintenance costs; lower staffing requirements; and, decreased emissions (including CO_2).

Only components that have a real incremental financial return greater than 10% have been considered for the project because of the need to decrease the cost of supply. All project components have an individual EIRR exceeding 11%, with a total project EIRR of 13% (excluding environmental benefits, 15% including environmental benefits).

The existing heat only boiler units are either beyond or approaching the end of their economic life. As the quality of maintenance has been good, the life of the existing 24 year-old boilers can be extended with modest upgrading of the original equipment. Some of the older boilers, however, will need to be replaced. The investment cost of the HOB component is estimated to be $3.4 million. The benefits largely consist of fuel savings due to higher efficiencies and lower electricity consumption. Minor benefits include decreased water losses, lower maintenance costs and decreased air pollution.

The upgrading of the CHP units is estimated to cost $18.9 million. Replacement of some of the equipment is required as the existing equipment is past its effective life. Existing burners will be replaced with low-NOx burners to reduce fuel consumption and NOx emissions. The instrumentation and control systems will be replaced to improve the quality of output, reduce maintenance costs and reduce fuel consumption.

The replacement of block substations with BLS is expected to have a particularly high rate of return, consistent with the experience in Bank-funded projects in other countries (generally in excess of 20%). The primary source of savings comes from the fundamental design change from a constant flow, variable temperature design (as was the case in all of the Former Soviet Union) to a variable flow design as is the norm in Western European countries. This design change enables heat losses to be reduced during the partial load periods in the spring and fall. Furthermore, it also enables new markets to develop by extending the season for those customers willing to pay for this service. Water meters at the building level enable a reduction in non-technical losses while piping improvements decrease the technical losses. Lower electricity and maintenance costs have a minor impact on the project benefits.

The Energy Conservation Fund would, by definition, fund investments whose financial returns exceed 10% as this is the criterion for approval into the program. Results from the market analysis shows that, in order of priority, building level substations, building insulation, thermostatically-controlled valves and window replacement would meet this criterion. Some of these investments include non-quantifiable benefits by increasing the value of the housing stock.

A summary of the incremental cost analysis implemented specifically for the GEF-supported components of the project can be found in Annex 2.

2. Financial

NPV=US$ 17 million; FRR = 12 %

Past Financial Performance

The collapse of the Soviet Union in 1990 resulted in massive increases in energy costs as Lithuanian providers adjusted to world energy prices. In the case of district heating, which supplied 80% of Lithuanian households and was by far the largest component of household energy consumption, the Government initially adopted a policy of softening the impact of higher energy costs on Lithuanian consumers. The country's six major district heating networks, which were integrated into the

operations of the Lithuanian State Power System (now Lietuvos Energija) supplied heat to the populations of Lithuania's principal urban areas at prices which were increasingly below cost recovery levels.

While this policy gave important protection to consumers at a time of general economic difficulty, it led to ever-rising losses within LE, increasingly financed by local and foreign borrowing. In the mid '90s, Government energy policy was redefined, and two of its principal objectives became:

- the introduction of economic costs throughout the energy system; and
- the restructuring the electric power sector to prepare for EU membership and possible future privatization.

The condition of LE's district heating business stood in the way of both objectives. It was decided to separate the district heating system from the rest of LE. This was achieved in July 1997, with the creation of a number of municipally-owned district heating utilities, of which VDHC is the largest. At about the same time, the process of developing Lithuania's regulatory structures was advanced by the establishment of an autonomous National Control Commission for Energy Prices and Activities (known as the Energy Prices Commission, or EPC), which was charged with the establishment of economic pricing throughout the sector.

By the time separation occurred, the Government was in the process of implementing a program of restitution to LE in relation to the losses it had sustained through the past uneconomic pricing of heat. However, a share of the long-term debt originally incurred by LE was transferred to each newly-created district heating company. VDHC's financial statements at December 1997 showed long-term debt of LTL 115 million, which had increased to LTL 148 million by December 1998 giving a debt: equity ratio of about 0.4:1. A profit of LTL 6 million was earned in 1998. According to pro forma financial statements for 1999 (unaudited: the company has changed its year end to accord with the heating season, and the next audited accounts will be for the eighteen-month period to June 30, 2000) a loss of LTL 24 million was incurred in 1999. This result was due to lower revenues (the effect of a single-part tariff during an unusually mild heating season) and to higher bad debt provisions against receivables.

Since 1997, tariffs have been approved by the National Control Commission for Energy Prices and Energy Activities (Energy Prices Commission, or EPC). The EPC is an independent body which has had considerable success in balancing the conflicting positions of providers and consumers of electricity, gas and district heating, Its price determinations in its first years of operation have been based on temporary methodologies which are not founded on long-term analysis of demand or investment needs. It has developed a new tariff methodology for district heating, application of which, however awaits the enactment of the new energy laws. Currently, most residential consumers are charged on the basis of a single-part tariff for heat, based solely on total heat energy consumed. Factors relevant to the pricing of heat in Vilnius include:

In evaluating VDHC's heat costs, the EPC allocates the fixed costs of co-generation plants according to plant capacities, and variable costs according to energy volume produced.

The current single-part tariff in Vilnius, which was set in 1998, is LTL 108.8 per MWh for residential customers. The company is aware that the current tariff structure neither appropriately compensates it for its valid costs (particularly cost recovery of fixed costs during warm winters)

nor adequately incentivises economy in energy consumption by its customers. The introduction of more complex tariff structures is expected to improve both of these situations.

The competitive environment within which VDHC operates is increasingly difficult because of the sharp challenge to district heating presented by suppliers of alternative heat sources, particularly gas. The research conducted on the company's behalf confirms that it is likely to lose customers at an increasing rate if tariffs for heat rise faster than the consumer price index. A key element of its survival strategy, therefore, will be to seek to use targeted investment to transform its cost paradigm so that tariffs can remain at their present level in real terms.

By law, the municipality of Vilnius constitutes the heating authority, and tariff applications to the EPC come from it rather than from VDHC itself. This arrangement allows for a degree of political input into VDHC's pricing strategy which could, in certain circumstances, prevent it from maintaining prices in real terms.

The borrower in the present project will be a reconstituted VDHC, from which its regional branches (serving communities which are physically separated from the Vilnius infrastructure) are now separated. Separation is proceeding on the basis of the Law of December 17, 1998, which sets out rules for the allocation of assets and liabilities. While separation will pose major strategic and financial problems for these communities (the transition will be supported separately by an ESMAP study), it will greatly assist the financial position of the "new" VDHC. Pro forma accounts and estimates for the reconstituted entity show a much better picture than for the larger company: estimated profits of LTL 31 million in 1998 and LTL 28 million in 1999. The 1999 profit was entirely due to the 1998 tariff increase and to the increased value of electricity sales, which offset a 4% fall in heat sales volume and inflation-led increases in operating expenses.

Financial Problem Areas

The partial data available (the audited 1998 accounts and estimates for 1999) show the company to be profitable at present. However, it suffers from a number of chronic problems and it faces new challenges, if not countered: the combination of these is likely seriously to compromise its future financial performance, and could lead to an inability to fully service its debt with the Ministry of Finance.

Technical shortcomings: the impact of the technical characteristics of the company's assets, including its CHP plant, its distribution networks and its substations, will be increasingly felt in financial terms. Shortcomings in the original design, compounded by the technical deficiencies of the heat installations *within* buildings will lead to increased operating costs, particularly maintenance costs, and to significant opportunity costs arising from the limited availability of the CHP plant to sell power to the national grid.

Competition: VDHC is encountering new and increasingly effective competition from providers of alternative sources of heat, particularly natural gas. The greater flexibility and control which gas boilers provide to consumers will increasingly dislodge district heating customers from the network and erode VDHC's revenue base. For larger consumers, the current single-part tariff structure reinforces the incentive to disconnect. Research conducted by the consultants indicates that the disconnection rate would probably be a minimum of 3% of consumers per annum without improvements to the existing assets.

Tariff limitations: In these competitive conditions VDHC can no longer regard itself as having monopoly status in the Vilnius heat market, and will not be able to rely on regular tariff increases in real terms to cover the increased unit costs which will result from both of the above factors - higher fixed operating costs and a narrower customer base. It is likely that the only pricing stance which will be compatible with VDHC's survival will be a strategy of unchanged real prices over the medium term. In order to provide incentives for customers to economize in heat consumption (while not compromising VDHC's ability to recover its fixed costs, particularly during mild winters), it will also be necessary to achieve continued real price stability within a multi-part tariff environment of instead of the current single-part scheme.

Collections: Since the separation of the district heating utilities from LE in 1997, the valuable mechanisms which had been put in place over the previous year to enforce payment discipline among budgetary organizations have not been available to VDHC. As a result of this, and also of the very serious financial problems faced by the municipalities themselves since the Russian crisis of 1998, VDHC's receivables have increased:

- Receivables due from households rose by LTL 6 million (35%) between July 1999 and July 2000.
- There was an increase of LTL 2.5 millions (40%) in receivables due by State budgetary organizations.
- The amount owed by municipal budgetary organizations rose from LTL 13.4 million in July 1999 to LTL 24.8 million in July 2000, an increase of 85%. (This figure had been as low as LTL 7.6 million in 1997.)
- It is estimated that collections from municipal budgetary organizations (overwhelmingly schools and hospitals) in 1999 amounted to only 12% of sales.
- In addition to normal arrears, the Municipality has been slow to pass on to VDHC the compensation it receives from the State budget in respect of the reduced heating bills of qualifying low-income families whose entitlement to subsidy has been certified by SODRA (the Lithuanian Social Security System).
- The cumulative effect of the collapse of payment discipline has been to subtract between LTL 40 and 50 million to VDHC's working capital, and thus to its borrowings.

Without urgent corrective action, the impact of the factors outlined above on the future financial performance of VDHC is likely to be devastating. With unchanged real tariffs, and with 3% of the customer base being lost each year, while costs rise with inflation, VDHC is projected to move into a chronic loss-making position from 2002. A year later the company would be resorting to continuous short-term borrowings to finance its normal operations, and bankruptcy would follow within a further few years if fundamental changes to its operations do not take place. Given the favorable impact of district heating on economic costs of supply and the environment, the financial problems need to be addressed urgently.

The Financial Consequences of Not Proceeding with the Rehabilitation Project

The effects on Vilnius District Heating Company (VDHC) of a declining market share, coupled with tariffs which have not fully covered costs in the past, have been severe. Operating margins have declined, and liquidity reduced. Without the investments needed to enhance VDHC's competitive position, as well as other radical measures designed to restore an adequate level of profitability and liquidity, the company cannot avoid progressive financial decline and the erosion of the shareholders' equity. The table below, in which an unchanged *real* tariff is assumed after 1999, illustrates the trend if there is no rehabilitation:

	1998 (actual)	1999 (estimated)	2000 (projected)	2001 (projected)	2002 (projected)	2003 (projected)	2004 (projected)	2005 (projected)
Heat sales volume (GWh)	2581	2472	2302	2264	2231	2202	2170	2139
Average heat tariff (Lt./MWh)	101.8	108.8	111.0	114.8	117.8	120.8	123.8	127.0
Total sales revenue (Lt mn.)	340.2	353.6	348.0	354.9	361.5	346.5	370.6	359.6
Total fuel costs (Lt mn.)	162.4	164.7	199.5	190.1	194.1	185.6	197.6	196.1
Other operating exps. (Lt mn.)	109.1	137.7	132.4	137.0	140.6	144.3	148.3	162.0
Net operating margin	20%	14%	5%	8%	7&	5%	7%	0%
Net income after tax (Lt mn.)	6.3	28.1	(4.5)	12.2	(9.5)	(15.1)	(13.6)	(44.2)
Equity (Lt mn.)	418.6	446.7	394.6	406.8	397.3	382.2	368.6	324.4

The projections made in the course of preparing the rehabilitation project indicate that, without the project, the company's equity would evaporate rapidly from 2005 onwards, and would be totally eliminated by 2010. Total debt (long and short-term), currently about LTL 120 million, would be double that figure by 2005 and over LTL 500 million by 2010.

A number of fundamental problems make it unrealistic for the Company to expect to correct the picture shown above without radical rehabilitation and reform. The market for heat is increasingly competitive. Even apart from the energy price issue, district heating as provided by an unreformed Vilnius network is perceived by consumers to be inconvenient and unreliable and wasteful of water and energy. The extra costs thereby imposed on the company cannot be reduced without wholesale rehabilitation. The company's overall financial situation would make it an extremely unattractive borrower unless fundamental changes are made.

These problems will persist irrespective of the ownership structure of VDHC. They can only be dealt with by investment at the building level and in the networks and generating facilities so that VDHC can provide a service which is objectively competitive with other heating systems, and by improved management. The proposed project can achieve this, and allow the current owners of VDHC to plot its future as a profitable company. In turn, this will allow the owners to consider a wide range of options as to the future capitalization of the business, and to consider these from a position of strength.

The Financial Projections

Available financial projections show (compared with the without-project case) improving profits and a more secure cash position. In the year 2005, for example (the first post-implementation year), revenues would be 5% higher, fuel costs 7% lower, water usage and maintenance costs decreased by nearly 50% than without the project. Additionally, staff numbers would have been cut by 8% and receivables by 25%.

The projections show an after-tax return on equity in the region of 4%-5% post implementation, but substantially lower during the earlier years. Both the Debt Service Coverage Ratio and the Self-financing Ratio are projected to be generally satisfactory, with the DSCR increasing from 1.1 in 2001 to 1.6 by 2004 and self-financing increasing from 3% to 39% in the same period.

Fiscal Impact:

Without the project, VDHC is forecast to face serious financial problems. Further deterioration in their position would jeopardize its ability to fully service existing debt. With the project, VDHC is forecast to be able to fully service debt after 2001 and transfer profit taxes to the Government amounting to roughly LTL 7 million per year starting in 2003.

3. Technical:

The technical solutions selected for eliminating block substations and installing building-level substations and inlet pipes and heat-only-boiler plants represent technology that has been routinely and successfully used for the purpose in the neighboring countries. VDHC has become familiar with the technology and design concept by visiting many of the experienced DH/CHP companies in the region having already implemented some modern substations and pipeline projects themselves. The combined heat and power plant rehabilitation and the process automation rehabilitation of the CHP units in particular, require that special attention be paid to project design in order to minimize losses of electricity sales. VDHC staff are also expected to draw on the experience of Helsinki Energy staff (as part of the proposed twinning arrangement) who are currently undergoing a similar exercise of CHP plant upgrading themselves.

The project costs were estimated by the VDHC with assistance from its consultants and reviewed by the Bank team. The costs are similar to the experiences in the recent past in similar projects in Latvia and Poland. The project cost estimate include the costs of design work and work site management, which have been estimated at about 4% of the investment costs. Physical contingencies are estimated at 9% which is based on the level of the status of detailed design and the uncertainties associated with rehabilitation projects.

The technical aspects of energy efficiency investments have been successfully piloted in the EEHP project and will be replicated in this project. Households will receive assistance from VDHC, the Energy Efficiency Advisory Center and consultants to ensure that appropriate technology is properly implemented.

4. Institutional:

The VDHC is a special purpose joint stock company which is wholly-owned by the Municipality of Vilnius. The current arrangements are consistent with current global experience. However, in the recent past private sector participation in the provision of heat has become increasingly adopted. Furthermore, there are other examples of increasing private sector participation in similar sectors (water supply, for example). Therefore, the Municipality is considering a range of options that would increase private sector participation including: (a) divestiture of its ownership stake; (b) concession or leasing arrangements; (c) management contracts; and/or, (d) spin-off of some assets or services. The project includes a provision for funding of such a study and for the implementation of the recommendations.

The residential housing in Vilnius is now mostly (93%) privately owned. Recent (mid-2000) legislation provides for the establishment of Home Owners' Associations, or in cases where residents fail to agree on the establishment of such associations, the appointment by the municipality of administrators. The exact functioning of these arrangements needs to be clarified, so that implementation of the project is not held up by doubt or disagreement as to where responsibility for installations and their maintenance lies. The upgrading of the substations, and the move away from block substations, adds urgency to the issue. In the project design it is assumed that, upon upgrading of a substation it will be transferred to the residents under a hire-purchase contract. Consequently, substations are not included as assets in the balance sheet of VDHC.

Another important institutional issue is the manner in which the municipality exercises its prerogatives as owner of the district heating company. It will be fundamental to the commercial evolution of VDHC that the municipality does not interfere in the management or decision-making of the company. Specifically, it must not involve itself in the pricing policy of the company, in its dealings with the Energy Pricing Commission, in the control of its costs, or in any other commercial area. This will pose a challenge in the development of governance structures.

Thirdly, the internal management structures of VDHC need to be made less centralized and more customer-focused. The top management team should receive encouragement and practical help in their efforts to achieve this. This issue will be addressed by the proposed twinning program with Helsinki Energy.

4.1 Executing agencies:

The Vilnius District Heating Company would be the Executing agency for the proposed project. VDHC was registered as a special purpose joint stock company on 21 August 1997 and is wholly owned by the Municipality. The special purpose company fulfills functions that are of vital significance for the state or whose activities require a special regime. The company is a legal entity with full economic, financial, legal and organizational independence. Its activity is regulated by its by-laws, laws of the Republic of Lithuania and Governmental resolutions.

4.2 Project management:

VDHC would be responsible for implementing the project drawing from their own staff, assisted by foreign and local consultants. A Project Management Coordination Group (PMCG) would be guided by a Project Manager who was identified at the time of pre-appraisal. One engineer would be

responsible for the network and HOB components while the chief engineer for the CHP plant would be responsible for implementing the CHP component. The existing financial and accounting staff will be responsible for the project Management Reports, corporate accounts, project accounts and auditing. A consultant will be engaged to assist VDHC staff in establishing financial systems and procedures. Two procurement experts have been identified to work on the project, supplemented by a procurement specialist advisor, familiar with the Bank procurement requirements. They will be trained in Bank procedures and will be assisted by independent consultants. The implementation of the environmental mitigation aspects will be the responsibility of the Chief of the Construction Department.

Implementation of the Energy Conservation Fund would be the responsibility of VDHC's marketing department. At the outset, they will rely heavily on consultants who have experience in implementing similar projects. A training component is included as part of the project to ensure that this component will be sustainable over the longer term. The banking aspects of onlending and collections will be passed on to commercial banks on a competitive basis.

Information regarding procurement administration would be collected and recorded and quarterly reports would be sent to the Bank. These reports would indicate: (i) status of procurement; (ii) an updated procurement plan; and (iii) compliance with aggregate limits on specified methods of procurement. As the implementation of the project would be handled on a decentralized basis by heat and power generation and transmission and distribution divisions of VDHC, the PCMG will be responsible for supervising the technical and administrative aspects.

5. Environmental:

5.1 The project is in full compliance with all environmental requirements of the Government of Lithuania, Vilnius Municipality, World Bank policies and procedures (OP/BP/GP 4.01: Environmental Assessment), appropriate EU Directives concerning the environmental performance of boilers, and the Government of Lithuania's international commitments under the Montreal Protocol concerning Depletion of the Ozone Layer.

In accordance with World Bank policies the project has been rated “Category B”. An Environmental Management Plans (EMP) has been prepared, acceptable to the Borrower and the Bank, for CHPs, HOBs, Substations and the Distribution Network.

Overall efficiency improvements to be realized by the project will result in reduced fuel use and reduced pollutant emissions over the project life (through 2015) as indicated below:

Pollutant (tons)				**Tons of Emission Reduction by Project Component**
	CHP	HOB	Network	Substations
Sulfur Dioxide	60	130	120	460
Nitrogen Oxides	10,900	24	450	1800

Estimates of CO2 emission reductions resulting from the project are given in Annex 2.

Project Location

The project would focus on a large number of boilers, one combined heat and power plant, heat transfer stations and pipelines distributed throughout the municipality of Vilnius. Major boilers (VE-2, VE-3, Boiler House Number 8) are from 5 to 10 km outside the city center.

Major Environmental Issues

There are no major environmental issues associated with the project. On the contrary, the Project will improve air pollution levels by reducing energy consumption and, hence, burning of fuels.

Other Environmental Issues

Minor environmental issues associated with *construction* activities include dust and noise associated with the movement of men, machines, and materials and with solid waste management. Asbestos insulation is present in all components which are to be replaced under the project. At CHP facilities, there is a possibility that transformer coolants may be present and that they contain unacceptable levels of PCB. Preinsulated replacement pipes might be manufactured with CFCs or HCFCs. During *operation*, minor issues include atmospheric emissions of CO_2, NO_x, and SO_2. As presented above, efficiencies realized by project implementation will reduce all these emission levels over current values. Spills and leakage is possible during transfer of fuel oil, and from the hot water circuits.

Proposed Actions

Construction activities will be conducted during daytime hours and planned in a manner to minimize disruption to existing population activity patterns. Dusty areas will be sprinkled with water. Asbestos will be removed and transported by companies/units duly licensed to perform this work, and disposed of in an appropriate manner at sites officially approved by the Government to receive such material. If transformer oils are present, they will be tested for PCBs and, if contaminated, they will be disposed of in accordance with Lithuanian standards. Preinsulated replacement pipes will have foam insulation prepared with either carbon dioxide or cyclopentane foaming agents. Bid documents will be required to include this specification. Low-NOx burners and lower sulfur fuel oils will be used to assure that SO2/NOx emission levels will comply with Lithuanian standards, World Bank Guidelines, and EU Directives. Proper housekeeping measures will be instituted to minimize occurrence of leaks and subsequent contamination of soil and groundwater.

The main features of the EMP address the construction phase of the project. Issues include dust, noise and proper disposal of non hazardous wastes. The EMP includes testing for hazardous materials (PCBs) and, if found in levels exceeding standards, appropriate measures for management are to be taken. During operation, there are minor issues associated with emissions of SO_2, NO_x and CO_2, and leaks/spills of water or fuel oil. These aspects are the appropriate ones to be considered under the project. Their proposed management seems reasonable and entirely adequate.

A final draft of the EMP was submitted by the Borrower on May 22, 2000. The summary of public consultations as described under Section 5.1 (Public Consultation) was issued in June 2000.

A household survey (see Public Consultation discussion above) was undertaken in the early stages of project preparation (May 1999) for use in project design. Environmental issues are limited as the project is confined to repairing and upgrading existing assets. The key features of environmental protection and mitigation were taken into account in project design (particularly with regard to decreasing air pollution impact by improving boiler and burner efficiency). After the draft feasibility study was completed a meeting was held on May 25, 2000 with NGOs to present the findings and to address their concerns. As a direct result of this meeting, it has been decided that a demonstration project would be implemented as soon as possible with SIDA funding to demonstrate the expected benefits of the substation component of the project.

The EMP meets World Bank requirements as specified in OP 4.01 Annex C. As such, it includes: (a) a mitigation plan, (b) a monitoring plan, (c) institutional strengthening, (d) schedule, (e) institutional arrangements for environmental management, and (f) a summary of the results of public consultation and affected groups. The monitoring plan has been designed in a manner consistent with the mitigation plan. Issues which are to be mitigated during construction include dust, noise, and materials disposal (hazardous and non hazardous) and issues to be mitigated during operation include emissions of SO_2, NO_X, water leaks, and fuel oil spills. The monitoring plan address all these issues. During construction, monitoring is the responsibility of the Chief of VDHC's Construction Department and during operation, it is the responsibility of the Chief of the Technical Production Department. Monitoring results are normally reviewed and analyzed monthly by the Production Department. If the data indicate abnormalities, a report is sent to the Chief of the Technical Department. Any necessary actions are the responsibility of the Technical Director.

6. Social:

The project design was based on the results of the Social Assessment, taking into account the primary concerns of the consumers (largely cost and reliability of supply). Low income households are protected from the impact of heat supply costs that exceed 20% of household income through targeted subsidies from the Municipality. The safety net is under review as part of the Bank's Structural Adjustment Loan, but is generally considered to be satisfactory. The project is designed to assist the poor by reducing the cost of heat supply in the longer term and improve the quality of service. The benefits will accrue to a greater extent to the poor as the wealthier segments of the population have been able to afford alternative (more expensive but currently more convenient) forms of heat.

A survey was undertaken by VDHC to help design the project based on their customers' views. The project is designed to decrease the cost of supply which will benefit all groups but particularly the poor as heating absorbs a disproportionate component of their household income.

VDHC has introduced the project to the public through television interviews, newspaper and magazine articles. VDHC has also prepared a project description and made it available in public locations. They have invited public comment and will take their views into account in project design.

A meeting with NGOs took place on May 25, 2000 based on a project description that was circulated to them earlier. Their overwhelming concern was the cost of district heat. In addition they expressed concerns that those who take the risks associated with new substations should also benefit from this through cost reductions. During the discussions with the NGOs, it became clear that the communication program that had already been implemented had not reached a broad enough audience

and needed to be refocused. As a result, two efforts have been undertaken: a revised information campaign and a pilot scheme which includes information dissemination as a component.

The primary social objectives that need to be addressed are cost reductions and improved service. Both of these elements are distinct objectives of the project that will be monitored on a quarterly basis. The new Management Information System to be installed under the Project would monitor key indicators (such as primary cost elements - fuel, staff costs, maintenance costs, etc.) and customer complaints. The management of VDHC had established Working Groups within the company to address these specific issues both as a part of project preparation and project implementation.

Monitoring indicators were designed to address the key social assessment concerns. VDHC will be asked to report on these on a quarterly basis as part of the project design. The Management Information System would enable them to monitor and report on this aspect efficiently.

As noted earlier, some 50,000 family apartments in Vilnius belong to families organized into Home Owners' Associations (HOAs). Legislation enacted in June 2000 provides for the establishment of HOAs in each apartment building, or, in default of the establishment of such an association, the appointment by the Municipality of an Administrator to represent the residents.

Box 2. The HOAs are the only group of heat consumers in Vilnius that self-manage the heat supply to their buildings (if the technology allows). However, this indisputable advantage is often overshadowed by the responsibilities that HOAs have to face. The billing, for example, effectively becomes the responsibility of the homeowners. The DH company favors the HOAs as contracting with them saves it some of the administrative burden of bill collection (for the rest of the customers, the company has to maintain heat supply contracts on a family-by-family basis). However, this burden is not easily accepted by the homeowners. Besides, there are significant social learning costs associated with the formation of HOAs due to the legacy of State property management. People sometimes prefer to pay a low maintenance fee for poor quality service, but are unwilling to take on private initiative for common property issues. Finally, there are remaining legal and regulatory imperfections – e.g., the ceiling calculated on the basis of normative heat consumption is still applied to some customers who pay on the basis of a family contract. This ceiling does not apply to HOAs. Furthermore, HOAs are not exempt from VAT while individual flat-owners are. Although the law of June 2000 provides the basic framework, no appropriate subsidiary legislation exists yet to correct these imperfections.

Common property rights have been clarified in recently enacted legislation, but these rights and the corresponding responsibilities are not yet well understood by homeowners (and utilities). The project's focus on investments in common property will create the incentives for enterprising homeowners to organize their neighbors to agree to an investment that would improve their standard of living. In providing credit for energy efficiency investments, preference would be given to households organized into HOAs. However, this would not be a condition of extending credit.

F. Sustainability and Risks

1. Sustainability:

The borrower is committed to implementing this project as it will enable it to improve the quality of supply and reduce costs. Without the project, the viability of the company appears to be in serious

jeopardy. The owner (the Municipality) is also supportive of the project as it would decrease the subsidies to low income households by keeping heating costs down. The Project would also increase the value of the company and hence increase the revenues accruing to the Municipality from future divestiture, should it take place.

The project is also designed to assist VDHC to remain financially viable during the critical three-four year period when its debt service obligations are unusually high. Once past this period, VDHC is expected to be able to access debt and equity markets for future funding needs.

Price setting rests with the Energy Pricing Commission, an independent regulatory body. The depoliticization of price adjustments has reduced the risk to the financial sustainability of the project and of VDHC.

The long-term sustainability of the substation replacement and demand side management programs would be ensured through the creation of the Energy Conservation Fund ($7.5 million) that would operate on a revolving fund basis, targeting mostly the existing building-level substations of the old type. The substation replacements and installations would be implemented by the VDHC under a hire-purchase agreement with the HOA of the building. The repayments from the homeowners would be channeled to the ECF.

Within the ECF, the sustainability of the lending/leasing fund would depend on its default rate, rate of return, and ability to attract other capital. The most desirable scenario is that, starting from year 2 or 3, the initially high grant support rates for the apartment-level improvements would be phased out as the measure would have fulfilled its function of expanding the penetration rate of the substation replacements. As the new substations would enable the customer-controlled heat supply, it is expected that demand for further DSM measures in residential buildings would be generated. This would “push” the market early on and then allow a transition to a commercial market as both the technical possibility and the incentives would be in place for both the homeowners and emerging ESCOs to implement further energy saving investments in buildings equipped with modern building-level substations.

Sustainability of the grant/subsidy fund depends on policy reform and the ability and willingness of the government to continue to provide support for energy efficiency to targeted segments of the population. Specific activities within the project will assist the government to develop income-based subsidy policies for energy efficiency. These policies would be expected to lead to sustainability of the grant/subsidy fund from government contributions, based on the fund's demonstrated ability to reduce the need for heat-consumption subsidies for low-income households. GEF capitalization of the subsidy fund at the start of the project will be contingent on government commitment to sustain the subsidy fund after project completion, consistent with its evolving subsidy policies for low-income households. Further, the mid-term review will gauge the performance of the grant/subsidy fund and policy reform, and recommend corrective action if necessary to ensure the sustainability of the grant/subsidy fund by project completion.

The GEF-supported technical assistance components ($2.5 million) would serve to strengthen the VDHC's ability to implement marketing, public outreach, research, monitoring and other similar activities. The capacity built in the process will contribute to the company's financial viability as it will have a stronger customer base contributing to revenue growth in the long run.

2. Critical Risks (reflecting the failure of critical assumptions found in the fourth column of Annex 1):

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
Government's commitment to reforms and implementing its National Energy Strategy in particular, declines. Closure of the Ignalina Nuclear unit is of particular significance to this project.	M	EU Accession has motivated the Government to pursue reforms aggressively. The Seimas passed a law in May 2000, committing it to close Ignalina Unit 1 by 2005.
Unfavorable economic developments constrain demand for heat and erode household income, further impairing company's efficiency and reducing affordability of DH to consumers.	M	Prior to the economic collapse in Russia in August 1998, economic growth was strong. Growth in exports to Western Europe since then has helped refocus economic development.
Political and social pressures may make price adjustments difficult.	M	The independence of EPC helps mitigate this risk, as does the fact that competitors to district heating face the same fuel market conditions.
Increased fuel prices increase the price of heat, decreasing the market due to price elasticity of demand.	M	Other network fuels should face the same problem. In addition, the fuel switching capability of the CHP and boilers reduces the problem.
From Components to Outputs		
Inadequate regulatory capacity of the Energy Pricing Commission and the Supervisory Board of VDHC impair the company's financial performance.	S	To date, this has not been a problem, but it must be monitored during project implementation.

Expected project co-financing does not materialize or is delayed. Parliament delays loan ratification (issuance of a sovereign guarantee) and consequently loan effectiveness as well.	M	Clear Government and Municipal support prior to appraisal will be indispensable and has been reconfirmed by the new officials now in place.
Implementation delays due to inexperience with project implementation.	M	Engagement of consultants with relevant experience to support VDHC staff. Maintaining the VDHC Project staffing levels must be monitored. The twinning arrangements with Helsinki Energy are also expected to help.
Equipment proposed to be selected may not be optimal due to problems during the bidding process.	N	Review of proposals by the consultant and Bank staff with relevant experience.
The Municipality initiates private sector participation in a transparent manner and with adequate preparation.	M	The Vilnius Municipality has been asked to undertake a study to assess privatization options and discuss them with the Bank.
VDHC is unable to retain and ensure adequate management capacity.	M	Improved financial viability would enable VDHC to attract qualified staff.
Heat demand declines due to more switching to individual boilers than expected and/or warmer winters.	S	This issue must be closely monitored during project implementation to ensure that project and equipment sizing is appropriate.
VDHC continues to operate in a supply-driven mode (e.g., is unwilling to allow the home-owners exercise their option to reduce the level of heat received).	M	The component of the project dealing with the strengthening of VDHC's marketing skills and customer orientation will mitigate this risk.
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N(Negligible or Low Risk)

2a. Risks and uncertainties specific to the determination of the need for grant assistance to meet the Global Objective. The table below illustrates the contingency events that can be linked to the decision to resort to the grant/subsidy fund of the ECF for the substations and DSM component of the project. The table can also be used as a framework for surveys and corrective measures in the process of project implementation.

Buildings currently served by old-type BLS with no temperature control		
Trigger event/contingency	**Yes**	**No**
	Implications for demand for GEF funding through ECF	
The City Council approves the differentiated tariff policy based on the type of substation	Possible need for additional inducements (such as partial GEF/ECF grant funding of BLS upgrades, subsidized DSM measures in apartments, etc.) for customers to demand BLS upgrades	No need for additional inducements for customers to demand BLS upgrades
VDHC upgrades the BLS to modern BLS with temperature control once the differentiated tariff policy is introduced *(Note: the probability of this event is very low).*	No need for GEF/ECF funds to cover any of the BLS upgrade cost as VDHC would have funded the upgrades itself or, possibly, the homeowners themselves would invest in the substation upgrades	Need for GEF funding through ECF; Possible need for partial grant financing of the substation installation cost for the homeowners (depending on income, etc.).
With modern BLS installed, homeowners have the physical possibility, sufficient knowledge and economic incentives to use the BLS to regulate the heat level according to their comfort needs	No need to explain the benefits of energy conservation measures to homeowners	Need for Homeowners' Outreach Consultants funded under the ECF program to explain the benefits of energy conservation measures and technical possibilities for regulating heat with BLS to homeowners
Demand exists for DSM measures going beyond the control of heat at the building level through BLS (e.g., apartment-level DSM).	No need for assistance with apartment-level DSM measures	Need for partial grant financing of apartment-level DSM.

With the notable exception of the contingency given in the first row of the table, the following logic applies. If the contingency events described in the table materialize, producing the impacts described in the "Yes" column, there will be less demand for funding from the grant/subsidy fund of the ECF (and, possibly, from the ECF overall) as the global objectives of the project would be met through the application of domestic actions and resources. If the contingency events do not materialize, and the impacts from the "No" column prevail, there will be relatively more need for GEF grant funding through ECF.

Note: The first row of the table refers to the proposed decision by the Vilnius City Council to change the billing practices – effectively, introducing a new tariff policy. Under this policy, the Municipality would set the stage for VDHC's replacement of block substations with BLS by approving a 5% discount on the tariff to those households whose hot water is prepared inside the building (which is the case only when the building has a BLS). Simultaneously, it is proposed that the billing practices (effectively, the tariff structure) for those buildings without BLS (which receive their hot water from block substations) would be changed to introduce heat billing based on the estimated full cost of heat supply, including the estimated costs of domestic hot water (DHW) preparation currently unaccounted for. This would likely mean a net increase in the heating bill for about 60% of the DH customers (i.e., all customers currently served from block substations). With the introduction of BLS, the heat bill will be based on the full cost of heat supply incorporating the metered data on the amount of heat used for DHW preparation. At that point, the heat bill for these customers is not expected to change significantly (i.e., would remain high), unless DSM measures are implemented.

Annex 1: Project Design Summary

LITHUANIA: VILNIUS DISTRICT HEATING PROJECT

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Sector-related CAS Goal:	**Sector Indicators:**	**Sector/ country reports:**	**(from Goal to Bank Mission)**
Build capacity in local and municipal institutions.	Increase profitability of heating companies.	Corporate Annual Reports	Strong macro-economic framework.
Ensure access to basic services for the poor.	Reduce the rate of disconnection by customers	Auditors Reports	Improved price setting procedures.
Decrease the negative fiscal impact of heating subsidies on the fiscal deficit.	Decrease supply costs in real terms.	Quarterly Project Reports	Reasonable primary energy prices.

GEF Operational Program:			
Reduce the emissions of GHG from the Vilnius District Heating System through a targeted effort to remove the existing barriers to energy conservation (OP-5)	GHG emission reductions relative to the baseline; GHG emission abatement cost; Fuel consumption by type.	A reporting system would be established to monitor the fuel and GHG emission reductions achieved based on the marketing database of the VDHC; hiring an independent contractor to develop the monitoring system as necessary; fuel consumption data from VDHC.	The barrier removal measures result in long-lasting impacts such as collaborative relationship between the VDHC and the HOAs; these results are acknowledged and promoted by the Government and other relevant stakeholders; private sector interest to energy efficiency investments increases; increased participation of the private sector results in a more competitive market for products related to energy efficiency which, in turn, brings down the costs and makes energy efficiency (including DSM) more economic.
Achieve indirect/downstream GHG emission reduction benefits due to demonstration effect and replication activities	The number of similar projects emerging in Lithuania, the Baltic Region and elsewhere in ECA – based on the following criteria of similarity: ▪ District heating utility involved in DSM; ▪ Revolving fund or similar crediting facility for substations and DSM (*Note*: the source of initial capitalization does not matter); ▪ Identifiable GHG	The marketing department of VDHC in cooperation with the operator of the ECF, HUDF and other stakeholders	The publicity and demonstration impact from the project are focused on the potential benefits for a private investor entering the energy efficiency market (rather than on the global externalities).

	reduction benefits; The number of examples of government-supported energy efficiency grant/capital subsidy programs in the Baltic Region and elsewhere in ECA.		

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Project Development Objective:	**Outcome / Impact Indicators:**	**Project reports:**	**(from Objective to Goal)**
Decrease the economic cost of heat supply.	Using financial records, impute an economic cost of supply	Annual financial reports of the company, supplemented by quarterly PIU reports with particular focus on changes in fuel costs	No major changes to unit input costs (fuel, labor) and no exceptional events.
Increase the profitability of supplying heat from District Heating networks.	Annual review of the Income Statement expected to show improving profitability starting 2002.	Auditors Reports.	Periodic price adjustments to enable full cost recovery.
Increase the quality of supply.	Decreased outages by x% per annum.	Outage Statistics/Customer Complaints, disconnection rates	Retain good managers.
	Enabling temperature control	Focus Groups	Improved collections.
Global Objective:			
Expand the market penetration of the building-level substation (BLS) technology and DSM measures to a larger number of households while ensuring the full degree of ownership and operation of the substations by the homeowners.	Annual and cumulative rate of replacement of block substations with building-level substations; The same for BLS upgrades; The same for other energy efficiency improvements in common areas (stairwells, roofs, basements); The same for the number of apartment-level improvements made, with	Annual reports produced by the VDHC marketing department	The new BLS technology allows the technical possibility of customer-controlled heat supply; VDHC is willing to give control of the BLS to the homeowners seeing this as effective marketing tool; The customer-controlled operating mode of the existing and newly installed BLS provides the incentives for the homeowners to participate in the

	a breakdown by category (thermostatic valves, cost allocators, energy-efficient windows, insulation improvements, etc.).		substation replacement and upgrade program. The fuel savings due to the installation of BLS are sufficient to produce the GHG saving targets.

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Output from each Component:	**Output Indicators:**	**Project reports:**	**(from Outputs to Objective)**
Customer substations to decrease energy consumption.	Energy use over time.	Quarterly Reports on consumption.	Results are temperature sensitive and a function of income growth.
Improved managerial controls.	Management Information Systems and related analytical tools.	Quarterly management reports.	Quality of management to be retained.
Boiler replacement to reduce fuel costs.	Lower fuel consumption.	Annual financial reports.	Fuel use is temperature dependent.
Decrease operating costs of the CHP plant.	Lower fuel consumption.	Quarterly management reports.	As fuel use is temperature dependent we assume no unusual temperature excursions.
Global Outputs:			
Financially and institutionally sustainable operation of the ECF	▪ Volume of cofinancing attracted to lending/leasing fund; ▪ Rate of return of lending/leasing fund; ▪ Government subsidy contributions to grant/subsidy fund; ▪ Reductions in heat-purchase subsidies for low-income households as a result of grant/subsidy fund investments on behalf of these households.	Semi-annual reports and mid-term review focusing on the question of financial sustainability of the ECF and the level of co-financing attracted.	Terms of financing from ECF are sufficiently attractive to fulfill the projected market penetration objectives; Homeowners are actively involved in making the decisions about the substations and their operation; Demand exists for DSM measures (including apartment-level DSM).

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Project Components / Sub-components:	**Inputs: (budget for each component)**	**Project reports:**	**(from Components to Outputs)**
Building-level sub-stations with metering and temperature control and apartment-level DSM investments	$36 million (of which $7.5 million covered by GEF though the ECF)	Quarterly Reports	Well-organized management of this task is required as it is logistically complex.
Heat-Only Boilers	$3.4 million	Quarterly Reports	Rehabilitation of existing equipment often includes unforeseen technical problems.
CHP Plant Rehabilitation.	$18.9 million	Quarterly Reports	Rehabilitation of existing equipment often includes unforeseen technical problems.
MIS Tools	$0.5 million	Quarterly Reports	Maintain good quality staff through continued institutional reforms.
Technical Assistance for Project Implementation, Privatization, Demonstration Project and Twinning Arrangement	$3.8 million (grants from SIDA, etc.).	Periodic Reviews	Effective working relationship between VDHC and the consultants.
GEF-financed Energy Conservation Fund (ECF) consisting of a lending/leasing fund and a subsidy fund	$7.5 million, of which $5 million for the lending/leasing fund and $2.5 million for the grant/subsidy fund.	Quarterly Project Monitoring Reports, monthly disbursement summaries	The lending/leasing fund operates in a financially sustainable manner (low default rate, sufficient rate of return on investments, able to attract co-financing). The subsidy fund management's ability to reduce the subsidies to the level necessary to support energy efficiency investments for lower-income

			households, with the government gradually taking over the subsidy inputs.
The ECF Management	$0.8 million (GEF grant)	Semi-annual reports	Effective cooperation between VDHC and the entity operating the ECF.
Marketing, Outreach, and Information Dissemination for the substation replacement and upgrade program under GEF barrier removal	$1.2 million (GEF grant) to implement a marketing campaign, energy audits, and dissemination activities including the production of fact sheets, published case study and stakeholder workshop.	Semi-annual reports	Effective cooperation between VDHC and the entity implementing the Marketing and Outreach component.
Training for Market Analysis	$0.2 million (GEF grant)	Semi-annual reports	The ongoing corporate restructuring within VDHC results in adequate staffing for market analysis.
Monitoring and Evaluation of the global environmental benefits	$0.3 million (GEF grant), including for Midterm Review	Semi-annual reports	The implementation arrangement for the M&E (including Midterm Review) allows for objective and independent evaluation.

Annex 2: Incremental Cost Analysis Summary

Vilnius District Heating Project

Scope of Analysis

The incremental cost analysis implemented to justify the GEF support to the project focuses on the energy efficiency measures on both the supply and demand sides. The supply-side energy savings would be achieved largely through the reduced network losses as a result of investments in the building-level substations (BLS) coming to replace the group substations with the simultaneous reconfiguration of the distribution network from a four-pipe system to a two-pipe one. The demand-side energy savings are at the level of the substation in residential apartment blocks as well as at the individual apartment level.

The global environmental impact from the project is due to the fuel and associated GHG emission savings that would not have been feasible outside the framework of the GEF component of the project. The relationship with the other components of the project is based on the impact of these savings on the heat production needs at the Vilnius District Heating Company (VDHC). The investment costs of the non-GEF components of the project such as the CHP rehabilitation and the replacement of HOBs are not affected and remain outside the system boundary of the GEF project.

The current fuel mix used by the VDHC for heat generation (about 90% gas and 10% heavy fuel oil) is potentially subject to fluctuations depending on the relative prices for gas and oil products. However, both the project and the baseline (the "without-project" scenario) are subject to the same uncertainty in this respect and thus the impact of this variable on the incremental cost analysis is considered minimal.

Baseline

The baseline scenario is built on the assumption that the VDHC would continue its operation in the conditions of a declining demand. The heat sales forecast is based on the projections prepared by independent consultants and reviewed by the office of the Chief Economist of the VDHC. The company would continue replacing block substations with building-level substations, but the progress of the program would be hampered by the lack of incentives for the homeowners to implement the replacements (as noted before, the heating bill would increase for the majority of the customers currently receiving heat from block substations - i.e., for 60% of the DH customers in Vilnius). This would result in the replacement of about 80 block substations by some 1,200 new building-level substations by 2015. This estimate is based on the VDHC's original plan to replace the block substations by 2015, with an expected success rate of 50% (higher replacement rates have been modeled as cases under sensitivity analysis). The 50% success rate is based on experience over the past three years in substation replacements of about 3-5 block substations per year, each block substation being replaced with 15 building-level substations on average. The lack of marketing expertise and shortage of qualified personnel would prevent implementing the replacements in a larger number of residential buildings. The high transaction costs associated with reaching a formal agreement with the homeowners would probably lead to implementing the replacements without cost-sharing with the homeowners (or, worse, without their consent) and possibly without giving control over the substation

to the homeowners. External debt financing (such as the SIDA loan) would not be available after 2003, which would also constrain the progress with implementing the replacement of block substations with BLS. No upgrades of existing building-level substations would be implemented by VDHC, although some upgrades would be implemented on a limited scale by other parties. Demand-side energy conservation measures would be practiced on a very limited scale due to the lack of incentives for such measures in the absence of customer-controlled heat supply at the substation level.

GEF Proposed Project

The proposed GEF alternative for the Vilnius District Heating Project would aim to expand the market penetration of the BLS technology to a larger number of households while ensuring the full degree of ownership and operation of the substations by the homeowners. The customer-controlled operating mode of the existing and newly installed BLS would provide the incentives for the homeowners to participate in the substation replacement and upgrade program and thus ensure that the environmental and energy conservation benefits of this technology are fully realized.

Higher penetration rate of the substation replacement program. The GEF support is expected to increase the penetration rate of the substation replacement program, resulting in the replacement of a larger number of block substations than in the baseline. In the project scenario, the replacement of all 161 group substations currently owned by VDHC with about 2,400 new building-level substations would be completed by the year 2006. Lower replacement rates have been simulated in the sensitivity analysis. The reasons for the increased speed and rate of replacements relative to the base case are the following:

- The increased attractiveness of the substation replacement program for the homeowners due to guaranteed ownership of the building-level substations by the homeowners; the removal of the access barrier to the substation will enable the customer-controlled mode of operation of the substations and the resulting savings on the heating bill;
- Better awareness of the substation replacement program and its benefits by the home owners resulting from the public outreach campaign;
- Additional incentives to BLS owners such as apartment-level improvements implemented with a 50% discount during the start-up phase.

As a result of the replacements, the losses in the heat supply networks will be reduced, with major fuel and GHG emission savings as a result.

Demand-side energy conservation measures. Once the building-level substations are installed, and home-owner access is ensured, the customer-controlled mode of operation of the substations would enable energy savings on the demand side. These would also translate into lower fuel consumption by the district heating system with associated GHG reductions. These savings would only be possible after the substation replacements and thus would depend, first of all, on the realization of the replacements, but also on the energy saving measures implemented on the apartment level. These savings would be additional to those achieved due to the reduced network losses. It is expected that the most basic energy conservation behaviors (such as avoiding keeping the windows open when not

necessary) would be practiced widely. More sophisticated measures with relatively high capital costs (replacement of windows to install energy-efficient ones; installation of apartment-level heat meters and thermostatic valves; roof insulation, etc.) would be implemented inasmuch as the savings on the energy bill would justify the investments needed. For these measures, the VDHC will offer its services to implement the installation through a crediting scheme with the repayment fees going from the homeowners to the Energy Conservation Fund (ECF). For the start-up period of the program, these improvements may be offered with a sizable discount on the value of investment.

The Costs of Barrier Removal

The acceptance of the VDHC-implemented substation replacement program by the homeowners presents a major barrier to BLS penetration. To stimulate the customer buy-in to the substation replacement program, VDHC will offer that for those homeowners who sign up to the substation replacement during the first year or two, the VDHC will implement apartment level improvements. The homeowner will be asked to choose from a list of measures such as the installation of thermostatic valves, apartment-level heat meters, replacement of windows, etc. To help VDHC bear the financial burden of these improvements and partially compensate VDHC for the possible loss of sales revenue resulting from these DSM improvements, the GEF will be asked to provide about US$ 2.5 million designated for grants/subsidies under the Energy Conservation Fund. This would provide a further incentive to the homeowners to convert to BLS.

Another essential element of the GEF's investment program will be the Marketing, Outreach, and Information Dissemination component, totaling US$ 1.2 million funded by the GEF. The administrative costs of ECF management (US$ 0.8 million) bring this up to US$ 2 million. The contractor for the component will be procured competitively. This would assist to establish a marketing department within the VDHC, implement energy audits, manage an outreach campaign to increase the public acceptance of VDHC's substation replacement program, and implement information dissemination activities to reach the objectives of replication of the project concept both within and outside Lithuania.

Under the US$ 0.5 million GEF-funded Technical Assistance component, the funds would be used for market studies and training to VDHC in demand-side energy conservation to explain the long-term benefits for the heat supplier to engage in client-driven energy conservation measures. Market rigidities would be analyzed and solutions proposed. The component would also cover a monitoring and evaluation sub-component, including a survey of households who had a BLS installed under the EEHPP's and under VDHC's conversion programs, and a comparison of impact on the energy bill in both of these cases.

Taken together, the components mentioned above (grant-financed by a total of about US$ 5 million from the GEF) can be considered a barrier removal investment by the GEF. The barriers to be removed are both on the demand and supply side, as well as on the interface between these. On the supply side, the main barrier is the absence of appropriate marketing capabilities and insufficient client orientation of the VDHC. On the demand side, the main barrier is the lack of attention of homeowners to the common areas and equipment (such as heating substations) in their buildings and lack of motivation to take responsibility for common property. The barrier on the interface of supply and demand side is the lack of dialogue or effective coordination between the two sides on energy conservation. This barrier

would be addressed through creating a collaborative engagement of public authorities and private participants in the market, with the VDHC's substation replacement program. The low incomes and lack of collateral presents a barrier to obtaining commercial credit for substation replacement for many customers. This problem would be solved by extending credit for substation replacements through the ECF owned by the VDHC. The DSM measures enabled by the substation replacements would eventually provide an opportunity for the businesses operating in an ESCO mode to split the benefits of DSM measures with the homeonwers. Finally, the legal uncertainty about the ownership status of the substations installed by the VDHC in residential buildings is a substantial regulatory barrier that would need to be removed – through amendments to relevant legislation if necessary.

Box 1 (Annex 2). Incentives to homeowners' associations

As part of barrier removal efforts and in addition to the modest contribution to buying down the up-front cost of the substations as applied to the upgrades of the existing BLS, the GEF support would have a role in strengthening the local institutional capacity. Ideally, the GEF funding would be structured in a way that would encourage the effective ownership by the homeowners by stimulating the formation of HOAs. E.g., for buildings who have formed an HOA, the substations could be installed with a larger grant portion in the installation cost. An additional premium may be given for earlier installation (e.g., for completing the installation during the 1st year of the program).

For buildings who have failed to establish an HOA but have ensured a minimum required level of buy-in for the substation replacement program (expressed and documented as a decision by the general meeting of the apartment building), the installation may still be implemented by VDHC at the request of the administrator of a building appointed by the municipality. The homeowners of the apartment building would still be encouraged to form an HOA (e.g., the access to the substation by a homeowners' representative would only be granted when an HOA is established and a loan/lease agreement for the substation is signed with the HOA). No substation replacement would take place in buildings where no explicit homeowners' consent for the substation replacement has been established.

The Energy Conservation Fund would ensure the continuity of the energy efficiency program. The GEF funding through the ECF, as well as the money accumulated in the fund from the return cashflow from the homeowners, would be offered on a loan or hire-purchase contract basis to finance additional substation replacements and upgrades as well as other energy conservation measures. The revolving nature of the ECF is particularly important because the bilateral support through the SIDA loan will be discontinued after the year 2003. At that point, a maximum of 1,480 substation replacements are expected to have taken place. The replacement of the remaining over 900 substations, upgrades for a large number of existing (old-type) BLS, as well as apartment-level improvements and other DSM measures would represent the remaining market for the ECF.

Project investments

Substation investments

The inclusion of the barrier removal measures estimated to cost about US$5m allows increasing the market penetration of the BLS technology. The relationship between the costs for barrier removal and the market penetration has not been quantified precisely, but the incremental cost model utilized for this analysis helps estimate the basic dimensions under certain working assumptions.

Additional replacement of block substations with BLS. The return on the marginal investment to replace block substations with BLS is about 20% for the initial 1,000 – 1,200 BLS. As noted above, the installation of some 1,200 BLS is considered part of the Baseline. Achieving the target of 2,400 new substations would bring an additional reduction of CO2 emissions by 1,640,000 tons, due both to the additional network loss reductions and basic energy conservation measures enabled on the demand side. However, this would be done at the cost of lowering the EIRR on the overall substation replacement program to about 14%. The financial return would also decline – due partly to the fact that even the most basic demand-side conservation measures are estimated to reduce the DH company's sales by US$ 10 - 15 million in terms of present value (assuming that the company has no possibility to compensate for this loss by raising the tariff).

Even though the rate of return remains above the discount rate of 12%, the additional substation replacement investments (including the barrier removal costs) are considered part of the project costs rather than the baseline. The assumption of additionality of these costs rests on the following considerations: (i) the nature of the barrier removal measures, which makes them unlikely to be implemented outside the framework of the proposed project; (ii) the availability of the baseline investment program which, while smaller in scale, can bring a higher rate of return of 20% as noted above; (iii) the initial increase of the heat bill for 60% of the DH customers as a barrier for the acceptance of the program by the customers; (iv) resource constraints such as insufficient availability of qualified staff to implement substation replacements in large numbers unless VDHC's marketing capacity and technical expertise are strengthened; (v) lack of external funding (such as the SIDA loan) for substation replacements after 2003.

It should be noted that no direct investment of GEF resources is envisaged for the replacement of block substations, and the expanded penetration of this market is expected only due to the barrier removal activities described above.

Upgrades of existing BLS. This investment would not be pursued by VDHC in the absence of the GEF support. Relative to the replacement investments described above, the upgrades bring only modest gains to the company, and, from its perspective, the return on this investment is insufficient. The reason is that the losses in the heat and domestic hot water supply networks are already not as large and better accounted for than in the previous case. However, the measure still offers substantial fuel and GHG savings, and the size of the market is quite large, with 2,300 substations of the old type (indeed, as many as 3,000 – 3,500 if non-residential buildings are included) potentially suitable for upgrading. The analysis assumes a partial penetration of this market with the investment financing provided through the Energy Conservation Fund (ECF). With one thousand substations upgraded, an additional 252,000 tons of CO2 can be saved.

Basic energy conservation measures on the demand side

These measures are closely linked to the substation investments since: (i) they only become meaningful after the client-controlled operation becomes possible at the building substation level; (ii) the possibility of demand-side conservation is an important factor contributing to the acceptance of the substation replacements by the homeowners. Project case A (see the Table below) represents the possibility of expanding the penetration of BLS from 1,200 to 2,400 combined with these basic energy saving measures.

Apartment-level investments

Further carbon savings can be realized on the next level of the demand-side management program illustrated in the Table 1 by Project case B. The support through the ECF, for which the GEF is asked to contribute US$ 7.5 million, would include about US$2.5 million for these investments. The demand for measures such as apartment-level heat meters and thermostatic valves, window replacement with more energy-efficient ones, etc., is subject to uncertainty and will depend both on the economic return and on the financial incentives for the customer. At the same time, these measures are solidly additional (i.e., not part of the baseline) since the pay-off from the domestic benefit perspective is insufficient, although this conclusion is sensitive to the assumptions made about the true economic cost of fuel (natural gas) used by the DH company.

Under the current assumptions, 310,000 tons of additional CO2 emission reduction can be achieved by a 25% penetration of apartment-level heat meters and thermostatic valves into the homeowners' market. By achieving a market penetration of 25% for energy-efficient windows, a further 247,000 tons of CO2 can be saved, bringing the total CO2 emission reduction to about 2,374,000 tons. The unit abatement cost corresponding to Project case B is US$ 4.37 per ton of carbon equivalent. With the GEF contributing in total US$10 million, the unit abatement cost for the GEF is US$ 15.45 per tCe. It should be kept in mind that only about one-third of this would be extended to the final beneficiaries as grants, with the remainder being lent through the ECF on a revolving loan basis.

Table 1. The key comparisons between the Baseline and two Project cases (Case B = Proposed Project).

	Baseline: 1200 building-level substations (BLS) replacing block substations; 370 BLS upgrades; 40% incidence of basic demand-side energy saving behavior; 10% penetration for apartment-level heat meters and thermostatic valves, and 10% penetration for energy-efficient windows	**Project (Case A): 2400 BLS replacements and 80% incidence of basic demand-side energy saving measures; the rest as in the Baseline**	**Project: (Case B): 2400 BLS replacements, 30% penetration of market for substation upgrades (1000 building-level substations), 80% incidence of basic demand-side energy saving behavior, 25% penetration for apartment-level heat meters and thermostatic valves, and 25% penetration for energy-efficient windows**
Business as Usual (BAU) Emissions, thousand ton CO2	14,306	14,306	14,306
Baseline Emissions, thousand ton CO2	13,350	13,350	13,350
Project Emissions, thousand ton CO2		11,710	10,976
Emission Reduction relative to BAU, thousand ton CO2	956	2,596	3,330
Emission Reduction relative to Baseline, thousand ton CO2	-	1,640	2,374
Incremental Cost, thousand US$		-3,796	2,829
Unit abatement cost, US$/tCe		-8.49	4.37
EIRR without GEF support	20%	14%	11%
Unit abatement cost to GEF with financing at $5 million, US$/tCe		11.18	
Unit abatement cost to GEF with financing at $10 million, US$/tCe			15.45

Additionality

The global environmental benefits pursued under the project are represented by the incremental emission reductions calculated as the difference between the baseline and project emissions.

As this project is proposed under GEF's OP-5 ("Barrier Removal for Energy Efficiency and Energy Conservation"), it is essential to include the cost of barrier removal as part of the proposed project costs. As noted earlier, the barrier removal costs totaling about US$ 5m consist of the cost of a marketing and outreach program, technical assistance for the VDHC, and a modest temporary subsidy towards apartment level demand-side management measures. The subsidy will also serve to expand the market penetration of the BLS by engaging HOAs in evaluating energy conservation measures.

Before the addition of the barrier removal costs, the economic rate of return on the block substation replacements is about 20%, which is high enough to justify the inclusion of these investments into the baseline scenario. The pay-off comes mostly from the reduced losses in the heat supply network. Based on this consideration, the baseline scenario assumes 1,200 new substations and resulting in 711,000 tons of CO2 saved relative to the business as usual. Combined with some other improvements that would conceivably have taken place without the project, this amounts to 956,000 tons of CO2 reduction relative to the business-as-usual case (see the "Baseline" column in Table 1). These emission reductions are not claimed to result from the GEF support as the fuel savings provide a sufficient incentive to justify the investment from the domestic economy point of view.

Table 2
Incremental Cost Matrix /Benefit Analysis Summary

	Proposed (Project (Case B)	**Base**	**Increment**	**Benefits/Impacts from Incremental Project**	
				Domestic	**Global**
Benefits/Impacts	2,400 building-level substations (BLS) with customer-controlled operation replacing 161 block substations by 2006	1,200 building-level substations replacing 80 block substations by 2015; uncertain level of customer control over BLS operation	1,200 additional building-level substations replacements and guaranteed customer-controlled operation of all 2,400 BLS	Fuel cost savings of about US$ 21 million due to reduced heat network losses; Cost savings of about US$ 1 million for O&M for substations	CO2 emission reduction of 1,185 kton

	Proposed (Project (Case B)	**Base**	**Increment**	**Benefits/Impacts from Incremental Project**	
	30% penetration of market for substation upgrades (1,000 building-level substations) by 2006	Less than 10% penetration of market for substation upgrades (370 building-level substations) by 2015	630 additional building-level substations replacements with guaranteed customer - controlled operation	Fuel cost savings of about US$ 4.7 million due to reduced heat network losses; Cost savings of about US$ 1.3 million for O&M for substations	CO2 emission reduction of 252 kton
	80% incidence of basic demand-side energy conservation behavior in 3,400 residential buildings	40% incidence of basic demand-side energy conservation behavior in 1,500 residential buildings	Basic demand-side energy conservation behavior in more than 60,000 additional apartments	Fuel cost savings of US$ 6.5 million due to reduced consumption of heat in buildings	CO2 emission reduction of 380 kton
	25% penetration rate for apartment-level heat meters and thermostatic valves in 3,400 residential buildings	10% penetration rate for apartment-level heat meters and thermostatic valves in 1,500 residential buildings	Heat meters and thermostatic valves in more than 20,000 additional apartments	Fuel cost savings of US$ 5.3 million due to reduced consumption of heat in buildings	CO2 emission reduction of 310 kton

	Proposed (Project (Case B)	Base	Increment	Benefits/Impacts from Incremental Project	
	25% penetration for energy-efficient windows in 3,400 residential buildings	10% penetration for energy-efficient windows in 1,500 residential buildings	Energy-efficient windows in more than 20,000 additional apartments	Fuel cost savings of US$ 4.2 million due to reduced consumption of heat in buildings	CO2 emission reduction of 247 kton
	Marketing outreach and TA for the VDHC		Enhanced client orientation of the VDHC and improved marketing expertise Better awareness of the homeowners about the benefits of energy conservation and options available to them	Better quality DH service for the homeowners Customer-controlled operation reduces the cost of DH services for the homeowners Stronger long-term financial position of VDHC as a result of a consolidated customer base	GHG emission benefits due to increased market penetration of modern technology for space heating and demand-side energy conservation in Vilnius
	Establishment of the Energy Conservation Fund		Availability of financial and technical assistance to homeowners from the Energy Conservation Fund	Access to financing for substation replacement and reduced transaction costs for the homeowners interested in implementin	Same as above, plus potential GHG savings downstream as result of demonstration effect

	Proposed (Project (Case B)	Base	Increment	Benefits/Impacts from Incremental Project	
				g energy-conservation measures in their homes	
Global Emissions:					
(thous. ton CO2)	11,458	12,951	-2,374		
(thous. tCe)	3,125	3,532	-647		
Costs ($000):					
Investment	49,858	11,389	38,469		
Fuel	218,694	260,383	-41,688		
O&M	12,103	14,371	-2,268		
Transaction costs	3,973	389	3,585		
Barrier removal costs	4,732	-	4,732		
Total ($000):	289,360	286,531	2,829		
Unit Abatement Cost:					
US$/tCO2			1.19		
US$/tC			4.37		
Unit Abatement Cost for GEF (based on US$10m grant):					
US$/tCO2			4.21		
US$/tC			15.45		

Sensitivity Analysis

The impact of the following variables has been considered:

- Price of natural gas
- Larger number of substation replacements in the Baseline
- Lower replacement rate for substations in the Project case
- Number of upgrades in the Project case
- Transaction costs per substation replacement in the Project case

An increase in the price of natural gas increases the economic return on the proposed investments. However, it would take a much higher price for natural gas to change the ranking of the investments. The analysis shows that the investments for which the economic return decreases with an increasing scale (penetration level) remain so even when substantially higher shadow prices are assigned to

natural gas. Conversely, the investments which increase the economic return on the margin do so even at the current level of gas price (335 Lt or US$83.8 per thousand cubic meters for CHP plants of the district heating system). The demand side measures (other than the basic energy saving behavior) belong to the former category of investments, while substation replacements represent the latter.

The assumption of a large number of replacements in the Baseline is capable of reducing the GHG reduction benefits from the project substantially. Lowering the number of replacements in the Project case has the same effect. However, it should be noted that the Baseline currently selected is a challenging one, with several energy conservation measures (e.g., some upgrades of existing building-level substations) assumed to be happening in the absence of the project – despite the apparent lack of motivation on the part of VDHC to implement these measures without GEF support.

An increasing number of substation upgrades in the Project case influences the GHG savings substantially, but this investment is somewhat below economic cost recovery based solely on the domestic benefits such as fuel savings. The GEF support for this investment would be well justified.

The assumption of higher transaction costs under the project puts the EIRR on additional substation replacements (Project case A) below the discount rate of 12% and turns the incremental cost from negative to positive. This change occurs when the transaction cost per substation exceeds $3,300 per BLS as compared with the current assumption of $1,500.

Table 3. Barriers to Energy Efficiency Addressed by the Project

Description of Barrier	Measures to Address/Remove the Barrier	Benefits as compared with the Baseline	Sustainability	Replicability
Perceived lack of financial incentive for the district heating company to participate in demand-side management measures such as introduction of building-level substations. The perception is that demand-side energy conservation benefits the customers but not the utility. While in the long run the DH company could benefit from such measures due to increased customer satisfaction and reduced costs of supplying heat to the customers, the company can lose revenue in the short run. The lower heat consumption cannot be fully compensated by heat tariff increases due to social considerations and competition	1) Technical assistance to VDHC for conducting a multi-perspective financial and economic analysis (from the utility's, customer's, societal, and global environmental perspectives) of implementing demand-side energy conservation measures – including the DSM aspects of the building-level substations component. 2) Public outreach, potentially using NGOs established under Bank's EEHPP project, and provision of affordable financing from the Energy Conservation Fund (ECF) to building owners and building substation management companies to enable investments into modernization of existing building-level	The implicit baseline project would have included a more limited penetration of the market for new building-level substations. The GEF component would save additional 2.37 million tons of CO2 over the project life due to installation of additional building-level substations and the demand-side energy conservation enabled as a result. The marketing research during project implementation will allow determining the level of direct incentive (partial grant financing) sufficient to achieve the desired penetration targets.	With broad introduction of building-level substations and customer control over heat consumption, the level of customer satisfaction will increase, and the customer base of the DH company will stabilize. The company's profitability should eventually grow as the long-term cost savings due to improved demand-side efficiency are utilized by the DH company. Likewise, potential use of NGOs and other outreach channels would help to demonstrate benefits of working with these organizations to promote demand-side improvements.	The approach is highly replicable throughout Eastern Europe where many district heating systems built under central planning are in need of fundamental modernization to improve energy efficiency, and where awareness of energy saving opportunities at the customer level has been lacking. The findings of the TA component for the DH company will be readily transferable to other DH companies. The provision of financial resources for partial grant financing to the consumers is potentially replicable without resort to GEF once it is established that demand side improvements can eventually benefit DH companies and other actors in the emerging

Description of Barrier	Measures to Address/Remove the Barrier	Benefits as compared with the Baseline	Sustainability	Replicability
from disconnected boilers.	substations. 3) Availability of ECF funding as a contingent finance facility for the replacement of block substations with BLS in the case of unforeseen obstacles arising in the process of implementing the SIDA-financed substation replacements. 4) Market research during the implementation of the project to establish the level of direct incentive to consumers needed to achieve the expected penetration of the BLS technology.			energy efficiency market.
Decentralized structure of ownership and decision-making leading to high transaction costs of obtaining the agreement to implement the needed investments into building-level substations. There are about 4,800	Under the proposed GEF-financed component, the VDHC would establish an Energy Conservation Fund and hire a firm to handle the program of outreach and technical and financial assistance to homeowners. The outreach program would	The baseline project would not have included creating an ECF or hiring an entity specially designated to handle the public outreach aspects of the substations component. The benefit of the GEF-funded staff committed under	The ECF would not depend on grant support once it is established. The lending/leasing account of the fund would have a sufficient rate of return to attract other financing. At a minimum, the impact from the envisaged investment	The approach to addressing the barrier of high transaction costs by matching them with an appropriate level of technical and human resource allocation is very common and highly replicable. The lessons learned from the

Description of Barrier	Measures to Address/Remove the Barrier	Benefits as compared with the Baseline	Sustainability	Replicability
buildings in Vilnius served from heating substations owned by municipal, commercial, and private owners and operated and maintained by separate service companies.	promote the concept of energy efficiency investments and publicize the sources of funding for energy efficiency available in Lithuania.	the ECF program would translate into better penetration of the building substation market and eventually into higher energy and CO2 savings. The number of building-level substation conversions and new installations made by the VDHC will be one measure of effectiveness of the outreach and technical and financial assistance program.	program will last for the operating life of the building-level substations installed with the support of this program. Once the substations are installed, the energy savings of customer-controlled operation would create a lasting incentive for the customers to keep them.	experience of the ECF program would be shared throughout Lithuania by making use of the existing network of Energy Efficiency Advisory Centers (of which there are at least five). Replication outside Lithuania may be achieved through the network of energy efficiency demonstration zones established within the framework of the Energy Efficiency 2000 program of UNECE.
Many consumers are unable to pay the price that reflects the full economic cost of heat supply; awareness of energy saving opportunities is also lacking.	The GEF-financed market research program will use survey data relating to the percent of individual incomes spent for heating in order to determine where the provision of financial incentives for energy saving investments is the most effective. Grant financing will be applied selectively to maximize the	The GEF-supported program at VDHC would develop and utilize an empirical relationship between the customers' ability to pay and the energy/carbon savings from the increased market penetration of the building-level substation technology. The baseline project	Paying the full cost per GJ of heat received from the DH company will be easier as soon as the introduction of building-level substations removes the technical barrier for the building-level customer to choose the desired level of heat consumption. Moreover, the energy savings will provide a sustainable benefit	The market research during project implementation will enable judicious provision of incentives to the consumers once the optimal level of incentive is known. The findings on the ability to pay for energy efficient district heating in a relatively well-off ex-USSR

Description of Barrier	Measures to Address/Remove the Barrier	Benefits as compared with the Baseline	Sustainability	Replicability
	market penetration of the building-level substation technology; the awareness barrier will be addressed through public outreach and dissemination of technical information.	would not have involved such an effort.	to the households, contributing to their well-being and thus mitigating the affordability barrier.	republic would have a high replication potential for many other CIS locations approaching similar levels of market-oriented development.

Annex 3: STAP Review and Response of the Project Team

7 March 2001
STAP REVIEW OF:
Project Brief of 2 March 2001
Vilnius District Heating Project

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The review is based on the Project Brief dated 2 March 2001 and familiarity with the project based on an earlier review of a Project Concept Note (see Annex 3 of the Project Brief). The issues raised in the review of the Project Concept Note have been adequately addressed in the Project Brief and in the response of the Project Team.

Summary/Conclusion
The total project is relevant and justified. The GEF component is particularly important and valuable in that it addresses end-use energy efficiency and the transformation of VDHC into an energy services company. Without the GEF component, the technical performance of VDHC would improve, but not necessarily the overall business performance and longer term commercial viability of the company.

General comments and observations
The Project Concept Note review concluded that the project is relevant, justified and should be given high priority. The same can be concluded for the Project Brief. The project adequately meets or addresses basic requirements and issues, for example:

- It is clearly relevant and should be given high priority
- Objectives are valid and clearly stated
- Adequate background and justification is provided
- The situation is well analysed and understood
- Activities and institutional arrangements are adequate and balanced
- Sustainability, replicability and innovativeness is satisfactory
- It is consistent with GEF objectives

These and other issues were assessed in the review of the Project Concept Note. Given that the Project Brief meets such basic requirements, this review is limited to making some general observation that may be useful in finalising the proposal and for the implementation of the project.

One of the greatest challenges in the project is probably to transform VDHC into a business and customer oriented energy services company in a reformed energy market. DSM measures will, of course, be seen by VDHC as a "cannibal", reducing energy sales and income (incidentally, energy efficiency services may be a better term than DSM which is often associated with energy efficiency and load management in regulated monopoly markets). However, unless VDHC develop the energy (efficiency) services market on its own or in partnership with another company, other actors will (for a

U.S./Western Europe parallel see for example Enron Energy Services activities, or Siemens Landis&Staefa's performance contracting concept).

The local VDHC, World Bank and SIDA financing is mainly targeted at areas that are within the traditional business of VDHC (supply side improvements) and will improve technical performance. The GEF financing thus constitutes a very important complement targeting mainly investments that are relevant to end-use energy efficiency and promoting the transformation of VDHC into an energy services company. USD 2.5 million is allocated to technical assistance in the areas of Marketing, Outreach, and Education, and Training for Market Analysis, Measurement and Evaluation. A large part of this will be used for aiding or promoting the transformation of VDHC.

Detailed comments and observations
Present and future fuel for the CHP and HOBs is not explicitly discussed but understood to be natural gas? Has the prospects and potential for alternative fuels and fuel switching, now or in the future, been explored (biofuels, biogas, energy from waste)?

Should (has?) micro-CHP be considered instead of one or several of the Heat Only Boilers, perhaps mainly for the purpose of demonstrating new technology?

The development of more complex tariffs is mentioned (page 26). Please note that a tariff with a large share of fixed charges will discourage end-use energy efficiency.

Page 11: EEHPP used first time but not spelled out here.

Page 13: VDHC could become the supplier of heat for the 8 small communities in its future role as an energy services company?

Page 13: "The project will assist VDHC to make the transition from being part of a centrally-directed monopoly to being a commercial provider of heat in a competitive marketplace." It would be better yet if VDHC becomes a commercial provider of energy services (including efficiency services, e.g., outsourcing, performance contracting, etc.). Then VDHC need not exit from areas where DH does not have an advantage, but be a supplier of heat (and other services) based on other supply technology.

Page 27: "SODRA" is not defined.

Page 33: Subsidies kick-in at supply cost exceeding 20% of income. At 25% of income according to page 3. Which is correct?

Project results and experience may be valuable input to Joint Implementation discussions? Not mentioned.

I would like to reiterate (from the Concept Note review) the value and importance of involving relevant academic institutions, for the purpose of capacity building.

Response of the Project Team to the STAP Review of 07-Mar-01

The project team appreciates the comments and conclusions made in the first two sections of the review. We feel that your review has been excellent and insightful. The observation that, unless VDHC itself becomes active in the energy efficiency market, other actors will, is precisely on target. The "mission" of the ECF is, effectively, a win-win proposition since energy savings and associated GHG reductions will be achieved whether the energy efficiency investments are made by VDHC (through the ECF) or by its competitors in the energy efficiency market.

Regarding the detailed comments and observations, the team would like to respond as follows:

The current fuel mix used by the VDHC for heat generation is about 90% gas and 10% heavy fuel oil, and this is potentially subject to fluctuations depending on the relative prices for gas and oil products. However, both the project and the baseline (the "without-project" scenario) are subject to the same uncertainty in this respect and thus the impact of this variable on the assessment of the proposed project is considered minimal. The option of bio-fuel was examined by COWI (Denmark), subcontractor of AF-International, for one of the communities in the Vilnius area. However, this turned to be too expensive in operation. In the future, it is possible that alternative fuels will be displacing gas – especially, in the suburban areas around Vilnius which have been recently (Summer 2000) separated from VDHC, as the gas prices for smaller consumers do not currently reflect the full economic cost of supply and are likely to increase. Wood chips, for example, may become economically attractive.

Micro-turbines and fuel cells in CHP mode have been considered as a supply option for Vilnius and are an integral component of the ESMAP study for the eight outlying towns around Vilnius. These technologies do not appear technically ready or commercially attractive as yet. The proposed ESMAP study will address these issues and consider the option of developing these options on a pilot basis afterward. The market potential for increasing power capacity is limited because of the excess power generation capacity available for the next five years.

Regarding the share of fixed charges lowering energy efficiency incentives – generally, we agree with this point and feel that this will be an important aspect of tariff design. The fixed fee must exist in order to reflect heat supply costs and keep the company's financial stability in the case when savings on customer side are expected. The fixed charge, however, should only be enough to cover the fixed costs, not more, while the marginal cost of heat faced by the consumer should be reasonably close to the variable cost component of heat supply. The relevant comparison for energy saving incentives is how well the latter part is optimized in the new tariff structure and not how the new tariff compares with the old one, which may have not reflected either of the cost components properly. Also, from a practical perspective, it is likely that the end-user's decisions to save energy are driven to a large extent by the total energy bill. Few customers will bother to subtract the fixed cost component even if they do then divide the total bill by the number of GJ consumed. Thus, the transition to a tariff which is higher than

the old one because the fixed costs are included may in fact increase the incentives to save energy rather than lower them.

EEHPP is the Energy Efficiency Housing Pilot Project in Lithuania. This will be spelled out when the acronym is first used in the updated Project Brief.

Regarding the possibility of VDHC providing energy services outside the city of Vilnius, it should first be noted that it would not be economically prudent for VDHC to operate these systems jointly. On the other hand, if, in the future, VDHC becomes commercially effective, they could play a management role there – either through a management contract or concession. This is not expected to be the case in the near term, however.

Regarding the point that VHDH should become a commercial provider of energy services including performance contracting, etc. – the idea is absolutely valid, and moving in this direction is one the project's key objectives. However, it will take time to implement such a transformation. In a World-Bank supported project in Krakow, where such a service company (ESCO) was established in 2000 as a daughter company of the central heat supplier, this had taken several years to develop. The GEF project in Vilnius offers an opportunity for VDHC management to start this process by helping it to establish a customer-friendly, outward-looking organization and modestly expand its product line.

SODRA is the Lithuanian social security system. The acronym is based on the Lithuanian for State Social Insurance Fund Board.

Regarding whether 20% or 25% of income is the kick-in level for the subsidies, our current information is that it is 20% for heat and 25% for heat and domestic hot water. We shall double-check this during appraisal.

We agree that the project results may be valuable input to Joint Implementation discussions. Opportunities for such projects certainly exist – especially, in the disconnected communities around Vilnius (see our comment on alternative fuels above).

Regarding cooperation with academic institutions, we agree that involving academic institutions may be increasingly appropriate as the Government becomes more involved in such aspects of the project as M&E and information dissemination. However, the current focus of the project is on the commercialization of VDHC, and thus cooperation with partners such as Helsinki Energy is more critical for capacity building purposes at present.

4 January 2001
STAP REVIEW OF:
Project Concept Note of 11 October 2000
Vilnius District Heat Project

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Summary
The review is based on the Project Concept Note and the Aide Memoire. The proposed project is relevant, justified and should be given high priority. Still in the form of a Project Concept Note, several parts of the project remains to be developed in greater detail. The close links to the Vilnius District Heating Rehabilitation Project and the Energy Efficiency Housing Pilot Project (EEHPP) further strengthens the proposal. One suggestion is to strengthen capacity building through involving a Lithuanian university(ies).

1. Overall impression
Overall this is an important and relevant project. The main component in the proposed project is to remove barriers and replace existing group substations with new in-building substations that facilitate heat control at the building level (and presumably better measurement/monitoring although the present ways of measuring and billing are not detailed in the project concept note). Measurement and control is, of course, an important prerequisite for realising future energy efficiency improvements from other demand-side measures.

There is not enough detail and data in the proposal to comment on the viability of achieving the proposed savings. For example, it is stated that it takes 450 kWh to heat one square meter of residential space and that: "The main reason is poor insulation and heat losses in the network, as well as lack of possibility for consumers to control heating." There is no detail on where the losses occur or what percentage of final energy (i.e., energy delivered to the building) that can be saved through the substation installations. However, more data and references to other reports are found in a background document (The Aide Memoire) indicating a solid foundation for the estimates.

2. Relevance and priority
The project is relevant and should be given high priority given the widely recognised need to improve the performance of district heating systems in Central and Eastern Europe. If present and potential customers are lost to other heating options, the possibility of low-polluting and energy efficient CHP may also be lost. It is a common misconception not only in Vilnius that energy conservation in buildings with district heating is not viable

3. Project approach
The approach is to give loans and grants to substation installations through a GEF supported Energy Conservation Fund, do marketing, outreach and education, and provide technical assistance to the Vilnius District Heating Company. A reasonable mix of carrots and sticks (through lobbying for regulatory changes) is proposed.

It should be a strength that the project is undertaken as a part of a greater project to modernise the heat and power production in the district heating system.

A key barrier is the perceived lack of financial incentive for the district heating company to participate in energy efficiency efforts. This is perhaps the greatest challenge in the project. As a result, it is a (necessary!) risk to establish certain functions at the district heating company and it is crucial that the company can be turned around to see the financial benefits (from reduced peak demand, better competitiveness against other heating options, and developing an energy services market).

It is not clear to what extent the Energy Conservation Fund will/can finance also other energy efficiency measures (windows, insulation, etc.) in addition to substation installations. Co-ordination and co-operation with the ongoing Energy Efficiency Housing Pilot Project (EEHPP) as indicated strengthens the proposal. Combining or co-ordinating substation installations with energy efficiency improvements (without which the installations may result mainly in reduced bills from lower comfort/indoor temperatures) can improve customer acceptance.

4. Objectives
The stated objectives are valid but there is not enough detail in the proposal (e.g., background data or quantified goals and penetration levels) to comment on the prospects for achieving the objectives.

5. Background and justification
As noted there is little technical detail provided in the proposal. Apart from that, the proposal is well justified and other background information is presented. Additional background and justification mainly on the institutional/organisational and economic aspects is presented in the Aide Memoire.

6. Critical analysis of the situation
The Project Concept Note and the Aide Memoire gives the impression that the situation has been well analysed and is well understood based on previous experiences, discussions with several stakeholders, etc.

7. Activities
An appropriate and logical set of activities is proposed (The GEF supported Energy Conservation Fund; marketing, outreach and education; technical assistance to the Vilnius District Heating Company). The exact organisation and administration of the activities is yet to be determined. A very close link to, or (as suggested) establishment at the district heating company is suitable.

8. National priorities and community participation
The project appears to be fully in line with national priorities and involves community participation in various ways. The project, however, does not address the needs in rural areas.

9. Institutional arrangements
The exact final institutional arrangements are not determined in the proposal but reasonable suggestions are made concerning the involvement of the district heating company, requirements on ownership of installations, etc. The involvement of local banks and other actors is not explicitly discussed in the Project Concept Note but the Aide Memoire makes reference to the training of

consultants and banks on servicing the market, indicating that building a lasting institutional capacity will be an important part.

Project evaluation is mentioned but not specified. It would be valuable to involve local academic institutions (the University of Vilnius) to facilitate local capacity building on this and various other relevant aspects of the project. (To my knowledge, the (Technical?) University of Kaunas is stronger in the area of energy and environment and may be a stronger candidate)

10. Time frame

The time frame is reasonable although it may be slightly optimistic that 25% of the substations can be converted in the first year.

11. Funding

The level of funding appears to be appropriate and there should be synergies from being linked to the World Bank-led Vilnius District Heating Rehabilitation Project as well as the EEHPP.

The proposed sum (7.5 million USD) divided by 2,400 substations (=3,125 USD) is slightly higher than what is indicated in Annex 2 (1,800 plus 900 USD from GEF in year 1-2 and 1,800 plus 450 USD in year 3-4). This is due to administrative costs?

There is no detail on how the unit abatement cost of -2.9 USD per ton of CO2 was calculated. Presumably the District Heating Rehabilitation project will include fuel switching if coal is the predominant fuel?

Funding for marketing, outreach, and education is 2 million USD equivalent to more than 800 USD per substation (2,400 substations), or 8% of cost of installation. The activities under this sub-component are not detailed in the Project Concept Note and it is difficult to assess whether this funding allocation is appropriate. Is evaluation included here also? In my view, the value and importance of evaluation (pre-, during, and post-project) is often underestimated.

12. Innovative features/replicability

The project is innovative (technically and institutionally) from a Lithuanian perspective and should be replicable in similar settings. In many cases the situation in each country/city may be quite unique in many respects. Nevertheless, the project should provide valuable lessons-learned for future applications (if not replications).

13. Sustainability

The risk that the Energy Conservation Fund does not reach cost-recovery is considered low in the proposal. Various options for the exit strategy are mentioned, including the continued use of recovered costs for other energy investments.

14. Development dimensions and rationale for GEF support

The project is consistent with the objectives of GEF operation programme 5 *Removal of Barriers to Energy Efficiency and Energy Conservation* through removing various barriers, including barriers to future additional energy efficiency investments.

15. Additional comments or questions

It may be argued that the substation project (and certainly the "total" project including rehabilitation) is concentrating on supply side improvements in the system although demand and customer orientation is discussed. Nevertheless, upgrading the system and installing substations is important for energy efficiency improvements through future demand-side measures.

With or without the project, the district heating company should be prepared for decreasing heat loads. Through modernising the system and becoming a more customer oriented energy service provider the company can be competitive and profitable in the future. Without the project, the company risk losing (especially wealthy) customers, and energy service business to other actors. The possibility or likelihood of decreasing heat loads should be an important concern also in the associated District Heat Rehabilitation Project. Closing or moth-balling plants can be an alternative to rehabilitation and replacement if energy efficiency investments are more cost-effective.

Page 4: "the current Vilnius District Heating project largely focuses on capacity building at the local level through commercialisation of the district heating functions in Vilnius." What does this mean?

Response of the Project Team to the STAP Review of 04-Jan-01

General Comment

The STAP review was provided on the basis of the initial Project Concept Document (PCN) and the Aide Memoire from the pre-appraisal mission in November 2000. The answers to the STAP review are given on the basis of the current Project Brief (the draft Project Appraisal Document), in which many of the concerns of the STAP reviewer have been addressed. The Annex numbering here refers to the numbers in the current Project Brief.

1. The breakdown of components showing how much CO2 is saved on each type of investment is given in Annex 2 (incremental cost analysis).

2. no comment

3. Project Approach

Lessons learned from the EEHPP project showed an increased interest in energy efficiency after the initial investment is implemented. A significant proportion of all investments included substation installation. The types of investments that are eligible under the EEHPP and would be eligible under the proposed ECF are: (i) modernization of the heat substation in the building, which typically includes replacement of the heat elevator (ejector circulation pump) by an electric circulation pump, automatic temperature control for space heating and domestic hot water, and heat exchangers for space heating and domestic hot water. In addition, demand side investments include thermostatic radiator

valves and heat cost allocators on the radiators improvement of windows, staircase renovation, wall insulation and roof repair (if justified).

Re: "Combining or co-ordinating substation installations with energy efficiency improvements (without which the installations may result mainly in reduced bills from lower comfort/indoor temperatures) can improve customer acceptance." – the point is very valid, and the project team has used it in the project design by offering window replacements and similar improvements on the customer's end as an additional incentive for homeowners to accept the replacement of the substation early on in the program. This measure is expected to contribute to higher market penetration of the substations.

4. Objectives

The market penetration is addressed in Annex 2 (incremental cost analysis summary).

5. Background and Justification

The project brief addresses technical aspects in Annex 4 and economic aspects in Annex 2.

6. No comment

7. Activities

More detail is provided in the Project Description in Section C and terms of reference are provided in the Project Implementation Plan. Operating manual for the Energy Conservation Fund, and terms of reference for public relations and outreach are to be finalized by negotiations.

8. National priorities and community participation

The project addresses the needs of rural areas mainly by assisting VDHC with developing a strategy for disconnecting nonviable sections of the network and installing alternative sources of heat supply in low density areas mainly located in the periurban/rural areas.

9. Institutional arrangements

Institutional arrangements are addressed in Section E: Summary Project Analysis. As mentioned above, the operating manual for the Energy Conservation Fund, and terms of reference for public relations and outreach are to be finalized by negotiations.

10. Time frame

The target number for substation replacements in the first year may have to be revised by the time of submission of the proposal for CEO endorsement. This is not going to change the results of the economic analysis materially. The current assumption is that the full number of substation replacements will occur by 2006, which is considered feasible.

11. Funding

The cost estimates for substation replacement given in Annex 2 of the initial Project Concept Note (PCN) were preliminary. A more complete and accurate calculation summarized in Annex 2 of the current project brief is now available. The economic cost per substation replacement, including a physical contingency, is about $11,680. In addition, the administrative/transaction costs have been estimated at about $1,500 per substation. For the financial calculation, the GEF-financed cost per substation is a useful point of reference, but it should be kept in mind that the full picture of financial flows involved in GEF's financing of the substation replacements through the Energy Conservation Fund is more intricate and involves a different mode of calculation. The options presented in last November's Aide Memoire as Options 1-4 are relevant in that respect.

Unit abatement costs are addressed in Annex 2 (incremental cost analysis).

Marketing, outreach and education is addressed more completely in Section C. Terms of reference would be agreed with VDCH before negotiations.

12. Replicability

Lessons learned from the existing Energy Efficiency/Housing Pilot project are applied to the Energy Conservation Fund implementing arrangements. If the project is successful, similar implementing arrangements would be applicable in similar urban areas.

Monitoring and analysis would be included in the economic study and communications programs would be required to have clearly defined, monitorable performance indicators. It is likely that a university or academic institute would be involved in the economic analysis, provided that Bank procurement guidelines would allow for this.

13. Sustainability

No comment.

14. Development dimensions and rationale for GEF support

No comment.

15. Additional Comments

Re: "the current Vilnius District Heating project largely focuses on capacity building at the local level through commercialization of the district heating functions in Vilnius " what does this mean?

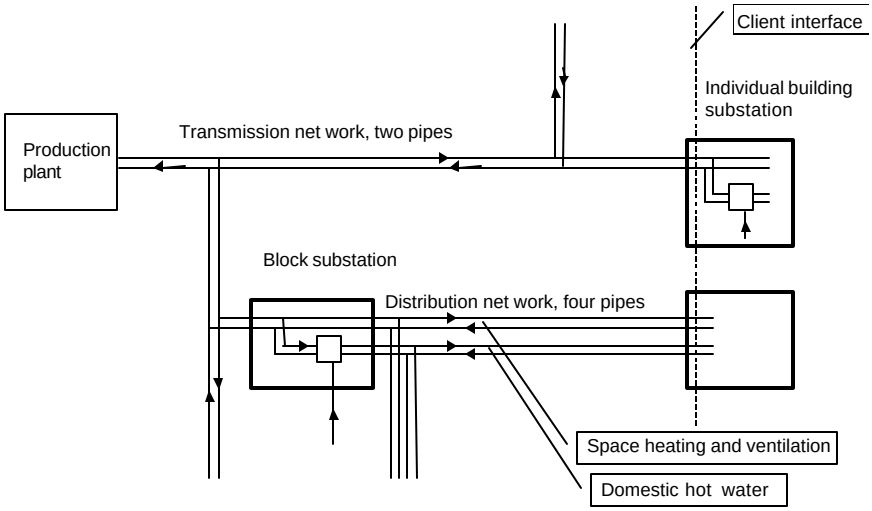
The project supports market-based initiatives that would enable the company to change to a more consumer friendly culture from its current inward-looking posture. A significant portion of the technical assistance provided will need to be provided by local consultants. The project would help to create value also by strengthening the company's financial position in preparation for a planned introduction of a private operator.

Annex 4: Detailed Project Description

LITHUANIA: VILNIUS DISTRICT HEATING PROJECT
DH/CHP System Description

The heat load density of Vilnius DH system is 5,8 MWh/m. This compares favorably with the average figure for Swedish and Finnish networks of 3,6 MWh/m on average. The system is supplied by the CHP-2 and -3 plants and five heat-only-boiler plants, all owned by the VDHC. Heat is transmitted in a 2-pipe network of 301 km length, 13 km of which modern preinsulated pipelines, and distributed to buildings parallel via 161 block substations, all owned by the VDHC, and 2,311 individual building substations, 85% of which owned by the municipality and the rest by others. The length of the 4-pipe system between the block substations and buildings is 146 km and some 11 km of pipes, 2.4% out of the total length of 460 km, supply steam for industry. In 2000, the CHP/DH system of Vilnius generated 770 GWh electric power and 2,848 GWh district heat.

The principal scheme of the DH/CHP system of Vilnius is presented below.



All buildings are equipped with heat meters, 5,940 in total, and the customers are invoiced according to meter readings. The heat transmission network is in a relatively reasonable shape and do not need immediate actions, whereas the distribution pipes are in poor condition requiring either elimination or replacement. The consumers have no means to regulate their heat consumption since it is regulated centrally by the heat sources. Due to unbalanced network system, some obtain excess and the others insufficient heating. Therefore, the substations shall be rehabilitated. The CHP-3 plant, the main heat source, is about 13 years old but poorly automated with outdated Soviet technology.

By Component:

Project Component 1 - US$29.70 million
A. Substations and Pipes Component includes elimination of most of remaining 161 block substations (group substations) and installing about 2,200 building-level individual substations that are

automated to reduce energy consumption and to convert the entire system from a supply to a demand driven operation mode.

The substation balance of Vilnius is presented in Table 1 below

Table 1. Substation data, central network

Type of connection	Block substation	Individual building substation	Total
Number of installations	161	2311	-
Average age of installation	21	21	
Number of substations connected	2513	2311	4824
Approximate total floor area of connected buildings (m2)	8,4 million	3,1 million	11,5 million
Installed capacity, MW total (MW heat/ MW DHW)	1 330	1´322	2,652 (1197/973)
Heat and hot water sold, GWh (1998)			2 485

VDHC's maintenance department does operation and maintenance of the block substations. The building installations are currently operated and maintained by separate service companies, which do not belong to VDHC. Most of the companies are 100 % owned by the Vilnius municipality and working by order of the owner of the building and the household.

Table 2. Actual number of installations in individual buildings of each type

Installations in individual buildings	Type	Number of installations
Direct space heating with ejector, ejector and pump or with motorized valve and direct domestic hot water	A1, B1 and C1	2 217
Closed space heating system with heat exchanger and direct domestic hot water	D1	33
Direct space heating with ejector, ejector and pump or with motorized valve and one stage heat exchanger for domestic hot water	A2, B2 and C2	1 421
Direct space heating with ejector, ejector and pump or with motorized valve and two stage heat exchanger for domestic hot water	A3, B3 and C3	595
Closed space heating system with heat exchanger and one stage heat exchanger for domestic hot water	D2	419
Closed space heating system with heat exchanger and two stage heat exchanger for domestic hot water	D3	127
Other installation		12
Total number of individual building installations		4 824

The average remaining lifetime of individual building substations can not be estimated from the financial statement of VDHC, since these substations are not owned by VDHC but by the building owners.

With an average age of equipment of about 21 years, and an average total life span of about 25-30 years, the average remaining life of the equipment would be about 4-9 years.

The problem with the substations is the lack of heat regulation, and in block substations in particular, poor condition of underground installed domestic hot water pipes. Elimination of block substations has the higher ERR than replacement of already existing individual substations, and is thus preferred in the investment plan.

the proposed Component is to convert block substations to individual substations in Category 1 (distribution pipelines installed in tunnels) and in Category 2 (pipelines installed in concrete ducts), upgrade existing building-level in Category 3, and replace building level substations in Category 4 that are linked to supply 1 to 4 other buildings as well with individual substations in each building. The numbers in Table 3 reflect the total number of individual building level substations to be installed.

Table 3. Individual building-level substations to be installed in each category.

Substation Category	2001	2002	2003	2004
1: New BLS in buildings with previous connection to GS by concrete ducts	299	532	100	
2: New BLS in buildings with previous connection to GS by tunnels		60	557	268
3: Upgrades to new BLS in buildings connected directly to mains			100	
4: Upgrades to new BLS in buildings with substations serving several buildings		50	110	100
Annual	299	642	867	368
Cumulative	299	941	1,808	2,176

Project Component 2 - US$6.35 million
B. Apartment-level Demand Side Management Component will be organized by means of an Energy Conservation Fund that will finance part of the above substation rehabilitation but also rehabilitation of buildings and apartments. Examples of such eligible investments are:

(a) modernization of the district heating system in buildings;
(b) installation of a dual pipe heating system;
(c) installation of heat meter;
(d) installation of hot water meters;
(e) installation of thermostatic radiator valves and heat cost allocators;
(f) wall rehabilitation due to cracks;
(g) wall insulation;
(h) window tightening, repairs or replacement;
(i) staircase window repairs and replacement
(j) new staircase entrance doors with door closers or repair of existing exterior doors;
(k) repair or replacement of leaking hot water pipes;
(l) hot water saving measures (e.g. pipes, shower heads, new taps);
(m) roof repair (only with insulation); and
(n) construction of pitched roofs with new insulation (but no interior construction for living space)

Project Component 3 - US$ 3.39 million

C. Heat-only-boiler Rehabilitation and Elimination Component covers rehabilitation of three HOB's (RK2, RK6 and RK8) with either new boilers or new burners and pumps, depending on the priorities in each particular case, to reduce fuel consumption, operating costs and emissions was analyzed as the least cost option. RK2 will be equipped with four Low-Nox burner units, 7.5 Gcal/h each. RK6 will be equipped with a steam boiler of 6 MW capacity to supply the local industrial heat load. RK8 is the major heat source in the northern part of the city and will remain an important peak-load and back-up source, where new frequency controlled pumping capacity at 15 m^3/h is necessary in the new operation mode.

On the industrial area, however, elimination of the RK4 (A. Paneriai region) boiler plant of 192 MW capacity was justified and installation of decentralized 9 small gas fired HOB's (8.8 MW in total capacity) would be sufficient to supply the existing heat load, since the industry mainly has collapsed there.

In 1999 and 2000, the HOB's produced 592 and 436 GWh respectively, 19% and 15% out of the total. In course of substation rehabilitation, the HOB's remain more and more peak-load sources.

Project Component 4 - US$18.92 million

D. Combined Heat and Power Plant Rehabilitation Component covers major rehabilitation of the block 1 of CHP-3 with a new process control & instrumentation system to improve efficiency and reliability, twelve environmental friendly low-Nox burner units adjusted both for mazut and gas firing to reduce emissions in order to meet EU environmental requirements, an additional feed water pump unit to improve plant reliability, hydraulic and lubrication system for the turbogenerator to improve reliability and controllability, frequency controlled district heating pump to adjust the plant to demand driven variable water flow operation mode, and a modernized regenerative air preheater to improve efficiency.

The block 2 of CHP-3 will be equipped with a hydraulic and lubrication system for the turbogenerator as well.

In addition, the CHP-2 will be equipped with a frequency controlled district heating pump to be adapted to variable water flow as well.

The CHP-2 and CHP-3 plants will be interconnected with a 2 km long high-pressure gas pipeline that will considerable reduce gas purchase costs.

At present CHP-3 consists of 2x 210 MWe condensing-extraction steam turbines that operate mainly in heating mode. The CHP-2 operates as heat-only-boiler only, because the small steam turbines have become outdated. In 2000, both CHP plants generated electricity about 770 GWh and 2,412 GWh heat, 85% out of total heat energy delivered to the network by the VDHC. The share of CHP production has been constantly increasing during the past six years, and are expected to increase due to Ignalina shut-down. The efficiency of the CHP-3 plant is 75.9% whereas the modern plants of similar type reach annual efficiencies around 90%.

Project Component 5 - US$7.18 million

E. Technical Assistance Component will include: (a) Management information system implementation covering billing and collections, financial management and customer database to enable up-to-date processing and prompt information to management to enable cost control and monitoring of their customer satisfaction; (b) Project implementation management support to VDHC to assist in procurement, supervision and management of implementation and during commissioning; (c) Demonstration project where some selected substations will be heavily instrumented and connected to internet , thus enabling anybody to have real time follow-up experiences from the substation functioning as apart of the public awareness campaign to be implemented and a system to optimize combined heat and power production in VDHC to minimize fuel costs; (d) Twinning arrangements between the VDHC and Helsinki Energy as both municipal District Heating companies are of a similar type and size with similar assets and issues including systems operation, financial management, customer and public relations, safety, environmental and management practices; (e) Assistance to the small heating companies being separated from the VDHC to prepare heating plans to decrease the cost of supply. The plans are designed to help the companies establish their strategies either to improve the system efficiency or close down their operations in a reasonable time span, replacing them with lower cost options; (f) public marketing and outreach campaign to support the Energy Conservation Fund be utilized by the heat customers; (g) Training VDHC staff in marketing and public relations; and (h) advisory services for private sector participation in VDHC, as well as support for subsequent changes.

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