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Report No: 26027

IMPLEMENTATION COMPLETION REPORT
(CPL-38760)

ON A

LOAN/CREDIT/GRANT

IN THE AMOUNT OF US$ MILLION

TO THE

RUSSIAN FEDERATION

FOR A

Russia Energy Efficiency

June 26, 2003

CURRENCY EQUIVALENTS

(Exchange Rate Effective May 28, 2003)

Currency Unit	=	Ruble
1 Ruble	=	US$ 0.033
US$ 1	=	30.72 Rubles

FISCAL YEAR

January 1 - December 1

ABBREVIATIONS AND ACRONYMS

CAS	Country Assistance Strategy
CPPR	Country Portfolio Performance Review
EEP	Russia Energy Efficiency Project
FEPS	Final Executive Project Summary
GEF	Global Environment Facility
GHG	Greenhouse Gas
GOR	Government of Russia
ICB	International Competitive Bidding
ICR	Implementation Completion Report
JSC	Joint Stock Company
MoF	Ministry of Finance of the Russian Federation
MoEDT	Ministry of Economic Development and Trade of the Russian Federation Until June 2000 – Ministry of Economy of the Russian Federation[1]
MoEN	Ministry of Energy of the Russian Federation Until May 2000 – Ministry of Fuel and Energy of the Russian Federation[2]
MOP	Memorandum of the President
NCB	National Competitive Bidding
OECD	Organization for Economic Cooperation and Development
PCD	Project Concept Document
PIU	Project Implementation Unit
PSR	Project Status Report
PTL	Program Team Leader
RESF	Russian Energy Saving Foundation
SAR	Staff Appraisal Report
SLA	Sub-Loan Agreement
TA	Technical Assistance
TM	Task Manager
TTL	Task Team Leader

[1] Until June 2000 – Ministry of Economy of the Russian Federation.

[2] Until May 2000 – Ministry of Fuel and Energy of the Russian Federation

Vice President:	Johannes Linn
Country Manager/Director:	Julian Schweitzer
Sector Manager/Director:	Peter Thomson
Task Team Leader/Task Manager:	Vladislav Vucetic

RUSSIAN FEDERATION
Russia Energy Efficiency

CONTENTS

Project ID: P008803	*Project Name:* Russia Energy Efficiency
Team Leader: Vladislav Vucetic	*TL Unit:* ECSIE
ICR Type: Core ICR	*Report Date: June 26, 2003*

1. Project Data

Name: Russia Energy Efficiency
L/C/TF Number: CPL-38760
Country/Department: RUSSIAN FEDERATION
Region: Europe and Central Asia Region

Sector/subsector: District heating and energy efficiency services (48%); Power (27%); Oil and gas (25%)
Theme: Other urban development (P); Climate change (P); Pollution management and environmental health (S)

KEY DATES

			Original	Revised/Actual
PCD:	02/15/1994	*Effective:*	11/02/1996	12/26/1996
Appraisal:	04/20/1994	*MTR:*		
Approval:	05/02/1995	*Closing:*	06/30/2001	01/31/2003

Borrower/Implementing Agency: RUSSIAN FEDERATION/Ministry of Finance/Ministry of Energy and JC Investenergoeffect
Other Partners: Municipal Unitary Enterprise Teplovye Sety of Semenov (city of Semenov), Municipal Heating Enterprise Kaliningradteploset (city of Kaliningrad), Unitary Enterprise Ryazan Municipal Heating Networks (city of Ryazan), Government of Archangelsk Communal Services Department (city of Archangelsk).

STAFF	Current	At Appraisal
Vice President:	Johannes F. Linn	Wilfried Thalwitz
Country Director:	Julian F. Schweitzer	Russell Cheetham
Sector Manager:	Peter Thomson	Jonathan Brown (EC3IV)
Team Leader at ICR:	Vladislav Vucetic (since 10/28/2002)	Gary Stuggins
ICR Primary Author:	Serguei Milenin; Pekka Kouri	

2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

Outcome: U
Sustainability: L
Institutional Development Impact: M
Bank Performance: S
Borrower Performance: U

	QAG (if available)	ICR
Quality at Entry:		S
Project at Risk at Any Time:	Yes	

3. Assessment of Development Objective and Design, and of Quality at Entry

3.1 Original Objective:

The principal objectives of the Russia Energy Efficiency Project (EEP) were: (i) to increase the efficiency of energy use in the selected regions of Russia by supporting investments in more efficient equipment and increasing the use of customer metering; and (ii) to support the government's gas sector reform program through technical assistance. Those objectives would be realized both directly through project-financed investments and indirectly through demonstration impacts.

Energy was estimated to account for 15 percent of Russia's GDP, 11 percent of the industrial production, and 50 percent of its convertible foreign exchange earnings in the early 1990s. Rapid stabilization of the overall economy was unlikely to occur unless macroeconomic reforms were paralleled by energy sector reform and recovery. Within the energy sector, the gas sub-sector is critical. Gas is the primary source of fuel in the domestic market, and in 1993 it accounted for approximately 20 percent of foreign exchange earnings. Natural gas is also expected to become increasingly important, in both export and domestic markets, because of its environmental attractiveness.

The Russian Federation is among the most inefficient users of energy; its energy intensity level is 3-14 times higher than that of the OECD countries. In 1992, Russia's energy use per unit of GDP was 14 times that of Japan, 8 times that of the United Kingdom, and 5 times that of the USA. This inefficiency stems from a combination of factors, including widespread use of outdated equipment, absence of metering, and prices and regulations that discourage efficient use of energy. Energy inefficiency not only accelerates the depletion of economic resources, but also represents the prime cause of pollution and degradation of the natural environment. Thus, Russia is one of the largest sources of GHG emissions in the world. In 1990 GHG emissions in Russia amounted to 3,039 mln tonnes of CO2 equivalent. Carbon dioxide, released to the atmosphere mostly as a result of the utilization of organic fuel, accounted for 78 per cent of the total emissions.

In that context the project objectives are clear, realistic, and important for the Russian Federation. They were in line with CAS objectives for the energy sector in Russia particularly with respect to increasing cost recovery and efficiency of energy use, and strengthening national institutional and regulatory framework for the sector (Report No 14473-RU of May 15, 1995; Report No 16549-RU of May 6, 1997; Update Note R98-288 of December 1, 1998; Report No 19897-RU of December 1, 1999). The project also followed CAS priorities for the environmental sector, with respect to providing support to the mitigation of GHG emissions and the atmospheric pollution.

The investment component of the EEP was closely linked with the Greenhouse Gas Reduction Project funded by the US$ 3.2 mln GEF grant (GEF Report No. 13076-RU of November 1995). A portion of the Grant (the Utilization Component, US$ 0.8 mln) was used to identify and appraise for further financing under the EEP investment projects, which would increase the efficiency of energy use and, thus, generate considerable benefits in CO2 emissions reduction. This blended GEF operation was closed on June 30, 1999 (ICR Report No. 20901 of September 18, 2000).

The project was built on priorities for macroeconomic reform and sector development in the country. Through a number of replicable model investment programs in the selected regions of Russia, it supported critical technical improvements in heating networks, which were in urgent need of rehabilitation. The project also demonstrated the potential for (i) improving cost-recovery through the increase in operational efficiency of heating enterprises, and (ii) reducing the associated adverse environmental impacts, including

GHG and hazardous emissions. In that regard, project objectives remain relevant under the most recent CAS (Report No 24127-RU of May 14, 2002), which specifies the improvement of business environment and mitigation of environmental risks as areas for priority Bank intervention.

The project aimed at influencing sector policies and supporting gas sector reform. However, from the outset it was recognized that such an effort would be difficult due to the complexity and instability of the institutional framework, and the large number of organizations, authorities and regions involved. Given the Borrower's very limited previous experience in administering similar operations, the project was demanding in terms of building implementation capacity.

Since the project was initiated, there were no changes in the Borrower's circumstances and development priorities, which would require revision of the project objectives.

3.2 Revised Objective:

The principal objectives of the project are: (a) to increase the efficiency of energy use within Russia: and (b) to support the government's reform program through technical assistance. Specifically, the studies will focus on gas sector structure, regulation, and pricing.

The original project objectives were not revised.

3.3 Original Components:

The project (original loan amount - US$ 70 mln) consisted of two components: (i) technical assistance to support governmental reform program for the gas sector – Part A; and (ii) investments in energy efficiency of the heating enterprises in selected regions – Part B. In particular, this includes (also see *Section 3.4*):

1. Energy Efficiency Investments (Investment Component, original budget – US$ 60 mln). The energy efficiency component would finance investments in improving energy efficiency of district heating and combined heat and power utilities in the selected regions. It would also provide support through technical assistance in developing and implementing such investments. The recommended investments (US$ 58 mln credit line) for increased efficiency include, inter alia: (i) burner replacement and associated controls; (ii) boiler replacement at municipal district heating companies; (iii) portable diagnostic instrumentation for power plants and municipal boilers to facilitate better adjustment of the equipment; (iv) automated control systems at boiler plants; and (v) automatic temperature control equipment and heat energy meters at heating substations. Technical assistance (US$ 2 mln) was envisaged to (i) help potential executing agencies in identifying sub-projects and in presenting their technical, economic and financial viability, (ii) appraise energy efficiency investments by municipal utilities (district heating) and power plants, and advise the Ministry of Finance on the feasibility of financing these sub-projects, and (iii) provide assistance and disseminate information to industrial enterprises to evaluate and assess commercial funding for energy efficiency measures. Local heating and power utilities located in the cities of (1) Saratov, (2) Voronezh, (3) Cherepovets, (4) Ryazan, (5) St. Petersburg, (6) Stavropol, (7) Rostov-on-Don, (8) Samara, (9) Nizhny-Novgorod, and (10) Vladimir were the originally proposed beneficiaries of the component.

2. Gas Sector Studies - TA to the Ministry of Energy to support reform program in the gas sector (original budget - US$10 mln). The project envisaged support for studies in the following areas: (i) upgrading the current gas industry standards and construction procedures; (ii) preparing a third party access decree for the gas industry; (iii) preparing specific tariff recommendations for gas transport; (iv) preparing recommendations for an energy pricing strategy; (v) preparing recommendations on the privatization of the gas sector; (vi) consulting assistance for a gas law and regulatory requirements; (vii) preparing an overall

plan for the gas distribution system rehabilitation; (viii) coordination of the study program. The beneficiary for that work was the Ministry of Energy of the Russian Federation

As indicated above, the EEP was complemented with the GEF-financed Russia Greenhouse Gas Reduction Project (Grant amount – US$3.2 mln), referred to in the SAR as a GEF-financed project component. Grant program was to include (i) assessment of the release of methane, and the development of mitigation programs for natural gas production, transmission, and distribution sub-sectors (PTD component), and (ii) assessment of GHG emissions from gas utilization and development of mitigation programs for the utilization sub-sector (Utilization component). Program for the utilization sub-sector (Grant budget – US$803,700) was to support preparation of financially viable investment projects, sound in terms of CO2 emissions reduction to be funded under the EEP. The Utilization component of the GEF grant was implemented successfully, while the PTD component was not implemented.

Assessment of the design:

Project components were well designed technically and were reasonably related to the project objectives. The national sector ministry - Ministry of Energy (MoEN) - had the overall responsibility for the project implementation. Energy efficiency investments were to be managed by MoEN through its affiliate entity - the Russian Energy Saving Foundation (RESF). In accordance with the Borrower's budgetary regulations, IBRD loan proceeds were to be on-lent to beneficiaries (sub-borrowers) by the Ministry of Finance (MoF) under sub-loan agreements (SLAs). RESF would (i) undertake review of initial investment proposals from the regions; (ii) work with potential sub-borrowers to strengthen their proposals; (iii) provide centralized support with technical, financial and procurement expertise to the implementation of individual investment programs (sub-projects). A number of sub-project proposals were reviewed at appraisal, and an initial list of potential sub-borrowers was made part of the legal document. It was expected that the project would build capacity within the RESF so that this entity could continue on behalf of the government identification, appraisal and follow-up on the energy efficiency investment programs in various regions of Russia beyond the project life. Since the project implementation unit would also manage the Utilization component of the associated GEF grant, its core expertise would initially be funded with GEF resources. A margin of 0.5% on the SLAs amount disbursed and outstanding would be paid to the RESF to cover the related operating costs in the longer term. Once the number of the signed SLAs exceeds ten, a commercial bank would be engaged to administer the repayment to MoF.

Gas Sector Studies were to be administered directly by MoEN with the technical and procurement support provided by a coordinating consultant. When this Loan was appraised, the Bank expected that it would provide considerable leverage to influence the reform agenda in the gas sector. However, this did not work out to be the case because there was considerable opposition from within the Government and outside to making major changes (also see *Section 8*).

The Project Interagency Supervisory Board, consisting of the authorized representatives and experts from MoEN, MoF, Ministry of Economy, and the other federal agencies concerned was established to provide governmental oversight and ensure interministerial coordination for both project components.

3.4 Revised Components:

Component; Cost; Rating

(1) Technical Assistance - Part A;	$9,395,000.00;	U
(2) Goods - Part B;	$47,500,000.00;	U
(3) Technical Assistance - Part B;	$2,300,000.00;	S
(4) Unallocated;	$10,200,000.00;	NR
(5) Incremental Operating Costs - Part B;	$605,000.00;	S

The following substantial modifications have been made to the project since appraisal:

(i) The Project SAR (Report No. 13046-RU of April 11, 1995) makes reference to a Gas Distribution Rehabilitation Component to be implemented in the city of Volgograd. Although this component (US$36.5 mln) was identified and appraised, it was later excluded from the project. MOP Regarding Modifications to the Project was communicated to the Board in September 1996.

(ii) On July 9, 1997 cities of Archangelsk and Kaliningrad have replaced Voronezh and Stavropol on the list of sub-borrowers. As of March 3, 2000 the original list of eligible sub-borrowers was modified to include potential beneficiaries from a wider range of regions. The legal definition of eligible sub-borrower was also extended to include regional and city administrations.

The loan closing date was extended from June 30, 2001 until September 30, 2002 (on June 21, 2001) and then until January 31, 2003 (on September 26, 2002) to allow completion of programs funded by the Investment Component.
In April 2001 GOR requested the Bank to utilize available funds of the Investment Component to support rehabilitation of the heating sector - linked to reforms and financial improvements - in the Far East regions of Russia. However, in June 2001 the government indicated that it would reconsider the format and specific geographical area for Bank's assistance. The decision on the part of GOR was delayed and, eventually, the Far East energy efficiency program did not proceed.

In June 2001 GOR also requested the Bank to restructure the Gas Sector Studies and transfer the responsibilities of Implementing Agency for this component from MoEN to the Ministry of Economic Development and Trade. Although the Bank concurred with that request, the restructuring did not materialize as GOR later decided to cancel the uncommitted funds.

Changes in the scope of project components are summarized in *Section 10.*

3.5 Quality at Entry:

The project was consistent with objectives of the CAS and governmental development priorities and complied with the applicable safeguard policies of the Bank. The technical design corresponded to the project objectives. Assumptions about the demand for the project output and the international commodity prices were reasonable. The SAR documented the project and its background in sufficient detail. Key project stakeholders participated in appraisal and loan negotiations. The proposed implementation arrangements were adequate and in direct control of the government; they correctly followed Borrower's governance structures and accounted for institutional constraints. Needs in the implementation capacity building were assessed and adequately addressed in the project design.

The project preparation was challenging for both the Bank and the Borrower. Bank-financed projects were new to Russia, and the Borrower's learning of the relevant operational requirements, procedures, and practices had to be an integral part of the dialogue. There was a need for the government to develop a number of new nation-wide policies, in particular – those related to the on-lending of IBRD loan proceeds to the regional sub-borrowers. During 1992 - 1998 GOR and MoEN also suffered from frequent changes in key officials responsible for the project. For all these reasons, the project start up was slow and required extensive input from the Bank (see *Annex 4*).

For the purpose of the ICR, the project is rated *satisfactory* for quality at entry. The project was not subject to a quality-at-entry review by QAG.

4. Achievement of Objective and Outputs

4.1 Outcome/achievement of objective:

The project objective with respect to increasing the efficiency of energy use in the participating regions has been largely achieved, and the demonstration impact of the project in that regard has been significant. Sub-projects, funded by the credit line, were completed successfully with satisfactory outcomes. These investments have significantly improved quality and decreased costs of energy supply in the subject regions. In some cases, the outcomes have exceeded initial expectations. Implemented programs have also generated substantial benefits in reduction of CO2 and hazardous emissions from heat production. Selected project activities are now being successfully replicated in non-project regions funded from the commercial sources. Thus, in the participating regions, the Energy Efficiency Investment component has achieved most of its major objectives and is expected to achieve satisfactory development results. The outcome of the completed investments is satisfactory, fully relevant to Russia's current policy objectives for the sector, and consistent with the objectives of the CAS for Russia. Actual benefits to date (see *Section 4.2* and *10.2*) are expected to exceed US$ 17.1 mln equivalent in economic savings, US$ 11.1 mln equivalent in financial savings, fuel savings of 109.1 thousand conventional tonne, and the CO2 emissions reduction of 193.1 thousand tonne. Annual fuel savings from sub-projects are estimated at 63.22 thousand conventional tonne (see *Annex 1*). Completed sub-projects have generated EIRR from 31.3% to 289%; and FIRR from 18.7% to 82.9% (see *Section 4.3, 4.4,* and *Annex 3*). The achieved results on the ground and direct benefits for the local population in the project regions are significant (see *Section 4.2*).

However, as only US$ 16.6 mln (i.e. 29 %) of the US$ 58 mln energy efficiency credit line was disbursed, and only 4 out of the planned 10 regional sub-projects were implemented, the actual scope of the completed investments is significantly smaller than originally expected. The second project objective - to support the gas sector reform through financing of critical studies – also has not been achieved in full, as the agreed program of Gas Sector Studies (see *Section 3.3*) was implemented only partially. For these reasons the development impact of the project was limited compared to what could have been achieved, and the project overall outcome is rated *unsatisfactory*.

4.2 Outputs by components:

Valuable physical outputs were delivered under both project components. However, none of the components have completed the original program in full.

Energy Efficiency Investments (US$60 mln planned, US$ 18.5 mln actual).

The component has financed: (i) investment sub-projects in the cities of Ryazan, Semenov (Nizhny Novgorod region), Kaliningrad and Archangelsk (US$ 16.6 mln in all), (ii) TA for the development and implementation of these sub-projects, including centralized technical, financial, and procurement support (US$ 1.36 mln), and (iii) incremental operating costs of the central PIU for the component (US$ 0.53 mln). Sub-loans have financed only the cost of equipment (boilers, pipes, meters, controls, etc.), whereas installation and commissioning were funded by beneficiaries as part of their co-financing. Identification and preparation of sub-projects was co-financed by the associated GEF Grant (See *Section 3.3* above).

Following the dramatic devaluation of the Russian ruble in 1998, local costs of all sub-projects increased more than three times and exceeded the amounts originally reserved or planned in city budgets. Particularly, the devaluation increased the sub-loan servicing and repayment obligations, and the local co-financing requirements when equipment was to be imported (to pay custom duties and etc.). Mainly for that reason, sub-projects developed for a number of regions and available for financing did not proceed. This includes programs in Saratov, Tobolsk, Samara, and the Rostov region for the overall amount of US$ 24.24 mln in foreign cost, which were originally accepted for funding under the EEP. Cities of

Cherepovets, St.Petersburg, and Vladimir have also withdrawn from the Project.

All procurement envisaged under sub-projects for Ryazan, Semenov, Kaliningrad and Archangelsk was completed in full. Economic and financial benefits for heating enterprises and cities are significant (see also *Section 4.3* and *4.4*). Investments have also generated significant environmental benefits, resulting from: (i) switch where possible from coal and heavy oil to gas-fired boilers, (ii) increased overall efficiency and reduced heat losses, and (iii) tightened hazardous emissions control. For the entire program, the 2001-2002 heating season demonstrated economic cost savings of US$ 6.4 mln equivalent and financial cost savings of US$ 3.4 mln equivalent, fuel savings of 53.1 thousand conventional tonne, and CO2 emissions reduction of 87.5 thousand tonne. Economic cost savings of the 2002-2003 season are expected to exceed US$ 10.7 mln equivalent and financial savings - US$ 7.7 mln equivalent, fuel savings - 56.0 thousand conventional tonne, and CO2 emissions reduction – 105.6 thousand tonne.

Implemented sub-projects have achieved tangible results on the ground and directly improved living conditions of more that 160 thousand people. In particular, for 76 thousand people in Archangelsk and 55 thousand in Semenov, their winter apartment temperatures increased from 12-16 to stable 20 degrees Celsius. In Semenov, in many buildings, hot water is now available in summer and not only during the heating season, as before. The quality of domestic hot water for more than 35 thousand people in Kaliningrad has improved dramatically. Following the installation of heat meters, the Ryazan municipality discovered that the actual heat consumption was 30% lower than what was regularly invoiced by the heat supplier (RAO UES), which resulted in savings and allowed the city to finance other priority programs.

Although four sub-projects were completed successfully, the implementation was demanding on the executing agencies and local project teams, which were at some points unable to effectively manage implementation and on a timely manner undertake installation and commissioning of the equipment. Thus, in Archangelsk, the lack of local technical and administrative capacity and leadership caused significant implementation delays. Providing of the local co-financing sometimes was an issue – in Archangelsk the installation of boiler houses was delayed for about a year as no funds were available in time to pay custom duties for the procured equipment.

Project cities also had to balance and manage their significantly increased multiple debt obligations to the federal government (MoF) and the other financiers. Ryazan, Kaliningrad and Archangelsk met their EEP sub-loan servicing and repayment obligations successfully, but Semenov failed to repay in time and had to enter in debt restructuring negotiations with MoF. The SLA with Semenov was suspended, and there were delays in payments to a contractor.

Details of individual sub-projects are summarized in *Section 10*. The completed programs have achieved important results, however, only US$ 16.6 mln (i.e. 29 %) of the US$ 58 mln energy efficiency credit line was disbursed, and only 4 out of the planned 10 regional sub-projects were implemented. The scope of investments and their resulting nation-wide impact is, therefore, much smaller than was originally expected. For that reason, the component is rated modest for the achievement of physical and financial objectives and its institutional development impact, although financial and economic returns for the implemented investments are quite good (see Sections 4.3 and 4.4).

Gas Sector Studies (US$10 mln planned, US$ 4.0 mln actual).
The component was expected to finance 10 contracts but in the end, it only financed studies on (i) gas pricing for the distribution sub-sector (US$ 1.2 mln); (ii) status of the gas distribution sub-sector, including its interrelation with the gas production and transmission sub-sectors (US$ 1.1 mln); (iii) re-organization and strengthening of enterprises in the gas distribution sub-sector (US$ 0.8 mln); and (iv) coordination of

studies and advisory support to MoEN (US$ 0.9 mln).

Studies contributed to the background analysis, underlying development of the governmental policy and regulatory framework for the gas sector. In particular, study outcomes were used by the government for the development of the (i) Methodological Guidelines on the Calculation of the Gas Transport Tariffs for the Gas Distribution Companies of Russia; (ii) Guidelines on the State Regulation of Prices and Tariffs on Gas Supply; (iii) Rules on Gas Supply to Consumers in Russia; and some other important policy documents, such as the gas industry section of the Governmental Action Plan for 2000-2001, the Concept for the Gas Market in Russia, and etc. Study recommendations with respect to further development of the legal framework for the sub-sector, institutional strengthening of the gas distribution companies, and establishment of the required regulatory controls are currently being used by the government in regular operational work.

Although the program has produced valuable results, a number of pre-identified at appraisal critical sector reform issues (see *Section 3.3* above) have not been addressed, largely due to significant implementation and procurement delays (also see *Section 7.6*). Therefore, the development impact is much lower than what was originally planned. The component is rated modest for the achievement of physical objectives and its impact on sector policies and institutional development.

4.3 Net Present Value/Economic rate of return:

Economic analysis for the investment component of the project (Energy Efficiency Investments) was conducted at appraisal and reflected in the SAR. The analysis reviewed costs and benefits of potential investment programs in four cities (Ryazan, Saratov, Volgograd, and Voronezh) and demonstrated that the package of sub-projects ultimately implemented could provide an average economic rate of return greater than 25 %. Rate of return for the evaluated replicable specific investments in municipal district heating varied from 14% (small boiler replacement in Voronezh) to 276% (installation of the automatic temperature controls in Ryazan). From that evaluation, an EIRR of 20% was established as a minimal requirement for individual sub-projects. The Loan Agreement indicates the EIRR of 20 % as one of the sub-project eligibility requirements.

Average economic rates of return for the implemented sub-projects, expected at the time of sub-projects preparation, and re-estimated at completion, are provided in a table below. EIRRs for the specific investments under sub-projects are provided in *Section 10*.

Economic values

Sub-Project	Expected at preparation			Re-estimated at completion		
	EIRR	NPV (12%)	Cost	EIRR	NPV (12%)	Cost
Semenov	28.3%	7,059,543	(15,466,000)	34.7%	10,716,069	(9,548,000)
Ryazan	195%	4,457,418	(1,087,800)	289%	6,012,352	(656,967)
Archangelsk	72.4%	13,812,730	(9,792,000)	31.3%	6,224,017	(7,438,447)
Kaliningrad	44.0%	6,133,793	(6,788,000)	65.8%	6,251,178	(6,033,961)

The increase in re-estimated benefits for sub-projects in Semenov and Ryazan resulted from the lower actual investment cost and the lower gas prices. In Archangelsk the sub-project was restructured and a number of originally expected high-return investment items were not financed. For Kaliningrad, the original feasibility study provided conservative estimation of equipment efficiency and resulting benefits, which in practice turned to be higher.

The actual cost figures, projection of benefits, the underlying assumptions about costs and benefits, and the other key information supporting the analysis and economic IRR/NPV calculations is provided in *Annex 3*.

4.4 Financial rate of return:

Based on the analysis made at appraisal, an FIRR of 10% was established as a minimal requirement for individual sub-projects. The Loan Agreement indicates the FIRR of 10 % among the other sub-project eligibility requirements.

Average financial rates of return for the implemented sub-projects, expected at the time of sub-projects preparation, and re-estimated at completion, are provided in a table below. FIRRs for the specific investments under sub-projects are provided in *Section 10*.

Financial values

Sub-Project	Expected at preparation			Re-estimated at completion		
	FIRR	NPV (12%)	Cost	FIRR	NPV (10.5%)	Cost
Semenov	19.6%	5,470,000	(15,466,000)	19.5%	6,000,830	(9,548,000)
Ryazan	103.4%	3,621,858	(1,087,800)	82.9%	2,510,940	(656,967)
Archangelsk	61.6%	14,475,000	(9,792,000)	22.1%	4,481,572	(7,438,447)
Kaliningrad	38.9%	5,595,530	(6,788,000)	18.7%	1,838,253	(6,033,961)

Key information supporting the analysis and financial IRR/NPV calculations is provided in *Annex 3*.

4.5 Institutional development impact:

The project was expected to support the following institutional improvements: (i) building capacity of authorities and heating enterprises in the participating regions to develop and implement sound energy efficiency programs; (ii) strengthening ability of the federal government to design, appraise, and supervise investment programs in the heating sub-sector; and (iii) strengthening the federal legal and regulatory framework for the gas sector.

The institutional development impact of the project for the local administrations and heating enterprises of the participating regions was substantial. However, as only 4 regional investment programs were completed and as the Gas Sector Studies were not implemented in full, the overall nation-wide impact was limited and lower than expected. Therefore, for the purpose of the ICR (*Section 2*), the institutional development impact of the project is rated as *modest*.

The valuable results of the completed program include, in particular, the following:

- The project provided important technical and methodological support to regional and local authorities in developing commercially viable and environmentally sound investment programs for the heating sector. Based on assessments made as part of the project, local heating companies were active in building up their internal decisional, analytical and technical capacity, as well as in acquiring at their own cost monitoring, metering, and control equipment, which would lead to improved operation of facilities and increased quality of heating services.

- Dissemination of experience with preparation and implementation of sound investment programs

generated significant positive response from the regional authorities and managers of the heating enterprises. The project had a strong demonstration impact and triggered energy efficiency programs in the non-project areas, which are funded from the commercial and governmental sources. In particular, 9 energy efficiency programs, with the total costs exceeding the equivalent of US$ 34.7 mln, were launched in the Nizhny Novgorod region to replicate activities of the Semenov sub-project. These programs have individual investment costs ranging from the equivalent of US$ 0.1 mln to US$ 25.0 mln and are financed mostly by the (i) local, municipal, regional, and federal budgetary funds; (ii) commercial investors; and (iii) loans from the Sberbank (Savings Bank of Russia). The blended GEF-financed Russia GHG Reduction Project (see *Section 3.1* and *3.3* above) supported publicizing the effects of the project – it funded two seminars on methods and equipment to determine GHG emissions from thermal processes (in Rostov-on-Don and Kaliningrad). The PIU Investenergoeffect also presented the experience gained during the preparation and implementation of the energy efficiency programs under the EEP at five major thematic conferences in Russia.

- The project has strengthened the capacity of the federal government to support targeted and commercially viable investments in district heating across the country. The JSC Investenergoeffect, established as a subsidiary entity of the Russian Energy Saving Foundation under MoEN, which served as a central implementation unit for the project, has gained sufficient experience and competences in projects design, competitive procurement and implementation supervision to continue on behalf of MoEN appraisal and supervision of energy efficiency programs beyond the project life. During the EEP implementation, the input of Investenergoeffect to the project was essential. However, currently its impact is limited as it is not engaged in implementation of any follow-up program.

- Through the TA component for the gas sector, the project contributed to a legislative and regulatory capacity-building effort of the government. However, the institutional development impact of that component is viewed as still relatively modest compared to what was expected under the project.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

None

5.2 Factors generally subject to government control:

Governance. Project implementation required a high degree of coordination between MoEN and the other federal agencies concerned. Although formally established, this coordination was not effective enough to ensure timely consideration of the critical implementation issues under the Investment Component of the project. Continuous delays on the part of MoEN in addressing key project matters (particularly – in approval of the PIU budgets) have caused significant operational problems, including blocked funding for the central PIU and the virtually discontinued implementation of sub-projects in the regions. This eventually led to a suspension of disbursements under that component from August 18, 2000 till December 27, 2000 (see *Section 7.2*).

Macroeconomic conditions. The financial crisis of August 1998 has negatively affected the implementation of the Investment Component, resulting in inability of several pre-identified cities to borrow under the credit line (see *Section 4.2* above) and the shortage of local counterpart financing, which delayed implementation in Archangelsk and Kaliningrad.

Budgetary co-financing. Co-financing from the federal budget for the implementation of the TA under both project components was provided in full and on a timely manner.

5.3 Factors generally subject to implementing agency control:

JSC Investenergoeffect, which was established by MoEN as an implementing agency (PIU) for the Investment Component, operated effectively. Internal arrangements for project management, monitoring and evaluation were adequate. Investenergoeffect has demonstrated strong commitment to the project: despite the unavailability of funds to cover operating expenses throughout the year 2000 (see *Section 5.2* and *7.5*), the PIU has maintained the required project management controls, retained qualified staff, and ensured continuity of implementation and supervision services.

Gas Sector Studies were implemented by MoEN directly through its relevant departments. However, MoEN failed to establish single point responsibility for component deliverables and ensure adequate coordination between various internal authorities, which resulted in delays with procurement and inefficiencies in managing consulting contracts.

5.4 Costs and financing:

In the SAR total costs of the project activities (as restructured in 1996 before loan signing (see *Section 3.4(i)*)were estimated at the equivalent of US$ 76.3 mln., of which US$ 70.0 mln were to be financed by the IBRD loan. Counterpart co-financing to cover costs of engineering, procurement, and installation of equipment under investment sub-projects was estimated at US$ 6.3 mln. Original loan allocations were as follows: (i) US$ 47.5 mln for the procurement of goods, US$ 2 mln for the technical assistance, and US$ 10.5 mln of unallocated under the Investment Component; and (ii) US$ 10 mln for the TA under Gas Sector Studies. Revisions made to the project scope during implementation are summarized in *Section 10*.

Disbursements amounted to US$ 22.5 mln**,** or 32.2 % of the loan. The incomplete use of funds mostly resulted from (i) the reduced scope of the Investment Component due to the decreased cities' borrowing capacity following the 1998 financial crisis, which led to cancellation of potential sub-projects (see *Section 4.2* above); and (ii) implementation and procurement delays with Gas Sector Studies. Also, disbursements under the Investment Component of the project were suspended from August till December 2000 in view of significant operational problems (see *Section 7.5*).

Estimated project costs and actual disbursements are presented in *Annex 1*.

6. Sustainability

6.1 Rationale for sustainability rating:

The project is *likely* to be sustainable with respect to its objective to increase efficiency of energy use in the participating regions of Russia. Key considerations affecting the rating are as follows:

- Since the project's initiation, regional counterparts have maintained a strong commitment to the project objective (recent actions of the Borrower at the policy level in support of energy efficiency are summarized in *Section 10.1*). Given the commitment on the part of authorities, efforts are expected to be made by the Borrower to maintain and strengthen the development capacity established under the project (also see *Section 4.5* above).

- Investments in the regions have shown high economic, financial, and environmental viability. The project had a strong demonstration impact and triggered energy efficiency programs for some non-project areas and facilities, which are funded from the commercial and governmental sources. For example, as indicated in *Section 4.5*, in the Nizhny Novgorod region 9 programs replicating the relevant project's technical solutions have been launched mostly with local and budgetary financing.

- The Russia Municipal Heating Project, funded by the IBRD loan (US$ 85 mln), has been approved. It will address issues of energy efficiency in the context of the overall reform of the housing and communal services, and will allow the government, participating municipalities, and heating companies to deploy viable investment programs in 8 - 9 regions of Russia.

Therefore, activities initiated under the EEP are likely to be sustained and expanded in the long term.

6.2 Transition arrangement to regular operations:

Investments under the project have supported core functions of beneficiaries and addressed their critical priorities. The appropriate technical, financial and institutional arrangements for the regular operation are in place.

The output of energy efficiency programs will be monitored on a regular basis and a monitoring plan is now under finalization with MoEN. Transfer of the required knowledge and skills from the PIU Investenergoeffect to MoEN for that purpose has been successful. Although MoEN is yet to define the exact role of the Investenergoeffect in further energy efficiency programs, arrangements are under consideration to maximize benefits from its available capacity and skills for the governmental follow-up and the appropriate replication and dissemination of the project experience.

7. Bank and Borrower Performance

Bank

7.1 Lending:

The Bank performance in lending is rated overall *satisfactory*. The Bank provided adequate support to GOR and MoEN in identifying key project activities. It has also assisted the Borrower in project preparation and ensured a high degree of participation on the part of GOR and MoEN in the appraisal. Objectives of the project were fully consistent with the governmental development priorities and the Bank's assistance strategy for the country. The project complied with Bank's applicable safeguard policies. The project's technical design was simple and effective. Components of the project were clearly defined in the legal document and the respective technical requirements were laid out in appropriate detail. Project's institutional design and the proposed implementation arrangements, including those for procurement and financial management, were adequate.

However, as indicated in *Section 3.5*, there was a need for the Borrower to learn and adapt to Bank policies and requirements, and develop its own new operational procedures (covering the on-lending to the regions, project governance, etc.). For that reason the project start-up was slow and required extensive support from the Bank. Thus, there were delays in loan effectiveness, in establishment and staffing of the project implementation unit (PIU). Procurement under Gas Sector Studies was also delayed. The Bank, therefore, maintained Unsatisfactory IP rating until early 1998, when the PIU became fully functional. DO rating remained unsatisfactory until early 1999, when Gas Sector Studies started to make progress.

7.2 Supervision:

The project implementation progress was reviewed and reported, and the project performance ratings appropriately reflected the performance during the particular rating periods. Implementation problems were identified in a timely manner and were addressed adequately and proactively. Advice to the Borrower and the follow-up on agreed actions was adequate. The project performance was also reviewed as part of the CPPRs beginning in 1997.

The Bank maintained Unsatisfactory both DO and IP ratings for the project from July 1996 till July 1997 to account for significant delays in loan effectiveness and establishing the implementation capacity. DO rating remained Unsatisfactory until March 1999, as there were delays in launching the Gas Sector Studies. The Bank also maintained an Unsatisfactory implementation performance rating for the project throughout the year 2000, when the MoEN abolished the PIU for the Investment Component, and later on, when there were delays with the implementation in the regions. In all cases remedial actions were recommended to the Borrower to resolve the project implementation issues. In 2000 the Bank had to suspend disbursements to enforce legal covenants and ensure re-establishment of the central implementation capacity for the Investment Component (see *Section 7.5* below). Extensive support was provided to MoEN in restoring the required capacity within the PIU Investenergoeffect, and later, in the attempt to bring implementation in the regions back on track.

The quality and quantity of Bank staff and consultants, their time in the field, the timing of supervision missions, and the support of the Bank management to staff at critical points were adequate. The Bank performance in supervision was *satisfactory*.

In the meantime, the Bank probably should have been more active in pushing the Borrower to cancel the uncommitted funds of the investment credit line when it became apparent that no more sub-projects from the agreed list would proceed. That cancellation took place, but at a later stage as the government first tried to identify new sub-projects, and then was considering a near-emergency program to rehabilitate heating sector in the Far East of Russia (see also para 7 in *Section 8* below).

7.3 Overall Bank performance:

At all stages of the project cycle the support to GOR and MoEN from the Bank was adequate. Bank's effort both at lending and supervision was intensive (see *Annex 4*) and the Bank has exercised maximum flexibility to address changing circumstances and priorities of the Borrower. Staffing of the Bank's team was adequate and the required skill mix and continuity was maintained. The country office provided full support to the task team at all stages. During supervision, the Bank's response to implementation risks was adequate. The project complied with the applicable Bank's policies and procedures. Overall, the Bank performance was *satisfactory*.

Borrower

7.4 Preparation:

At the preparation stage, GOR and MoEN demonstrated a strong commitment to the project objectives. The provided technical, institutional, administrative and financial support was adequate. Regional stakeholders were participating in the project design and involved in loan negotiations. The performance of the Borrower during project preparation is rated *satisfactory*.

However, following the Board presentation, the project had to be restructured (see *Section 3.4*). As the EEP was one of the early IBRD investment projects in Russia, both preparation and initial implementation

involved a lot of learning on the part of the Borrower. It took time for the Borrower to make the loan effective, establish the implementation capacity (PIU for the Investment Component and arrangements within MoEN to implement the Gas Sector Studies), and finalize on-lending arrangements for the sub-projects. This resulted in a slow start-up of the project.

7.5 Government implementation performance:

During implementation, commitment to the project objectives on the part of the government at the policy level was reiterated by MoEN officials. However, at the project level, the implementation was constrained by poor stakeholder coordination and administrative inefficiency (also see *Section 5.2* above). The Project Interagency Supervisory Board under MoEN, although formally established, operational, and in direct control of the government, often failed to address critical implementation issues on a timely manner (the Project Interagency Supervisory Board was originally comprised of the authorized representatives of MoEN, and RESF (general); MoEN, Ministry of Economy, Federal Energy Commission, and MoF (for Gas Sector Studies); MoEN, State Committee on Science and Technology, MoF, and Ministry of Economy (for the Investment Component)).

For example, in 2000 the lack of coordination and inaction on the part of the government caused significant operational problems with the Investment Component of the project, which required the Bank to exercise remedies and suspend disbursements under the loan. In particular, due to delays in review and approval of the PIU agency agreement and operational budget, for 8 months from March till October 2000 no funds were made available to the PIU to cover staff salaries, office supplies, communications, office rent, and other operating costs. PIU staff contracts, which expired in September 1999, were not officially extended, and, as a result, the PIU staff were not paid, even though they continued to implement the project. The accumulated backlog of unpaid invoices from suppliers amounted to US$3 million. There was also a great concern regarding the adequacy of internal controls and adherence to the relevant project implementation policies and procedures. On June 21, 2000, in view of implementation problems, the Ministry of Finance revoked existing authorizations to sign withdrawal applications under the Investment Component of the loan. Suspension of disbursements was in effect from August 18 till December 27, 2000, and the implementation of the Investment Component resumed only in 2001. The irregularities of 2000 undermined credibility of the program in the regions, demotivated regional participants and contractors, and eventually resulted in significant implementation delays.

Overall, the implementation performance of the government for the project is rated *unsatisfactory*.

7.6 Implementing Agency:

As outlined in *Section 5.3*, JSC Investenergoeffect was authorized by MoEN to implement the Investment Component of the project, whereas the Gas Sector Studies were administered by MoEN directly. Thus, both entities should be considered implementing agencies for ICR purposes.

PIU Investenergoeffect - a subsidiary of the RESF - was established by MoEN in 1997 to administer the investment program under the EEP and manage the Utilization Component of the associated GEF-financed Russia Greenhouse Gas Reduction Project (see *Section 3.1*). Investenergoeffect operated effectively and delivered results in accordance with agreed implementation plans. The internal technical, financial, and administrative capacity was adequate. Throughout year 2000, despite the unavailability of financing to cover operating costs, the PIU continued to provide critical implementation support to sub-borrowers and maintained required project management controls. The performance of the JSC Investenergoeffect was *satisfactory*.

As regards the Gas Sector Studies, the capacity to administer the program in the relevant MoEN technical

department was adequate and the required external procurement support was in place. However, MoEN failed to impose sector reform, as there was apparently considerable opposition from within the government and outside to making major changes in the gas industry. Mostly for that reason only 4 of the expected 10 studies were launched. MoEN also failed to ensure single point responsibility for component deliverables and the required coordination between various concerned departments within the ministry was not established, resulting in delays with procurement and inefficiencies in managing consulting contracts. Eventually, the planned program of studies was not implemented in full. The performance of MoEN as an implementing agency is rated *unsatisfactory*.

7.7 Overall Borrower performance:

The Borrower failed to establish and maintain implementation capacity to fully achieve project objectives and maximize benefits from the operation. Despite the recognized need in the energy efficiency investments in many regions (also confirmed during preparation of the Municipal Heating Project), 67.8 % of resources available under the loan eventually had to be cancelled. Repeated changes in Government and MoEN officials may have contributed to reduced commitment and resolve to solve the issues. The Borrower's performance is rated *unsatisfactory*.

8. Lessons Learned

Examining the reasons why the project implementation was only partially successful leads to the following lessons learned.

1. The project demonstrated commitment on the part of the regional authorities to implement operational policies and practices supporting more efficient use of energy. Energy efficiency measures are viewed as an important element of development programs by local heating enterprises, which are willing to invest their own limited resources in advanced technologies and equipment.

2. Heating networks in most of the cities reviewed under the project were worn out and needed urgent rehabilitation. Due to the demonstrated high viability of investments in improved energy efficiency, the local commercial sector in the project regions now becomes increasingly active in supporting such initiatives. These investments also demonstrate significant development impact.

3. Strong local leadership and expertise is essential for the regional development programs to succeed. Timely availability of counterpart funding is also key for ensuring the quality of project deliverables. Establishment of the local implementation capacity and arrangements for the sufficient and timely local co-financing of project activities should be assigned the highest priority at the preparation stage since it directly affects procurement and administrative efficiency during implementation.

4. The ability of the government to implement the project was constrained by lack of coordination between MoEN and the other stakeholders and, for the Gas Sector Studies, by administrative inefficiency at the project level. The Borrower should consider it a priority during implementation to establish and maintain arrangements to ensure the required interagency coordination and single-point responsibility for project deliverables.

5. The PIU for the Investment Component of the project – JSC Investenergoeffect – was operationally autonomous from MoEN. Although arrangements for ensuring governmental oversight and the reporting of the PIU to the government were in place, it is now apparent that the implementation could have been more

efficient if the PIU would operate in a closer link to MoEN. This would strengthen PIU capacity to work with the regional authorities and executing agencies, and would help MoEN to address critical implementation matters timely and proactively.

6. When appraising regional sub-projects, special attention should be paid to assessing the creditworthiness of sub-borrowers. As indicated in *Section 4.2*, one of the participating cities (Semenov) failed to timely start repaying its SLA to MoF. The SLA was suspended, and there were delays in payments to a contractor. To prevent such cases in the future, the Bank and MoF have agreed that for the new operations, including the follow-up Russia Municipal Heating Project, all regional sub-borrowers (cities) are subject to detailed creditworthiness analysis.

7. Including a TA component on an investment loan to reform the sector has not yielded satisfactory reform results on this or several other loans, including the two large loans to rehabilitate the oil sector in Russia (Oil Rehabilitation Project – ICR Report No 20582 of June 30, 2000 and Second Oil Rehabilitation Project – ICR Report No 20671 of June 30, 2000). It has been found that Investment Loans do not provide sufficient leverage to overcome the resistance to making significant changes in the sector and adjustment loans are a much better lending product for that purpose.

8. There is no established practice for the Borrower's implementation response to a massive devaluation of the national currency, which significantly reduces its ability to commit funds and disburse under the loan (like in the case of the ruble devaluation in August 1998). In retrospect, it seems that the implementation of the Investment Component from late 1998 should have concentrated on completing the ongoing sub-projects, whereas the uncommitted remainder of the credit line should have been cancelled. In case of the EEP, such major cancellation of funds took place at a rather late stage (in January 2002) as the government first tried to identify new sub-projects, and then was considering a near-emergency program to rehabilitate heating sector in the Far East of Russia (see *Section 3.4*).

9. Partner Comments

(a) Borrower/implementing agency:
The draft ICR was reviewed by the Ministry of Energy of the Russian Federation. The Ministry agrees in principle with the findings of the Bank's report. English translation of the project completion report prepared by the Ministry is attached to this ICR as *Annex 8.*

(b) Cofinanciers:
N/A

(c) Other partners (NGOs/private sector):
N/A

10. Additional Information

10.1 Borrower's actions at the policy level to support energy efficiency and address project objectives.

The development of a national institutional and legal framework to increase the efficiency of energy use in the country has been considered a priority by GOR in recent years. A set of laws, procedural requirements and technical standards were put in place at the federal level, including 2 federal laws, 22 resolutions of the government, and 2 decrees of the president. In particular, these are the federal law "On Energy Efficiency" (1996); guidelines on the energy audit of enterprises (1999); government resolutions "On the urgent

measures to promote energy efficiency" (No 1087 of 10/02/95), "On increasing the efficiency of the use of energy resources and water by enterprises and organizations funded from the federal budget" (No 832 of 07/08/97), and "On additional measures to provide incentives for energy efficiency" (No 588 of 06/15/98). Twenty new regulatory acts are expected to be put in place in support of the federal law "On Energy Efficiency". The *Federal Program "Energy Efficiency in Russia"* was implemented in 1998 - 2001. The follow-up *Federal Program "Energy Efficient Economy"* for 2002 – 2005, recently launched by the government, supports a wide range of measures to strengthen efficiency in the production and utilization of energy. Increasing energy efficiency in the various sectors of national economy is also assigned the highest priority by the *Energy Strategy of Russia until 2020*, adopted by the government in 2000. Twenty six such sectoral programs are currently operative. Energy efficiency requirements are currently part of 314 federal standards (GOST) and 15 more federal standards are expected to be adopted soon. Existing construction standards (SNIP) are being revised to increase up to 1.5 – 2 times the requirements with respect to energy saving ability of residential and industrial buildings. They will also require more extensive use of heat metering and control equipment.

At the sub-national level, an institutional and legal framework to promote energy efficiency is also being established - 35 respective regional laws are effective, 362 resolutions on energy efficiency have been issued by the regional governments. Forty seven sub-national energy efficiency programs are under implementation. Strong efforts are being made to establish entities to support and monitor energy efficiency activities and to ensure that energy service companies have access to advanced technologies and equipment as well as the best operational practices. More than 50 regions have established energy efficiency centers, agencies and associations for that purpose, which operate either on a commercial or non-profit basis. Ten regional foundations to support energy efficiency activities are currently operative.

10.2 Summary description of the energy efficiency programs supported under the Project

a) Ryazan (loan cost - US$ 494,984; local co-financing – US$ 161,983; beneficiary - Unitary Enterprise "Ryazan Municipal Heating Networks")

The sub-loan has financed installation of heat meters and automatic control systems for heat sub-stations. Thus, 35 heat meters were installed at heat sub-stations, 6 centralized heat sub-stations were equipped with automatic controls. The sub-project was completed in 1998 and since then has resulted in annual economic cost savings of US$ 1.26 mln equivalent and financial cost savings of US$ 0.35 mln equivalent, fuel savings of 2.0 thousand conventional tonne per year, and GHG emissions reduction of 3.9 thousand tonne of CO2 annually.

Component	Description	EIRR
Contract EEP/RZN/IHM001	Heat meters	508%
Contract EEP/RZN/RCS003	Automation of 6 CHS	26.1%
All components total		**289%**

Component	Description	FIRR
Contract EEP/RZN/IHM001	Heat meters	241%
Contract EEP/RZN/RCS003	Automation of 6 CHS	17.3%
All components total		**82.9%**

Environmental savings	ton / year
CO2 - emissions savings	3,908
NOx - emissions savings	6
SO2 - emissions savings	0
Dust - emissions	0
Ash-emissions	0

Fuel savings of thousand conventional tonne per year	2.02

IBRD-loan	**USD**	**494,984**
Co-financing	**USD**	**161,983**

b) Semenov - Nizhny Novgorod region (loan cost - US$ 7,305,578; local co-financing – US$ 2,242,472; beneficiary - Municipal Unitary Enterprise “Teplovye Sety of Semenov”)

Activities have covered almost full rehabilitation of the heating system of the city. The installed equipment includes: (i) 30 automated container boiler houses with a total output of 116,7 megawatts; (ii) 20 kilometers of pre-insulated heating pipelines; (iii) instrumentation for the tuning of energy equipment and the energy and environmental audit; and (iv) 6 sets of meters and control instruments for heat and hot water supply. Results of the 2001-2002 heating season demonstrate high economic, financial and environmental efficiency of investments: economic cost savings of US$ 2.93 mln equivalent and financial cost savings of US$ 1.91 mln equivalent, fuel savings of 25.6 thousand conventional tonne, and CO2 emissions reduction of 30.7 thousand tonne.

Component	Description	EIRR
Contract EEP/SEM/BFE004A	Boilers for the city of Semenov	32.0%
Contract EEP/SEM/BFE004B	Boilers for the city of Semenov	36.9%
Contract EEP/SEM/BFE010	Boilers for the city of Semenov	27.0%
Contract EEP/SEM/CLD009	Meters for the city of Semenov	40.1%
Contract EEP/SEM/HEM005	DH and DHW pipes for the city of Semenov	3.2%
Contract EEP/SEM/BFE083A	Boilers for the Oblast of Nizny Novgorod	63.2%
Contract EEP/SEM/BFE083B	Boilers for the Oblast of Nizny Novgorod	35.0%
Contract EEP/SEM/OMO054	Mobile Laboratory Equipment for the Oblast area	469.5%
All components total		**34.7%**

Component	Description	FIRR
Contract EEP/SEM/BFE004A	Boilers for the city of Semenov	17.1%
Contract EEP/SEM/BFE004B	Boilers for the city of Semenov	22.6%
Contract EEP/SEM/BFE010	Boilers for the city of Semenov	14.0%
Contract EEP/SEM/CLD009	Meters for the city of Semenov	25.5%
Contract EEP/SEM/HEM005	DH and DHW pipes for the city of Semenov	-0.6%
Contract EEP/SEM/BFE083A	Boilers for the Oblast of Nizny Novgorod	28.2%
Contract EEP/SEM/BFE083B	Boilers for the Oblast of Nizny Novgorod	17.6%
Contract EEP/SEM/OMO054	Mobile Laboratory Equipment for the Oblast area	191.0%
All components total		**19.5%**

Environmental savings	ton/year
CO2 - emissions savings	30,744
NOx - emissions savings	50
SO2 - emissions savings	1,740
Dust - emissions	42
Ash-emissions	79

Fuel savings of thousand conventional tonne per year	**25.6**

IBRD-loan	**USD**	**7,305,578**
Co-financing	**USD**	**2,242,472**

c) Kaliningrad (loan cost - US$ 4,910,328; local co-financing – US$ 1,123,633; beneficiary - Municipal Heating Enterprise “Kaliningradteploset”)

The sub-project has addressed rehabilitation of the city’s main heat production facility, and upgrade of secondary heating facilities and distribution networks. Procured equipment includes: (i) water, heat and gas meters; (ii) equipment for the automated gas boiler house; (iii) 11 automated centralized heat sub-stations; (iv) 185 automated individual heat sub-stations; (v) 16 km of pre-insulated plastic hot water pipelines; (vi) automated control system for the combined heat and power plant; (vii) dispatch system for the heating facilities of the city; and (viii) emissions control equipment. The 2001-2002 heating season demonstrated economic savings of US$ 1.52 mln equivalent and financial savings of US$ 0.71 mln equivalent, fuel savings – 15.9 thousand conventional tonne, and CO2 emissions reduction – 38.3 thousand tonne. Most of the procured equipment have entered in operation in 2002, and economic cost savings of the 2002-2003 season are expected to exceed US$ 2.2 mln equivalent, corresponding financial savings - US$ 1.11 mln equivalent, fuel savings – 23.7 thousand conventional tonne, and CO2 emissions reduction – 52.5 thousand tonne.

Component	Description	EIRR
Contract EEP/KLN/HME014_SPM015_GME016_BAS021_HEM019	RTS"Severnaya" Heating Station	142.3%
Contract EEP/KLN/BFE017	Boiler House Emeljanova 300	75.5%
Contract EEP/KLN/CHS018_RCS020_CHS022	Central Heating Substations	25.6%
Contract EEP/KLN/CHS018A_WHE023	Central and Individual Heating Substations	20.3%
Contract EEP/KLN/HEM024	DHW pipelines	103.5%
All components total		**65.8%**

Component	Description	FIRR
Contract EEP/KLN/HME014_SPM015_GME016_BAS021_HEM019	RTS"Severnaya" Heating Station	31.0%
Contract EEP/KLN/BFE017	Boiler House Emeljanova 300	44.0%
Contract EEP/KLN/CHS018_RCS020_CHS022	Central Heating Substations	9.3%
Contract EEP/KLN/CHS018A_WHE023	Central and Individual Heating Substations	13.4%
Contract EEP/KLN/HEM024	DHW pipelines	37.9%
All components total		**18.7%**

Environmental savings	ton / year
CO2 - emissions savings	61,455
NOx - emissions savings	85
SO2 - emissions savings	89
Dust - emissions	18
Ash-emissions	15

Fuel savings of thousand conventional tonne per year	28.7

IBRD-loan	USD	4,910,328
Co-financing	USD	1,123,633

d) Archangelsk (loan cost - US$ 3,844,402; local co-financing – US$ 3,594,045; beneficiary - Government of Archangelsk, Communal Services Department)

Investments supported rehabilitation and replacement of the selected heating facilities, and construction of a heating main to ensure adequate heat supply to a remote city district. Procured equipment includes: (i) container boiler house and boilers, (ii) heat main (10 km) and distribution (30 km) pipelines, (iii) electric transformer sub-station, and (iv) equipment for making energy audits. The heating main, boiler equipment with a total output of 10 megawatt, and 0.8 km of heat distribution pipelines have been commissioned. The rest of the equipment is expected to enter into operation by the end of 2003. In 2001-2002 heating season economic cost savings amounted to US$ 0.48 mln equivalent, financial savings - US$ 0.28 mln equivalent, fuel savings – 3.6 thousand conventional tonne, and CO2 emissions reduction – 14.7 thousand tonne. In the 2003-2004 season economic savings are expected to exceed US$ 3.4 mln equivalent, financial savings - US$ 3.6 mln equivalent, fuel savings – 5.9 thousand conventional tonne, and CO2 emissions reduction – 22.5 thousand tonne.

Component	Description	EIRR
Component no 1	Distribution pipelines, disconnection of old boiler houses	52.8%
Component no 2	Distribution pipelines, disconnection of old boiler houses	273.5%
Component no 3	Heating mains, 1000 mm pipeline	14.7%
Component no 4	Mobile laboratory equipments	88.7%
Component no 5	New boilers	14.9%
Component no 6	Mobile boiler house + transformer	37.7%
All components total		**31.3%**

Component	Description	FIRR
Component no 1	Distribution pipelines, disconnection of old boiler houses	28.5%
Component no 2	Distribution pipelines, disconnection of old boiler houses	54.8%
Component no 3	Heating mains, 1000 mm pipeline	8.7%
Component no 4	Mobile laboratory equipments	51.7%
Component no 5	New boilers	12.3%
Component no 6	Mobile boiler house + transformer	32.4%
All components total		**22.1%**

Environmental savings	ton/year
CO2 - emissions savings	29,940
NOx - emissions savings	22
SO2 - emissions savings	514
Dust - emissions	62
Ash-emissions	56

Fuel savings of thousand conventional tonne per year	**7.0**

IBRD-loan	**USD**	**3,844,402**
Co-financing	**USD**	**3,594,045**

e) Environmental benefits

Projections for environmental benefits of sub-projects are summarized below.

Ryazan

Emissions savings		1998	1999	2000	2001	2002	2003	2004	2005
CO2									
CO2 - emissions savings	Ton/yr	0	0	0	2,036	3,908	3,908	3,908	3,908
NOx									
NOx - emissions savings	Ton/yr	0	0	0	3	6	6	6	6
SO2									
SO2 - emissions savings	Ton/yr	0	0	0	0	0	0	0	0
Dust									
Dust - emissions	Ton/yr	0	0	0	0	0	0	0	0
Ash									
Ash-emissions	Ton/yr	0	0	0	0	0	0	0	0

Semenov

Emissions savings		1998	1999	2000	2001	2002	2003	2004	2005
CO2									
CO2 - emissions savings	Ton/yr	0	2,008	18,847	30,338	29,074	29,777	30,744	30,744
NOx									
NOx - emissions savings	Ton/yr	0	4	33	52	46	48	50	50
SO2									
SO2 - emissions savings	Ton/yr	0	105	674	992	1,576	1,686	1,740	1,740
Dust									
Dust - emissions	Ton/yr	0	2	10	15	39	41	42	42
Ash									
Ash-emissions	Ton/yr	0	4	27	40	73	77	79	79

Kaliningrad

Emissions savings		1998	1999	2000	2001	2002	2003	2004	2005
CO2									
CO2 - emissions savings	Ton/yr	0	6,063	17,028	30,780	45,811	59,143	61,455	61,455
NOx									
NOx - emissions savings	Ton/yr	0	8	18	39	62	82	85	85
SO2									
SO2 - emissions savings	Ton/yr	0	18	156	134	111	89	89	89
Dust									
Dust - emissions	Ton/yr	0	4	19	19	19	18	18	18
Ash									
Ash-emissions	Ton/yr	0	3	17	16	15	15	15	15

Archangelsk

Emissions savings		1998	1999	2000	2001	2002	2003	2004	2005
CO2									
CO2 - emissions savings	Ton/yr	0	4,162	10,662	14,474	15,060	18,853	26,163	29,940
NOx									
NOx - emissions savings	Ton/yr	0	3	7	11	11	15	20	22
SO2									
SO2 - emissions savings	Ton/yr	0	69	180	249	260	329	452	514
Dust									
Dust - emissions	Ton/yr	0	9	23	30	31	37	53	62
Ash									
Ash-emissions	Ton/yr	0	8	20	27	28	34	48	56

10.3 Summary of revisions in project scope

In the course of implementation, the scope of activities under both project components was revised at Borrower's request as follows:

(i) The budget for Gas Sector Studies was reduced from the original US$ 10 mln to US$ 9.395 mln as of March 3, 2000, and further to US$ 7.872 mln as of January 23, 2002 reflecting the decreased estimated cost of activities. As of March 18, 2002, uncommitted TA funds were cancelled, bringing the budget of the component down to US$ 4.422 mln.

(ii) The budget for the Energy Efficiency Investments was increased from the original US$ 60 mln to US$ 60.605 as of March 3, 2000, to account for PIU operating expenses. The component was reduced to US$ 22.128 mln as of January 23, 2002 based on actual commitments under the credit line, since it became clear that no more on-lending would be feasible. It was further reduced to US$ 21.188 mln as of September 20, 2002, when the uncommitted TA funds were cancelled.

Annex 1. Key Performance Indicators/Log Frame Matrix

The *amount of savings in fuel* was established at appraisal as an indicator to assess the outcome of the energy efficiency investment program. Table below provides details on the projected in SAR and the actual annual savings from the project.

		Estimated annual savings from the project	
		Projected in SAR	Actual
Mazut	(tonne)	-	21,358
Coal	(tonne)	-	18,141
Gas	(1000 nm^3)	180,000	20,423
Electricity	(MWh)	-	3,636
Untreated water	(m^3)	-	1,306,950
Treated water	(m^3)	-	414,442

It was estimated at appraisal that the annual fuel savings from the Energy Efficiency Investment Component would be equivalent to gas savings of 180,000 MCM (1000 nm3). This projection was based on the assumption that the US$ 58 mln credit line will be disbursed in full. However, only US$ 16.6 mln of the credit line was disbursed, therefore, an equivalent of 51,517 MCM or 58.49 thousand of fuel conventional tonne, should be considered as target annual savings for the actual investment program of reduced scope. As indicated in a table below, the actual annual fuel savings from the completed sub-projects are estimated at the equivalent of 63.22 thousand conventional tonne, which exceeds the appraisal target.

Estimated annual fuel savings by sub-projects (in thousand conventional tonne)	
Ryazan	2.02
Semenov	25.6
Kaliningrad	28.6
Archangelsk	7.0
Total	63.22

Annex 2. Project Costs and Financing

Project Costs by Components
(US$ million equivalent)

Project Component	Appraisal Estimate	Actual/Latest Estimate	Percentage of Appraisal
Gas Sector Studies (Part A)	10.0	4.1	41%
Energy Efficiency Investments (Part B)	66.3	26.0	39%
Total	76.3	30.1	39%

Project Costs by Procurement Arrangements
(US$ million equivalent)
Appraisal Estimate

Expenditure Category	Procurement Method*			N.B.F.***	Total Cost
	ICB	NCB	Other**		
1. Goods	(52.0)	-	(6.0)	-	58.0
2. Services	-	-	(12.0)	6.3	18.3
Total	(52.0)	-	(18.0)	6.3	76.3

Actual/Latest Estimate

Expenditure Category	Procurement Method*			N.B.F.***	Total Cost
	ICB	NCB	Other**		
1. Goods	(14.7)	-	(1.9)	7.1	23.7
2. Services	-	-	(5.4)	0.4	5.8
3. Operating costs	-	-	(0.5)	0.1	0.6
Total	(14.7)	-	(7.8)	7.6	30.1

* Figures in parenthesis are the amounts financed by the IBRD Loan.
** Includes goods to be procured through international shopping and consulting services.
*** Not Bank Financed - co-financing for engineering, procurement and installation from the local executing agencies and the Government of Russia.

Project Financing by Component
(US$ million equivalent)

Component	Appraisal Estimate		Actual/Latest Estimate		Percentage of Appraisal	
	Bank	Govt.*	Bank	Govt.*	Bank	Govt.*
Gas Sector Studies	10.0	-	4.0	0.1	40%	-
Energy Efficiency Investments	60.0	6.3	18.5	7.5	31%	119%
Total	70.0	6.3	22.5	7.6	32%	120%

* Includes financing of engineering, procurement and installation by the local executing agencies and the Government of Russia.

Annex 3. Economic Costs and Benefits

1. Economic Summary

Economic Rates of Return

From the perspective of economic feasibility, all subprojects and their components yielded a high economic rate of return.

	Archangelsk	Kaliningard	Ryazan	Semenov
EIRR	31.3%	65.8%	289%	34.7%

Data used for Economic Benefits and Costs calculations

Savings in fuel consumption, electricity, treated water, untreated water, personnel and repair/maintenance costs were computed based on the difference in costs before and after investments, and valued at the economic price of the relevant items.

The lifetime of the individual investment items is estimated as follows: (i) boilers - 15 years; (ii) pipes - 15 years; (iii) individual heat substations (IHS) and centralized heat sub-stations (CHS) - 10 years; and (iv) mobile laboratory equipment - 5 years.

Main Assumptions

Price of gas. Russia possesses an amble indigenous supply of natural gas. Proven reserves total over 40 trillion cubic meters, while annual production is in order of 600 billion cubic meters. The super-giant fields in the Yamal Peninsula (Urengoy, Yamburg, Zapolyarnoe) represent a low-cost source of supply, which, despite their remoteness, allow Russia to compete effectively in European markets and also convey the benefit of low-cost energy to domestic consumers.

Unfortunately, little information is publicly available on the long-run incremental costs of gas production. Sources have cited the production costs in Yamal at as low as US$5.00 per 1000 cubic meters (MCM). While existing wells are slowly being depleted, it has been estimated that step-outs from these fields could be developed, which could maintain current production levels at costs in the order of US$7 - US$10 per MCM. The marginal cost of transmission to European Russia (a distance of approximately 2,500 km.) is estimated at between US$1.00 and US$1.50 per MCM per 100 km. While this is relatively high given that an extensive pipeline network is already in place, the transmission system crosses adverse terrain, and is reputed to be in poor condition and costly to maintain. Assuming a marginal production cost of US$10 per MCM, the economic value of gas delivered to Semenov would range from US$35 to US$47.5 per MCM, and delivered to Kaliningrad - from US$45 to US$57.5 per MCM.

An alternative economic value can be derived by calculating the net-back for exported gas delivered to European markets. Assuming a price of US$68 per MCM at the Finland border, and taking into account that transit fees are virtually zero, it gives approximately a value of US$55 - US$50 at the Russian border, and it can be estimated that the price in Kaliningrad will be the same. Transmission costs from the border to Semenov would reduce the value to approximately US$45 - US$50 at the city gate. However, the quantity of gas which Russia can export is capped by the desire of European countries to maintain diversified sources of supply. Hence, the net-back figure probably overstates the true economic value - the economic value of gas delivered to Kaliningrad is estimated at US$50, and of gas delivered to Semenov –

at US$40 per MCM.

Price of Heavy Oil (Mazut) and Coal. The economic prices of mazut and coal are assumed to be equivalent to their financial prices in market economies (mazut - US$140 per ton, and coal - US$62 per ton in average), adjusted to reflect the shadow prices of local inputs. The economic value of mazut is estimated at US$98 per ton delivered to Semenov, and at US$110 per ton delivered to Kaliningrad. The economic value of coal is estimated at US$58 per ton delivered to Semenov and at US$63 per ton delivered to Kaliningrad.

Price of Electricity. The economic price of electricity in Russia is depressed by the effect of current over-capacity in the system. Hence, in calculating the economic price based on long-run marginal cost, the discounted value approaches the short-run marginal cost of supply. The low cost of the primary thermal fuel (gas), together with the prevalence of co-generation (CHP plants account for approximately 40 percent of total capacity) further limit the economic value. Since no comprehensive analyses of long-run marginal cost of supply was carried out in Russia, the economic value of generation is taken as US$20 per MWh. Since there is less reserve capacity in the transmission network, the economic value is assumed to be US$10 per MWh. Distribution is assumed to be at US$30 per MWh, because of high distribution losses and the relatively bad condition of the network. The economic value of electricity is estimated at US$58 per MWh in Semenov and US$63 per MWh in Kaliningrad.

Price of Water. The economic price of water is estimated to be comparable to financial prices in market economies. The economic value of untreated water is estimated at US$0.40 per m3 and, of treated wate - at US$1.20 per m3.

Economic values

City	Electricity	Coal	Mazut	Gas	Treated water	Untreated water	Salary
	USD/MWh	USD/ton	USD/ton	USD/1000 nm^3	USD/m^3	USD/m^3	USD/ month
Semenov	58	58	98	40	1.2	0.4	500
Ryazan	60	60	100	45	1.2	0.4	500
Archangelsk	63	63	110	N/A	2.4	0.8	500
Kaliningrad	63	63	110	50	1.2	0.4	500

2. Financial Summary

Financial Rates of Return

From the perspective of financial feasibility, all sub-projects and their components yielded a high financial rate of return, despite the relatively low prices paid for energy supply – and the low economic cost of supply, which will tend to temper future energy price increases.

	Archangelsk	Kaliningard	Ryazan	Semenov
FIRR	22.1%	18.7%	83%	19.5%

Main assumptions – Financial Analysis

The table below indicates the assumptions used in the financial analysis for the inflation, ruble/US$ exchange rate, and fuel price increases.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Inflation in Russia	28%	89%	32%	21%	16%	12%	10%	8%	7%	6%
Exchange Rate RUR/US$	9.74	24.63	28.50	30.00	32.55	34.73	36.54	37.97	38.98	39.59
Fuel Price Increase	95%	100%	116%	195%	238%	271%	290%	309%	330%	351%

3. <u>Cost-Benefit Analysis, EIRR, FIRR and NPV by sub-projects</u>.

Ryazan

All contracts

Calculation of Economic Internal Rate of Return

EIRR	**288.8%**

Total Capital Costs, without VAT	662,107	US$
	662,107	US$
Project Start Date	1997	
Project In-Service Date	2002	
Project Useful Life	11	years

Expenditures without VAT

	1997	1998	1999	2000	2001	2002	2003
Total Expenditure in Real Prices in US$	**144,564**	**509,388**	**0**	**0**	**6,244**	**1,911**	**0**

Savings	1997	1998	1999	2000	2001	2002	2003	2004	2005
Operating costs									
Electricity									
- quantity of electricity (Mwh)	0	0	0	0	122	199	199	199	199
- cost of electricity ($ / Mwh)	60	60	60	60	60	60	60	60	60
Total electricity	0	0	0	0	7,262	11,904	11,904	11,904	11,904
Operating costs									
Total operating costs	0	0	0	0	7,262	11,904	11,904	11,904	11,904
Heat Purchases									
- quantity of purchased heat (GCal/yr)	0	39,438	78,876	78,876	86,250	93,031	93,031	93,031	93,031
- heat purchase price	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Purchased heat	0	631,009	1,262,018	1,262,018	1,379,998	1,488,494	1,488,494	1,488,494	1,488,494
Total Savings	0	631,009	1,262,018	1,262,018	1,387,260	1,500,398	1,500,398	1,500,398	1,500,398
Net cash flow	-144,564	121,621	1,262,018	1,262,018	1,381,016	1,498,487	1,500,398	1,500,398	1,500,398

Net Present Value (disount rate 12%)	US$
NPV electricity savings	34,948
NPV heat purchases	6,517,072
NPV total costs savings	6,552,019
NPV	6,012,352

Ryazan
All contracts

Value added tax	20%

Calculation of Financial Internal Rate of Return

FIRR	**82.9%**

Total Capital Costs	794,528	US$
Project Start Date	1997	
Project In-Service Date	2002	
Project Useful Life	11	years

Expenditures including VAT

	1997	1998	1999	2000	2001	2002	2003	Total
Total Expenditure in Real Prices in US$	**173,477**	**611,266**	**0**	**0**	**7,492**	**2,293**	**0**	**794,528**

Savings	1997	1998	1999	2000	2001	2002	2003	2004	2005
Operating costs									
Electricity									
- quantity of electricity (MWh)	0	0	0	0	122	199	199	199	199
- cost of electricity ($ / MWh)	41.07	16.24	21.05	28.67	29.19	31.27	31.75	32.56	33.81
Total electricity	0	0	0	0	3,548	6,231	6,326	6,489	6,738
Operating costs									
Total operating costs	0	0	0	0	3,548	6,231	6,326	6,489	6,738
Heat Purchases									
- quantity of purchased heat (GCal/yr)	0	39,438	78,876	78,876	86,250	93,031	93,031	93,031	93,031
- heat purchase price	8.02	11.31	4.47	3.87	4.82	6.08	7.52	8.57	9.16
Purchased heat	0	446,180	352,845	304,932	415,811	565,433	699,176	797,537	852,046
Total Savings	0	446,180	352,845	304,932	419,359	571,664	705,502	804,026	858,784
Net cash flow	-173,477	-165,086	352,845	304,932	411,866	569,371	705,502	804,026	858,784

Net Present Value (disount rate 10.5%)	US$
NPV electricity savings	21,900
NPV heat purchases	3,152,458
NPV total costs savings	3,174,358
NPV	2,510,940

Ryazan
Project Summary

	Total **US$**	Ryazan Contract EEP/RZN/IHM001 US$	Ryazan Contract EEP/RZN/RCS003 US$
Investment Costs Without VAT	**575,850**	144,564	431,286
Investment Cost with VAT and Custom Duties	**689,109**	173,477	515,632
Internal Rate of Return			
EIRR	**289%**	508.3%	26.1%
FIRR	**83%**	241.0%	17.3%

Net Present Value from Economic Analysis (discount rate 12%)	US$	US$	US$
NPV electricity savings	**34,948**		39,141
NPV heat purchases	**6,517,072**	5,094,508	731,839
NPV total costs savings	**6,552,019**	5,094,508	770,980
Net Present Value from Financial Analysis (discount rate 10.5%)	US$	US$	US$
NPV electricity savings	**21,900**		23,201
NPV heat purchases	**3,152,458**	2,218,641	653,169
NPV total costs savings	**3,174,358**	2,218,641	676,369

Semenov
All contracts
Calculation of Economic Internal Rate of Return

EIRR	34.7%

Total Capital Costs, without VAT	9,484,483	US$
	9,484,483	US$
Project Start Date	1998	
Project In-Service Date	2002	
Project Useful Life	17	years

Expenditures without VAT

	1998	1999	2000	2001	2002	2003	2004
Total Expenditure in Real Prices in US$	**1,312,494**	**3,100,389**	**2,958,520**	**1,913,498**	**199,583**	**0**	**0**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	1,499	9,639	14,184	20,032	21,617	22,376	22,376
- cost of fuel ($ / ton)	98.00	98.00	98.00	98.00	98.00	98.00	98.00	98.00
- Subtotal	0	146,902	944,637	1,390,042	1,963,165	2,118,451	2,192,809	2,192,809
Coal								
- quantity of fuel (ton)	0	0	0	0	3,115	3,115	3,115	3,115
- cost of fuel ($ / ton)	58.00	58.00	58.00	58.00	58.00	58.00	58.00	58.00
- Subtotal	0	0	0	0	180,670	180,670	180,670	180,670
Gas								
- quantity of fuel (1000nm3)	0	-1,236	-5,247	-6,536	-19,916	-21,869	-22,518	-22,518
- cost of fuel ($ / 1000nm3)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
- Subtotal	0	-49,446	-209,892	-261,441	-796,658	-874,764	-900,700	-900,700
total fuel costs	0	97,456	734,745	1,128,601	1,347,177	1,424,357	1,472,778	1,472,778
Operating costs								
Untreated Water								
- quantity of water (m3)	1,576	721	6,834	-70,438	-388,263	-384,839	-383,893	-383,893
- cost of water ($ / m3)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
- Subtotal	630	288	2,734	-28,175	-155,305	-153,936	-153,557	-153,557
Treated Water								
- quantity of water (m3)	0	0	0	0	191,982	191,982	191,982	191,982
- cost of water ($ / m3)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
- Subtotal	0	0	0	0	230,378	230,378	230,378	230,378
Total water	630	288	2,734	-28,175	75,073	76,443	76,821	76,821
Electricity								
- quantity of electricity (Mwh)	0	-67	-50	-706	-745	-694	-660	-660
- cost of electricity ($ / Mwh)	58	58	58	58	58	58	58	58
Total electricity	0	-3,858	-2,877	-40,926	-43,196	-40,226	-38,298	-38,298
Operating costs								
Total operating costs	630	-3,570	-143	-69,101	31,877	36,217	38,523	38,523
Maintenance and repair spare part costs								
Repair savings								
Total repair costs savings	0	2,955	23,803	47,042	96,256	101,408	106,428	110,924
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	0	159	313	862	1,008	1,008	1,008
- salaries of personnel ($)	500.00	500.00	500.00	500.00	500.00	500	500	500
total personnel	0	0	79,658	156,415	430,970	503,957	503,957	503,957
Total maintenance and repair costs	0	2,955	103,462	203,457	527,225	605,365	610,385	614,881
Additional heat sales								
- quantity of additional heat sales (GCal/yr)	0	7,330	17,457	21,625	25,517	31,376	32,175	32,175
- heat sales price	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Additional heat sales	0	153,930	366,587	454,130	535,852	658,890	675,683	675,683
Heat Purchases								
- quantity of purchased heat (GCal/yr)	313	1,180	3,270	23,878	43,969	44,046	44,075	44,075
- heat purchase price	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Purchased heat	6,565	24,784	68,677	501,431	923,340	924,969	925,576	925,576
Avoided Investment	0	19,173	76,672	120,349	148,822	171,894	185,381	0
Residual Value of decommissioned equipmen	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	7,195	294,728	1,349,999	2,338,867	3,514,294	3,821,691	3,908,327	3,727,442
Net cash flow	-1,305,298	-2,805,661	-1,608,521	425,369	3,314,711	3,821,691	3,908,327	3,727,442

Net Present Value (discount rate 12%)	US$
NPV fuel cost savings	6,465,328
NPV water savings (treated and untreated)	318,658
NPV electricity savings	-201,293
NPV O&M savings	2,857,376
NPV heat purchases	4,372,788
NPV total costs savings	17,794,676
NPV	10,716,069

Semenov
All contracts

Value added tax	20%

Calculation of Financial Internal Rate of Return

FIRR	**19.5%**

Total Capital Costs	11,381,380	US$
Project Start Date	1998	
Project In-Service Date	2002	
Project Useful Life	17	years

Expenditures including VAT

	1998	1999	2000	2001	2002	2003	2004	Total
Total Expenditure in Real Prices in US$	**1,574,992**	**3,720,467**	**3,550,224**	**2,296,198**	**239,499**	**0**	**0**	**11,381,380**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	1,499	9,639	14,184	20,032	21,617	22,376	22,376
- cost of fuel ($ / ton)	53.99	30.56	45.40	52.57	61.45	58.83	59.73	61.27
- Subtotal	0	45,804	437,651	745,611	1,230,931	1,271,719	1,336,598	1,370,956
Coal								
- quantity of fuel (ton)	0	0	0	0	3,115	3,115	3,115	3,115
- cost of fuel ($ / ton)	43.79	15.31	16.32	28.50	30.79	31.41	31.89	32.71
- Subtotal	0	0	0	0	95,896	97,837	99,341	101,895
Gas								
- quantity of fuel (1000nm3)	0	-1,236	-5,247	-6,536	-19,916	-21,869	-22,518	-22,518
- cost of fuel ($ / 1000nm3)	25.67	11.81	12.36	13.18	19.57	22.75	23.10	23.69
- Subtotal	0	-14,605	-64,882	-86,145	-389,686	-497,461	-520,086	-533,455
total fuel	0	31,199	372,769	659,466	937,140	872,096	915,853	939,396
Operating costs								
Untreated Water								
- quantity of water (m3)	1,576	721	6,834	-70,438	-388,263	-384,839	-383,893	-383,893
- cost of water ($ / m3)	0.18	0.09	0.08	0.15	0.17	0.18	0.18	0.19
- Subtotal	280	67	549	-10,566	-65,019	- 68,889	- 69,776	- 71,570
Treated Water								
- quantity of water (m3)	0	0	0	0	191,982	191,982	191,982	191,982
- cost of water ($ / m3)	0.52	0.27	0.23	0.44	0.49	0.52	0.53	0.54
- Subtotal	0	0	0	0	93,234	99,662	101,194	103,796
Total water	280	67	549	-10,566	28,215	30,773	31,418	32,226
Electricity								
- quantity of electricity (MWh)	0	-67	-50	-706	-745	-694	-660	-660
- cost of electricity ($ / MWh)	41.07	18.68	23.86	29.67	34.41	35.96	36.51	37.45
Total electricity	0	-1,242	-1,183	-20,934	-25,627	-24,938	-24,108	-24,728
Operating costs								
Total operating costs	280	-1,175	-634	-31,499	2,588	5,834	7,310	7,498
Maintenance and repair spare part costs								
Repair costs								
Total repair costs	0	3,546	28,564	56,450	115,507	121,689	127,713	133,108
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	0	159	313	862	1,008	1,008	1,008
- salaries of personnel ($)	143.75	91.35	87.72	146.67	161.52	174.62	188.05	201.32
total personnel	0	0	13,975	45,882	139,219	176,002	189,540	202,915
Total maintenance and repair costs	0	3,546	42,539	102,332	254,725	297,692	317,253	336,023
Additional heat sales								
- quantity of additional heat sales (GCal/yr)	0	7,330	17,457	21,625	25,517	31,376	32,175	32,175
- heat sales price	20.74	15.18	13.82	13.37	11.58	12.38	12.57	12.89
Additional heat sales	0	111,304	241,328	289,058	295,556	388,472	404,500	414,898
Heat Purchases								
- quantity of purchased heat (GCal/yr)	313	1,180	3,270	23,878	43,969	44,046	44,075	44,075
- heat purchase price	24.89	18.22	16.59	16.04	13.90	14.86	15.09	15.47
Purchased heat	7,781	21,505	54,253	382,998	611,136	654,419	664,918	682,011
Avoided Investment	0	23,008	92,007	144,419	178,586	206,273	222,457	0
Residual Value of decommissioned equipment	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	8,061	189,386	802,262	1,546,773	2,279,732	2,424,786	2,532,291	2,379,825
Net cash flow	-1,566,932	-3,531,080	-2,747,962	-749,424	2,040,232	2,424,786	2,532,291	2,379,825

Net Present Value (disount rate 10.5%)	US$
NPV fuel cost savings	5,100,127
NPV water savings (treated and untreated)	182,575
NPV electricity savings	-160,507
NPV O&M savings	2,037,956
NPV heat purchases	4,226,302
NPV total costs savings	14,789,973
NPV	6,000,830

Semenov
Project Summary

	Total	Semenov Contract EEP/SEM/BFE004A	Semenov Contract EEP/SEM/BFE004B	Semenov Contract EEP/SEM/BFE010	Component 4 Contract EEP/SEM/BFE083A	Component 5 Contract EEP/SEM/BFE083B	Component 6 Contract EEP/SEM/CLD009
	US$	US$	US$	US$	US$	US$	US$
Investment Costs Without VAT	**8,277,764**	2,609,180	2,038,045	609,067	1,133,583	1,781,319	106,571
Investment Cost with VAT and Custom Duties	**9,872,664**	3,131,016	2,385,000	730,880	1,360,300	2,137,582	127,885
Internal Rate of Return							
EIRR	**34.7%**	32.0%	36.9%	27.0%	63.2%	35.0%	40.1%
FIRR	**19.5%**	17.1%	22.6%	14.0%	28.2%	17.6%	25.5%
Net Present Value from Economic Analysis (discount rate 12%)	US$	US$	US$	US$	US$	US$	US$
NPV fuel cost savings	**6,465,328**	1,700,663	1,727,748	851,792	-856,250	1,436,960	0
NPV water savings (treated and untreated)	**318,658**	32,066	52,312	16,164	-424,005	642,120	0
NPV electricity savings	**-201,293**	-118,680	28,318	32,310	-350,573	207,330	0
NPV O&M savings	**2,857,376**	667,442	1,064,226	259,441	-132,556	998,823	0
NPV heat purchases	**4,372,788**	1,877,889	1,636,490	65,709	5,466,703	0	229,697
NPV total costs savings	**17,794,676**	4,425,704	4,644,501	1,225,417	3,703,320	3,285,234	229,697
Net Present Value from Financial Analysis (discount rate 10.5%)	US$	US$	US$	US$	US$	US$	US$
NPV fuel cost savings	**5,100,127**	1,407,880	1,514,629	591,684	-669,991	1,187,888	0
NPV water savings (treated and untreated)	**182,575**	20,512	31,294	10,181	-258,981	379,502	0
NPV electricity savings	**-160,507**	-97,313	24,685	25,952	-290,593	176,763	0
NPV O&M savings	**2,037,956**	503,203	795,688	184,724	-90,443	643,408	0
NPV heat purchases	**4,226,302**	1,484,343	1,350,428	52,546	3,723,803	0	211,129
NPV total costs savings	**14,789,973**	3,659,835	3,891,716	865,086	2,413,795	2,387,560	211,129

Kaliningrad
All contracts
Calculation of Economic Internal Rate of Return

EIRR	65.8%

Total Capital Costs, without VAT	5,383,737	US$
	5,383,737	US$
Project Start Date	1998	
Project In-Service Date	2002	
Project Useful Life	17	years

Expenditures without VAT

	1998	1999	2000	2001	2002	2003	2004
Total Expenditure in Real Prices in US$	**101,771**	**641,732**	**259,846**	**2,047,341**	**1,659,904**	**587,007**	**86,137**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	-318	-636	-954	-1,271	-1,589	-1,589	-1,589
- cost of fuel ($ / ton)	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00
- Subtotal	0	-34,965	-69,929	-104,894	-139,858	-174,823	-174,823	-174,823
Coal								
- quantity of fuel (ton)	0	716	3,580	3,580	3,580	3,580	3,580	3,580
- cost of fuel ($ / ton)	62.64	62.64	62.64	62.64	62.64	62.64	62.64	62.64
- Subtotal	0	44,845	224,226	224,226	224,226	224,226	224,226	224,226
Gas								
- quantity of fuel (1000nm3)	0	2,201	3,588	10,304	17,602	24,127	25,180	25,180
- cost of fuel ($ / 1000nm3)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
- Subtotal	0	110,050	179,420	515,205	880,120	1,206,362	1,258,985	1,258,985
total fuel costs	0	119,931	333,717	634,537	964,487	1,255,765	1,308,388	1,308,388
Operating costs								
Untreated Water								
- quantity of water (m3)	0	3,375	10,397	270,407	481,617	820,572	820,572	820,572
- cost of water ($ / m3)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
- Subtotal	0	1,350	4,159	108,163	192,647	328,229	328,229	328,229
Treated Water								
- quantity of water (m3)	0	28,649	58,044	94,433	148,591	194,760	194,760	194,760
- cost of water ($ / m3)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
- Subtotal	0	34,379	69,653	113,320	178,309	233,712	233,712	233,712
Total water	0	35,729	73,812	221,482	370,956	561,941	561,941	561,941
Electricity								
- quantity of electricity (Mwh)	0	319	661	972	1,282	1,593	1,593	1,593
- cost of electricity ($ / Mwh)	63	63	63	63	63	63	63	63
Total electricity	0	19,960	41,393	60,861	80,330	99,798	99,798	99,798
Operating costs								
Total operating costs	0	55,688	115,204	282,343	451,286	661,739	661,739	661,739
Maintenance and repair spare part costs								
Repair savings								
Total repair costs savings	0	0	49,641	125,335	164,622	172,792	180,663	187,778
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	55	226	266	427	564	564	564
- salaries of personnel ($)	500.00	500.00	500.00	500.00	500.00	500	500	500
total personnel	0	27,600	112,800	133,200	213,600	282,000	282,000	282,000
Total maintenance and repair costs	0	27,600	162,441	258,535	378,222	454,792	462,663	469,778
Additional heat sales								
- quantity of additional heat sales (GCal/yr)	0	0	0	0	901	1,801	3,288	-36,212
- heat sales price	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Additional heat sales	0	0	0	0	18,915	37,831	69,046	-760,454
Heat Purchases								
- quantity of purchased heat (GCal/yr)	0	0	0	0	0	0	0	0
- heat purchase price	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
Purchased heat	0	0	0	0	0	0	0	0
Avoided Investment	0	150	1,195	7,706	34,759	79,528	100,869	96,952
Residual Value of decommissioned equipment	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	0	203,369	612,557	1,183,121	1,847,669	2,489,656	2,602,705	1,776,404
Net cash flow	-101,771	-438,362	352,711	-864,219	187,765	1,902,649	2,516,569	1,776,404

Net Present Value (disount rate 12%)	US$
NPV fuel cost savings	6,149,937
NPV water savings (treated and untreated)	2,503,656
NPV electricity savings	515,320
NPV O&M savings	2,260,865
NPV heat purchases	0
NPV total costs savings	9,617,938
NPV	6,251,178

Kaliningrad
All contracts

Value added tax	20%

Calculation of Financial Internal Rate of Return

FIRR	**18.7%**

Total Capital Costs	6,460,484	US$
Project Start Date	1998	
Project In-Service Date	2002	
Project Useful Life	17	years

Expenditures including VAT

	1998	1999	2000	2001	2002	2003	2004	Total
Total Expenditure in Real Prices in US$	**122,125**	**770,078**	**311,815**	**2,456,809**	**1,991,885**	**704,408**	**103,364**	**6,460,484**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	-318	-636	-954	-1,271	-1,589	-1,589	-1,589
- cost of fuel ($ / ton)	53.99	30.56	45.40	52.57	61.45	58.83	59.73	61.27
- Subtotal	0	-9,713	-28,864	-50,127	-78,127	-93,499	-94,936	-97,377
Coal								
- quantity of fuel (ton)	0	716	3,580	3,580	3,580	3,580	3,580	3,580
- cost of fuel ($ / ton)	42.98	21.48	22.31	30.19	35.31	37.04	37.60	38.57
- Subtotal	0	15,376	79,877	108,055	126,388	132,572	134,610	138,070
Gas								
- quantity of fuel (1000nm3)	0	2,201	3,588	10,304	17,602	24,127	25,180	25,180
- cost of fuel ($ / 1000nm3)	31.89	12.75	13.98	17.61	20.23	24.55	24.92	25.56
- Subtotal	0	28,060	50,162	181,404	356,112	592,205	627,541	643,672
total fuel	0	33,724	101,175	239,332	404,374	631,278	667,215	684,366
Operating costs								
Untreated Water								
- quantity of water (m3)	0	3,375	10,397	270,407	481,617	820,572	820,572	820,572
- cost of water ($ / m3)	0.14	0.08	0.11	0.12	0.14	0.15	0.15	0.15
- Subtotal	0	258	1,116	33,350	66,213	120,589	122,444	125,591
Treated Water								
- quantity of water (m3)	0	28,649	58,044	94,433	148,591	194,760	194,760	194,760
- cost of water ($ / m3)	0.43	0.38	0.54	0.62	0.69	0.73	0.75	0.77
- Subtotal	0	10,934	31,160	58,234	102,142	143,107	145,308	149,043
Total water	0	11,191	32,277	91,584	168,354	263,697	267,752	274,634
Electricity								
- quantity of electricity (MWh)	0	319	661	972	1,282	1,593	1,593	1,593
- cost of electricity ($ / MWh)	26.70	10.56	11.58	16.00	20.58	20.32	20.64	21.17
Total electricity	0	3,364	7,651	15,546	26,398	32,380	32,878	33,723
Operating costs								
Total operating costs	0	14,555	39,928	107,129	194,752	296,077	300,630	308,358
Maintenance and repair spare part costs								
Repair costs								
Total repair costs	0	0	59,569	150,402	197,546	207,351	216,796	225,334
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	55	226	266	427	564	564	564
- salaries of personnel ($)	110.90	66.50	79.88	96.41	108.24	119.29	130.96	142.92
total personnel	0	3,671	18,021	25,684	46,239	67,279	73,861	80,609
Total maintenance and repair costs	0	3,671	77,590	176,087	243,785	274,630	290,657	305,943
Additional heat sales								
- quantity of additional heat sales (GCal/yr)	0	0	0	0	901	1,801	3,288	-36,212
- heat sales price	20.74	15.18	13.82	13.37	11.58	12.38	12.57	12.89
Additional heat sales	0	0	0	0	10,433	22,304	41,335	-466,950
Heat Purchases								
- quantity of purchased heat (GCal/yr)	0	0	0	0	0	0	0	0
- heat purchase price	24.89	18.22	16.59	16.04	13.90	14.86	15.09	15.47
Purchased heat	0	0	0	0	0	0	0	0
Avoided Investment	0	180	1,434	9,247	41,710	95,434	121,043	116,343
Residual Value of decommissioned equipment	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	0	52,130	220,127	531,795	895,055	1,319,724	1,420,879	948,059
Net cash flow	-122,125	-717,948	-91,688	-1,925,013	-1,096,830	615,315	1,317,515	948,059

Net Present Value (disount rate 10.5%)	US$
NPV fuel cost savings	4,069,288
NPV water savings (treated and untreated)	1,581,422
NPV electricity savings	220,493
NPV O&M savings	1,789,360
NPV heat purchases	0
NPV total costs savings	6,105,832
NPV	1,838,253

Kaliningrad
Project Summary

	Total	Kaliningrad Contract EEP/KLN/HME014_SPM015_GME016_BAS021_HEM019	Kaliningrad Contract EEP/KLN/BFE017	Kaliningrad Contract EEP/KLN/CHS018A_WHE023	Component 4 Contract EEP/KLN/HEM024
	US$	US$	US$	US$	US$
Investment Costs Without VAT	**3,704,971**	1,361,013	659,061	738,835	946,061
Investment Cost with VAT and Custom Duties	**4,130,796**	1,633,215	475,705	886,602	1,135,274
Internal Rate of Return					
EIRR	**65.8%**	142.3%	75.5%	20.3%	103.5%
FIRR	**18.7%**	31.0%	44.0%	13.4%	37.9%

Net Present Value from Economic Analysis (discount rate 12%)	US$	US$	US$	US$	US$
NPV fuel cost savings	**6,149,937**	2,279,991	928,988	466,638	1,930,894
NPV water savings (treated and untreated)	**2,503,656**	898,772	22,974	0	1,296,701
NPV electricity savings	**515,320**	500,737	14,583	0	0
NPV O&M savings	**2,260,865**	393,367	833,860	0	860,462
NPV heat purchases	**0**	-2,410,267	0	246,585	0
NPV total costs savings	**9,617,938**	1,669,983	1,800,405	873,730	4,090,571
Net Present Value from Financial Analysis (discount rate 10.5%)	US$	US$	US$	US$	US$
NPV fuel cost savings	**4,069,288**	1,380,983	1,360,288	514,477	1,283,920
untreated)	**1,581,422**	709,598	12,978	0	662,072
NPV electricity savings	**220,493**	214,611	5,870	0	0
NPV O&M savings	**1,789,360**	334,053	575,088	0	817,762
NPV heat purchases	**0**	0	0	206,222	0
NPV total costs savings	**6,105,832**	2,664,952	1,954,224	908,364	2,767,140

Arkhangelsk
All contracts
Calculation of Economic Internal Rate of Return

EIRR	**31.3%**

Total Capital Costs, without VAT	6,477,454	US$
	6,477,454	US$
Project Start Date	1998	
Project In-Service Date	2004	
Project Useful Life	20	years

Expenditures without VAT

	1998	1999	2000	2001	2002	2003	2004
Total Expenditure in Real Prices in US$	**1,414,710**	**799,650**	**1,561,240**	**1,393,378**	**780,100**	**425,745**	**102,630**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	0	0	0	83	369	571	571
- cost of fuel ($ / ton)	110.00	110.00	110.00	110.00	110.00	110.00	110.00	110.00
- Subtotal	0	0	0	0	9,141	40,557	62,832	62,832
Coal								
- quantity of fuel (ton)	0	1,767	4,285	5,509	5,613	6,820	9,736	11,446
- cost of fuel ($ / ton)	62.64	62.64	62.64	62.64	62.64	62.64	62.64	62.64
- Subtotal	0	110,687	268,385	345,055	351,587	427,184	609,894	716,970
total fuel costs	0	110,687	268,385	345,055	360,728	467,741	672,726	779,802
Operating costs								
Untreated Water								
- quantity of water (m3)	0	34,888	38,038	38,038	38,038	68,740	100,964	102,485
- cost of water ($ / m3)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
- Subtotal	0	27,910	30,430	30,430	30,430	54,992	80,771	81,988
Treated Water								
- quantity of water (m3)	0	0	0	0	100	13,950	27,700	27,700
- cost of water ($ / m3)	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
- Subtotal	0	0	0	0	240	33,480	66,480	66,480
Total water	0	27,910	30,430	30,430	30,670	88,472	147,251	148,468
Electricity								
- quantity of electricity (Mwh)	0	238	341	341	341	755	1,836	2,504
- cost of electricity ($ / Mwh)	58	58	58	58	58	58	58	58
Total electricity	0	13,790	19,805	19,805	19,805	43,773	106,464	145,206
Operating costs								
Total operating costs	0	41,700	50,235	50,235	50,475	132,245	253,715	293,674
Maintenance and repair spare part costs								
Repair savings								
Total repair costs savings	0	3,674	7,349	7,349	9,397	42,453	80,585	88,939
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	108	216	216	216	588	1,104	1,656
- salaries of personnel ($)	500.00	500.00	500.00	500.00	500.00	500	500	500
total personnel	0	54,000	108,000	108,000	108,000	294,000	552,000	828,089
Total maintenance and repair costs	0	57,674	115,349	115,349	117,397	336,453	632,585	917,028
Heat Purchases								
- quantity of purchased heat (GCal/yr)	0	-3,456	-6,911	-6,911	-6,911	-9,143	-15,359	-19,344
- heat purchase price	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Purchased heat	0	-63,929	-127,857	-127,857	-127,857	-169,140	-284,141	-357,858
Avoided Investment	0	0	0	41,829	138,840	5,419,064	1,419,985	356,608
Residual Value of decommissioned equipment	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	0	146,133	306,112	424,610	539,583	6,186,363	2,694,870	1,989,254
Net cash flow	-1,414,710	-653,517	-1,255,129	-968,768	-240,517	5,760,618	2,592,240	1,989,254

Net Present Value (disount rate 12%)	US$
NPV fuel cost savings	3,338,105
NPV water savings (treated and untreated)	601,527
NPV electricity savings	543,348
NPV O&M savings	3,457,957
NPV heat purchases	-1,560,900
NPV total costs savings	10,826,174
NPV	6,224,017

Arkhangelsk
All contracts

Value added tax	20%

Calculation of Financial Internal Rate of Return

FIRR	**22.1%**

Total Capital Costs	7,772,945	US$
Project Start Date	1998	
Project In-Service Date	2004	
Project Useful Life	20	years

Expenditures including VAT

	1998	1999	2000	2001	2002	2003	2004	Total
Total Expenditure in Real Prices in US$	**1,697,652**	**959,580**	**1,873,488**	**1,672,054**	**936,120**	**510,894**	**123,156**	**7,772,945**

Savings	1998	1999	2000	2001	2002	2003	2004	2005
Fuel Cost								
Mazut								
- quantity of fuel (ton)	0	0	0	0	83	369	571	571
- cost of fuel ($ / ton)	110.00	54.59	54.86	96.67	98.32	105.09	106.71	109.45
- Subtotal	0	0	0	0	8,170	38,748	60,952	62,519
Coal								
- quantity of fuel (ton)	0	1,767	4,285	5,509	5,613	6,820	9,736	11,446
- cost of fuel ($ / ton)	46.21	14.21	15.16	29.87	29.34	31.27	31.75	32.56
- Subtotal	0	25,110	64,945	164,522	164,686	213,235	309,118	372,730
total fuel	0	25,110	64,945	164,522	172,856	251,983	370,071	435,249
Operating costs								
Untreated Water								
- quantity of water (m3)	0	34,888	38,038	38,038	38,038	68,740	100,964	102,485
- cost of water ($ / m3)	0.57	0.36	0.47	0.48	0.48	0.63	0.66	0.69
- Subtotal	0	12,592	17,831	18,296	18,113	43,359	66,585	70,250
Treated Water								
- quantity of water (m3)	0	0	0	0	100	13,950	27,700	27,700
- cost of water ($ / m3)	1.66	1.05	1.36	1.39	1.38	1.83	1.91	1.99
- Subtotal	0	0	0	0	138	25,518	52,978	55,064
Total water	0	12,592	17,831	18,296	18,251	68,877	119,563	125,314
Electricity								
- quantity of electricity (MWh)	0	238	341	341	341	755	1,836	2,504
- cost of electricity ($ / MWh)	26.70	14.62	19.65	20.00	21.51	25.91	28.57	29.31
Total electricity	0	3,475	6,709	6,829	7,344	19,557	52,449	73,374
Total operating costs	0	16,068	24,540	25,125	25,595	88,434	172,012	198,689
Maintenance and repair spare part costs								
Repair costs								
Total repair costs	0	4,409	8,819	8,819	11,276	50,943	96,702	106,727
Maintenance and repair personnel costs								
- maintenance personnel (man-month)	0	108	216	216	216	588	1,104	1,656
- salaries of personnel ($)	211.32	99.80	114.84	117.23	132.58	144.73	157.38	170.12
total personnel	0	10,778	24,806	25,322	28,638	85,102	173,744	281,746
Total maintenance and repair costs	0	15,187	33,625	34,141	39,915	136,045	270,446	388,472
Heat Purchases								
- quantity of purchased heat (GCal/yr)	0	-3,456	-6,911	-6,911	-6,911	-9,143	-15,359	-19,344
- heat purchase price	18.50	5.85	4.42	7.20	8.63	10.50	11.43	11.72
Purchased heat	0	-20,203	-30,555	-49,761	-59,624	-96,033	-175,544	-226,771
Avoided Investment	0	0	0	50,195	166,608	6,502,877	1,703,982	427,930
Residual Value of decommissioned equipment	0	0	0	0	0	0	0	0
Residual Value of Investment after 2020								
Total Savings	0	36,162	92,555	224,221	345,350	6,883,306	2,340,966	1,223,569
Net cash flow	-1,697,652	-923,418	-1,780,933	-1,447,833	-590,770	6,372,411	2,217,810	1,223,569

Net Present Value (disount rate 10.5%)	US$
NPV fuel cost savings	2,331,233
NPV water savings (treated and untreated)	605,658
NPV electricity savings	389,777
NPV O&M savings	2,248,959
NPV heat purchases	-1,255,802
NPV total costs savings	10,223,946
NPV	4,481,572

Arkhangelsk
Project Summary

	Total	Arkhangelsk	Arkhangelsk	Arkhangelsk	Component 4	Component 5	Component 6
		Contract EEP/ARO/HEM/042C	Contract EEP/ARO/HEM/042B	Contract EEP/ARO/HEM/042A and EEP/ARO/HEM/042D	Contract EEP/ARO/CMA/038	Contract EEP/ARO/BFE/039	Contract EEP/ARO/BFE/043 and EEP/ARO/PWS/045
	US$	US$	US$	US$	US$	US$	US$
Investment Costs Without VAT	**6,477,454**	701,207	108,485	4,046,084	163,283	474,803	983,592
Investment Cost with VAT and Custom Duties	**7,772,945**	841,448	130,182	4,855,301	195,939	569,764	1,180,310
Internal Rate of Return							
EIRR	**31.3%**	52.8%	273.5%	14.7%	88.7%	14.9%	37.7%
FIRR	**22.1%**	28.5%	54.8%	8.7%	51.7%	12.3%	32.4%
Net Present Value from Economic Analysis (discount rate 12%)	US$	US$	US$	US$	US$	US$	US$
NPV fuel cost savings	**3,338,105**	1,272,978	1,130,672	47,931	647,570	73,945	165,009
NPV water savings (treated and untreated)	**601,527**	18,968	30,615	1,685	134,606	1,941	413,712
NPV electricity savings	**543,348**	356,299	73,069	26,788	41,223	0	45,969
NPV O&M savings	**3,457,957**	1,492,994	700,666	112,576	0	15,601	1,136,120
NPV heat purchases	**-1,560,900**	-737,068	-776,646	-47,186	0	0	0
NPV total costs savings	**10,826,174**	2,404,170	1,158,376	3,230,924	1,091,706	456,478	2,484,521
Net Present Value from Financial Analysis (discount rate 10%)	US$	US$	US$	US$	US$	US$	US$
NPV fuel cost savings	**2,331,233**	995,423	670,489	40,146	349,536	83,767	191,872
NPV water savings (treated and untreated)	**605,658**	20,973	27,204	1,925	105,044	1,974	448,537
NPV electricity savings	**389,777**	273,351	41,368	21,902	18,898	0	34,258
NPV O&M savings	**2,248,959**	1,032,829	337,787	82,317	0	21,543	774,482
NPV heat purchases	**-1,255,802**	-684,957	-524,966	-45,879	0	0	0
NPV total costs savings	**10,223,946**	1,637,619	551,882	3,456,919	829,349	527,278	2,466,599

Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
Month/Year	Count	Specialty	Implementation Progress	Development Objective
Identification/Preparation				
09-10/1992	*1*	Senior Energy Economist (TM)		
03/1993	*2*	Senior Energy Economist (TM), Consultant		
06/1993 (pre-appraisal)	*8*	Senior Energy Economist (TM), Economist, Energy Specialist (engineering), Energy Specialist (energy conservation), Senior Counsel, Consultant (financial analysis), Consultant (institutional analysis), Consultant (environmental issues)		
Appraisal/Negotiation				
03-04/1994 (appraisal)	*13*	Senior Energy Economist (TM), Energy Economist (financial analysis), Economist (financial analysis), Economist (risk analysis), Energy Specialists (2) (engineering), Environmental Specialist**, Senior Counsel, Consultant (procurement), Consultant (environmental issues), Consultants (2) (institutional analysis), Consultant (energy conservation)		
05/1994 (post-appraisal)	*3*	Senior Energy Economist (TM), Energy Economist, Consultant		
10-11/1994 (post-appraisal)	*2*	Senior Energy Economist (TM), Energy Economist		
02-03/1995 (negotiations at Bank HQ)	*8*	Division Chief, Senior Energy Economist (TM), Energy Economist, Senior Energy Specialist, Senior Counsel, Senior Disbursement Officer, Consultant (engineering), Consultant (district heating)		
Supervision				
06/1995	*2*	Senior Energy Economist (TM), Energy Economist	S	S
12/1995	*2*	Senior Energy Economist (TM), Engineer	U	S
06/1995	*9*	Senior Energy Economist (TM),	U	U

		Energy Economist (financial analysis), Heating Specialist (engineer), Environmental Specialist, Energy Specialist, IT Specialist, Operations Officer **, Disbursement Oficcer **, Procurement Specialist **		
11/1996	*7*	Senior Energy Economist (TM), Energy Economist, Heating Specialist (engineer), Financial Analyst, Environmental Specialist, Operations Officer**, Disbursement Specialist**	U	U
02/1997	*3*	Senior Energy Economist (TM), Energy Economist, Operations Officer**	U	U
06/1997	*5*	Senior Energy Economist (TM), Energy Economist, Financial Analyst, Heating Specialist (engineer), Operations Officer**	U	U
10/1997	*5*	Senior Energy Economist (PTL), Senior Oil&Gas Specialist, Energy Economist, Gas Specialist, Operations Officer**	U	U
01-02/1998	*5*	Senior Energy Economist (PTL), Energy Economist (financial analyst), Heating Specialist (engineer), Operations Officer**, Operations Analyst	S	U
03/1998*	*4*	Prinicpal Oil&Gas Specialist, Gas Specialist, Operations Officer**, Procurement Specialist**	S	U
05/1998	*3*	Senior Energy Economist (PTL), Heating Specialist (engineer), Operations Officer**	S	U
10/1998*		Prinicpal Oil&Gas Specialist, Gas Specialist, Operations Officer**	S	U
11/1998	*7*	Prinicipal Energy Economist (PTL), Energy Economist (financial analyst), Energy Specialist, Institutional Development Specialist, Operations Officer**, Consultant (heating and engineering)	S	S
12/1998	*2*	Prinicipal Energy Economist (PTL), Operations Officer**	S	S
01/1999	*4*	Prinicipal Energy Economist (PTL), Principal Oil&Gas Specialist, Energy Economist Operations Officer**	S	S
11/1999	*2*	Senior Energy Economist (PTL),	S	S

		Operations Officer**		
11/2000	*4*	Senior Energy Economist (PTL), Operations Officer**, Procurement Specialist**, Consultant (heating and engineering)**	U	S
06/2001	*2*	Senior Energy Economist (PTL), Operations Officer**	S	S
9-10/2001	*5*	Senior Energy Economist (PTL), Energy Specialist**, Procurement Specialist**, Consultant (financial analysis), Consultant (heating and engineering)**	S	S
12/2001	*6*	Senior Energy Economist (PTL), Principal Oil&Gas Specialist, Financial Management Officer**, Energy Specialist**, Procurement Specialist**, Consultant (heating and engineering)**	U	U
03/2002	*3*	Senior Energy Economist (PTL), Energy Specialist**, Consultant (heating and engineering)**	U	U
06-07/2002	*6*	Senior Energy Economist (PTL), Senior Procurement Specialist**, Financial Management Officer**, Consultant (heating and engineering), Consultant (heating and engineering)**, Consultant (institutional issues)**	U	U
10/2002	*6*	Senior Energy Economist (PTL), Lead Energy Specialist, Senior Procurement Specialist**, Energy Specialist**, Financial Management Officer**, Consultant (heating and engineering)**	U	U
02/2003	*7*	Lead Energy Specialist (PTL), Senior Procurement Specialist**, Energy Specialist, Financial Management Officer**, Disbursement Officer**, Consulatnat (heating and engineering)**, Consultant (institutional issues)**		
ICR				

Missions marked (*) supervised Gas Sector Studies only.
Staff marked (**) was based in Moscow.

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US$ ('000)
Identification/Preparation		843,926.77
Appraisal/Negotiation		
Supervision		768,563.83
ICR		
Total		1,612,490.60

Note: The amount for Indentification/Preparation includes Appraisal/Negotiation costs; Supervision includes ICR costs.

Annex 5. Ratings for Achievement of Objectives/Outputs of Components

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

	Rating
☐ *Macro policies*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Sector Policies*	○ *H* ○ *SU* ○ *M* ● *N* ○ *NA*
☐ *Physical*	○ *H* ○ *SU* ● *M* ○ *N* ○ *NA*
☐ *Financial*	○ *H* ○ *SU* ● *M* ○ *N* ○ *NA*
☐ *Institutional Development*	○ *H* ○ *SU* ● *M* ○ *N* ○ *NA*
☐ *Environmental*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
Social	
☐ *Poverty Reduction*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Gender*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Other (Please specify)*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Private sector development*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Public sector management*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*
☐ *Other (Please specify)*	○ *H* ○ *SU* ○ *M* ○ *N* ● *NA*

Notes:

- The achievement of the physical objectives was rated M (Modest) because only four out of ten sub-projects were implemented, and only US$16.6 million (i.e., 29%) out of US$58 million were spent. Physical outputs of the four completed sub-projects were substantial, though.

- The achievement of the institutional development objectives for the four regions where the project was implemented were substantial. However, impact of the gas sector studies was modest, and the project was not implemented in six regions where it was planned. Thus, overall achievement of the institutional development objectives was rated as M.

Annex 6. Ratings of Bank and Borrower Performance

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

6.1 Bank performance	*Rating*
☐ *Lending*	○ *HS* ● *S* ○ *U* ○ *HU*
☐ *Supervision*	○ *HS* ● *S* ○ *U* ○ *HU*
☐ *Overall*	○ *HS* ● *S* ○ *U* ○ *HU*

6.2 Borrower performance	*Rating*
☐ *Preparation*	○ *HS* ● *S* ○ *U* ○ *HU*
☐ *Government implementation performance*	○ *HS* ○ *S* ● *U* ○ *HU*
☐ *Implementation agency performance*	○ *HS* ● *S* ○ *U* ○ *HU*
☐ *Overall*	○ *HS* ○ *S* ● *U* ○ *HU*
Implementing agency performance	*S (for the Energy Efficiency Investments)* *U (for the Gas Sector Studies)*

Annex 7. List of Supporting Documents

1. Project SAR of April 11, 1995;

2. Loan Agreement of September 29, 1996

3. Sub-project Feasibility Studies:
(i) Ryazan (July 13, 1997);
(ii) Semenov (June 2, 1997);
(iii) Kaliningrad (January 1998);
(iv) Archangelsk (July, 1998).

4. Sub-project Benefits Assessment Reports from the Borrower:
(i) Ryazan (December 17, 2002);
(ii) Semenov (January 20, 2003 and January 24, 2003);
(iii) Kaliningrad (February 3, 2003)
(iv) Archangelsk (October 31, 2002, and December 15, 2002);

5. Details of the IRR Calculation;

6. Borrower's Implementation Completion Report (original);

7. Comments by the Borrower on the draft Bank ICR;

8. Project Map

Additional Annex 8. Project Completion Report Prepared by the Borrower

IMPLEMENTATION COMPLETION REPORT
OF THE MINISTRY OF ENERGY OF THE RUSSIAN FEDERATION
FOR THE ENERGY EFFICIENCY PROJECT

1. Project Components

IBRD Loan No. 3876 RU to finance the Energy Efficiency Project was extended under the Loan Agreement between the Russian Federation and the International Bank for Reconstruction and Development, dated September 29, 1996. This Agreement was approved by Russian Government Resolution No. 1506, dated December 19, 1996.

In accordance with the data of the Russian Ministry of Energy, today all assets of the heating facilities in the country are ageing intensively: more than 30% of cogeneration equipment, 35% of equipment of large boiler houses, 50% of equipment of small boiler houses and heat generators have fully served their term; 60% of existing heat networks are completely worn out.

The Energy Efficiency Project, which is a pilot project and is important from the social point of view, was intended to seek solutions of the aforesaid issues.

The main objective of the Project is to increase the efficiency of using fuel and energy resources, use them in a rational way and ensure reliable supply of heat to the population and production facilities as well as to test financial and legal mechanisms for using loan funds to rehabilitate district heating systems.

It was assumed that successful implementation of the Project would make it possible to raise additional funds of foreign and Russian investors with a view of upgrading heat supply systems, restructure systems of their management, and reduce social tension caused by higher tariffs for heat.

The Project consists of two components:

One component (**Part A**) provided technical assistance and envisaged studies aimed to support a reform program in the gas sector as a whole and in the gas distribution sub-sector, in particular.

The program for gas sector studies under this Loan component (the Study Program) was specified in the Agreement, dated February 5, 1998, between the Russian Ministry of Finance that signed the aforesaid Loan Agreement on behalf of the Russian Federation and the Russian Ministry of Energy as an Implementing Agency under the Loan.

A need to develop and implement the Study Program was determined by the situation in the gas distribution sub-sector and the gas sector as a whole at that time (not well defined schemes of privatization of the gas distribution sub-sector; inadequate efficiency of state regulation; non-payment crisis), inadequate development of the sector reform issues, a need to analyze world experience as well as difficulties in arrangement and financing of relevant activities on an independent basis without impact of vested interests.

Soon after the launch of the Loan implementation Presidential Decree No. 426, dated April 28, 1997, was adopted; it contained a program of structural reforms in natural monopolies up to 2000. Guidelines of this program became the basis of detailed proposals implemented under studies of this component.

Study Program.

The agreed Study Program included the following studies:

- The status of the gas distribution sub-sector, including its interrelation with gas production and gas transmission sub-sectors, taking into account economic interests of consumers in Russia (No. 1)
- Study of natural gas pricing, with a special focus given to tariffs and prices in the gas distribution sub-sector (No. 2)
- Reorganization and strengthening of enterprises in the gas distribution sub-sector (No. 3)
- Regulation of the gas sector, with a special focus given to gas distribution (No. 4)
- Current status and outlooks of liquefied gas supplies in interrelation with overall demand in gas as a fuel (No.5)
- Current status and proposals for improvement of the regulatory and technical documentation system in the gas distribution sub-sector (No. 6)
- Development of proposals for improvement of the law and regulatory framework in the gas distribution sub-sector (No. 7)
- Creation of the information and analytical system in the gas distribution sub-sector in interaction with other components of the gas supply chain in Russia (No. 8).
- Coordination, supervision and advisory support to the Ministry of Fuel and Energy under the Technical Assistance Component of the Loan (No. 9).

The second component (**Part B)** is an investment component and consists of the following subcomponents:

- Investments in improving energy efficiency in various cities of Russia that were implemented by regional implementing agencies (sub-borrowers).
- Technical assistance to support the Project implementation.

The following factors were taken into consideration when this Project component was designed and implemented.

The financial and economic mechanism is based on the following preconditions.

Currently up to 50% of costs of heating enterprises to supply heat to the population are subsidized from local budgets. Up to 35-40% of funds from local budgets are spent to supply heat to the population and the budget sector consumers.

More than one third of energy resources used for heating and domestic hot water is not used efficiently. The fuel component in the production cost of heat is 60-70%. It is impossible to conduct a large-scale housing and communal services sector reform without drastic technical upgrade of district heating systems.

The financial arrangement of the loan does not envisage increase in prices for the population for the heating and domestic hot water services, but reduction in actual costs automatically leads to increase in percentage of full recovery charges paid by the population for heat and domestic hot water consumption up to 60-85%.

Most of the subprojects are based on replacement of worn-out boiler equipment that fires liquid and solid fuel by automated gas boiler units (fuel savings up to 50% and operational cost savings up to 60-70%); partial replacement and upgrade of worn-out heat mains (heat savings up to 10% accompanied by increase in reliability); rehabilitation of central heating substations and consumer feeders (heat savings up to 15%

accompanied by better heat comfort conditions).

Therefore, the implementation of this Project component in the participating cities allows the cities to reduce consumption of fuel and heat by 25-30% and at the same time improve heat comfort in housing, reduce heat production cost and budget subsidies by 15-20%.

The Russian Ministry of Energy believes that objectives and tasks of the Project were well designed.

2. Organizational Aspects of the Project Implementation

In accordance with Russian Government Resolution No. 1506, dated December 19, 1996, the Russian Ministry of Energy, the Russian Ministry of Finance and the Russian Ministry of Economic Development and Trade were made responsible for supervising the Project implementation. The Resolution also set forth that in respect of the investment component, the Russian Ministry of Finance and the Russian Ministry of Energy should enter into agreements with administrations of the Russian Federation regions and city heating enterprises that describe terms and conditions of lending, use and repayment of the loan proceeds.

The loan proceeds in the amount of $58 mln were on-lent to city heating enterprises, i.e. Project participants, for a specified term and on a repayable basis (principal and interest). Repayment of the principal debt, payment of interest and commitment fees area made using own funds obtained as a result of reduction in production costs.

With a view of implementing the Loan Agreement, a Project Interagency Working Group was set up in January 1997. It comprised representatives of the Russian Ministry of Fuel and Energy, the Russian Ministry of Finance, the Russian Ministry of Economic Development, and the Russian Energy Saving Foundation. Later by directive of MoEn No. 93, dated March 28, 2001, an Interagency Supervisory Board was set up to implement the investment component of the Project.

The Ministry of Fuel and Energy entered into the Agency Agreement, dated August 27, 1997, with a subsidiary of the Russian Energy Saving Foundation, i.e. Close Joint Stock Company Investenergoeffect, and subsequently amended it into three-sided agreement No. 01-01-06/27-640, dated October 25, 2000, between the Russian Ministry of Finance, the Russian Ministry of Energy and Investenergoeffect. In accordance with the aforesaid agreement, the Russian Ministry of Fuel and Energy authorized Investenergoeffect to act as the Project implementing agency and to undertake legal and actual actions on behalf of the Russian Ministry of Energy.

3. Project Implementation Results

Under technical assistance, three studies have been completed (Part A).

Study 2 on natural gas pricing, with a special focus given to tariffs and prices in the gas distribution sub-sector. The contract with consultants was signed in April 1998, and the study was completed at the end of 1999. A significant amount of analytical work was conducted taking into account experience of foreign countries and specific features of Russian gas distribution. The output of the study was used in preparing methodological guidelines for calculating gas transmission tariffs for gas distribution companies in Russia. Today on the basis of these guidelines, individual tariffs for services have been introduced for all main gas distribution companies of Russia. As a whole, the study conducted made an important contribution to the development of the state regulation system of prices and tariffs in the gas distribution sub-sector.

Study 1 on the status of the gas distribution sub-sector, including its interrelation with gas production and gas transmission sub-sectors, taking into account economic interests of consumers in Russia was started in August 1999. Consultants submitted the last version of the Final Report that incorporated results of discussion in the Russian Ministry of Energy and other ministries, agencies and organizations. Intermediary documents of the study were quite widely used in 2000-2001 by the Russian Government, ministries and agencies during preparation of the Action Plan of the Russian Government for 2000-2001 in the gas sector, the Concept for the gas market, and the reform of the gas sector, as a whole.

Study 3 on reorganization and strengthening of enterprises in the gas distribution sub-sector. The contract with consultants was signed in October 1999. The activity was completed in mid-2001. The study includes a comprehensive and multifactor analysis of the economic and financial situation, production operations, corporate and functional status of gas distribution companies, the role of state agencies in the sub-sector regulation. Foreign experience of the gas sector regulation was studied. Major issues impeding efficient operation of gas distribution companies and resolution of state regulation tasks were identified. The study was used to work out recommendations for addressing problems of the Russian gas distribution sub-sector and improving the regulatory and legal framework of gas distribution; these recommendations are aimed to improve the situation in gas distribution companies, restore state governance in the sub-sector, normalize relations between gas distribution companies and suppliers and consumers.

The Ministry of Energy and other bodies of power and companies use these recommendations of the study in their regular operational work. Results of the study were approved by Gasprom, representatives of the Russian Ministry of Economic Development and the FEC of Russia.

Study 9 on coordination, supervision and advisory support to the Ministry of Fuel and Energy under the Technical Assistance Component of the Loan. The activity under this study was conducted starting from March 1997. The work of coordination consultants was carried out in two main areas: comprehensive assistance in conducting all studies under the Program and advisory support to the Ministry under activities of the Project. The contract with coordination consultants terminated on January 1, 2000. Based on the results of activities in implementation of which the coordination consultants were directly involved, the following documents were approved: methodological guidelines for calculating gas transmission tariffs for gas distribution companies of Russia, Guidelines for state regulation of prices and tariffs in gas supply, Rules of gas supply to consumers of the Russian Federation and a number of other documents. The consultants prepared a significant amount of analytical documents on technical assistance areas (in accordance with the Ministry requests).

The overall amount of funds allocated under the Program for studies is $9,395,000. The total amount of contracts concluded was $4,315,900. Activities under contracts were completed and financed in the amount of $4,184,900.

Implementation of Regional Investment Subprojects (Part B)

At the initial stage of the Project implementation, potential participants did not have finalized feasibility studies and subloan agreements approved in accordance with the established procedures. Therefore, the Project Implementation Unit together with potential Project participants undertook efforts to prepare feasibility studies and conclude subloan agreements.

Grant funds were used to prepare, appraise the following feasibility studies that were approved by the IBRD: Ryazan ($757,000); Kaliningrad ($5,346,000); Semenov, Nizhny Novgorod Region ($9,480,000); Samara ($3,500,000); Saratov ($5,000,000); Archangelsk ($6,120,000); Rostov ($5,500,000); Kaluga

($4,300,000); Omsk ($10,000,000); Tobolsk ($10,300,000), Gorodets ($2,500,000), with the total amount of loans exceeding $62,8 mln, as well as an additional feasibility study for Semenov.

The Project could be implemented only in Ryazan, Kaliningrad, Semenov, and Archangelsk, with the total amount of loan funds about $21.4 mln. A set of planned activities was carried out in these cities. More detailed information about activities carried out is provided further in the text.

As for other cities, for various reasons participants refused to implement feasibility studies they had developed. The main reason was a financial crisis of 1998.

Ryazan

In accordance with the approved feasibility study under the sub-project, it was planned to install 35 heat meters; to purchase, install and commission six automatic control devices and telemechanics for six central heating substations as well as commission the first stage of the automatic control system for the Heating Network Enterprise.

The first two activities were completed in full, and the last subcomponent was implemented by the enterprise using its own funds. Therefore, the feasibility study is implemented in full. It was planned to utilize $757,000 of loan funds, actually $497,000 were disbursed.

Semenov, Nizhny Novgorod Region

The subproject envisaged an integrated rehabilitation of the district heating system in Semenov with the use of loan proceeds. In accordance with the agreed feasibility study, the subproject included purchase and commissioning of more than 20 gas fired automated boiler houses with a total output of 70.5 megawatts; up to 10 km (two-pipe system) of heat networks; installation of individual heating substations in six budget sector facilities; purchase and commissioning of a telemechanics system to control operation of heat facilities of the city. It was planned to utilize $9,480,000 of loan funds to undertake the aforesaid activities. As a result of the project implementation, it was planned to obtain fuel savings up to 35,700 tons of reference fuel and cost savings of up to $2,710,000.

As of today, all planned activities have been fulfilled, with the exception of the telemechanics system which could not be purchased due to financial difficulties the sub-borrower was experiencing and which are not linked directly with the implementation of this Project.

For example, 30 container boiler houses with a total output of 116.7 megawatts were purchased. The sub-borrower proposes to purchase the telemechanics system to control all energy facilities of the city using its own funds.

In total eight contracts worth of $7,578,811 were concluded, $7,321,000 were disbursed by the Project Closing Date.

Activities conducted helped reduce production cost of heat almost by twofold, to increase quality of heat supply in the city. The number of complaints of the population concerning unsatisfactory quality of heat supply reduced by roughly 2.5 times.

The following facilities were installed for the first time in the city during the Project implementation:

- fully automated gas-fired boiler houses that operate without constant presence of operational personnel;
- pre-insulated heating pipelines with polyurethane insulation;
- instrumentation for the tuning of energy equipment, hydraulic conditions of heat network and energy audit;
- meters and control instrumentation for heating and domestic hot water for budget sector enterprises.

Activities conducted create conditions for reforming the housing and communal services sector of the city and shifting to non-subsidized operational arrangement of communal enterprises.

It should be specifically noted that all equipment purchased meets modern technical conditions. At the same time roughly 20% less of funds were spent on purchase of equipment against the plan. Savings were obtained through using bidding procedures of the IBRD and due to good quality of bidding documentation.

Experience gained during this sub-project implementation is recommended for rollout in various regions and for use during rehabilitation of municipal district heating and domestic hot water systems/

At the first All-Russian exhibition on Energy Savings in Russian Regions this sub-project received the first prize in the competition of the best energy saving project and was awarded a diploma.

Kaliningrad

Fourteen contracts in the total amount of $5,365,000 were concluded under this subproject. Equipment purchased includes, among other devices, water meters, heat meters, natural gas meters, technological equipment of the automated gas-fired boiler house, eleven fully automated central heating substations, 185 automated individual heating substations, 16 km of plastic pre-insulated domestic hot water pipelines, the automated control system for the RTS Severnaya, a dispatch system for a number of city energy facilities as well as a mobile repairs and diagnostics laboratory.

A set of equipment for determining composition of flue gases at the boiler exit was purchased under the project.

It was for the first time in the Russian Federation that a large boiler house was equipped with emission control systems and fully met EU and Russian standards.

It should be specifically noted that under this Project it was practically the first time in Russia that so many plastic pre-insulated pipelines were used for distribution networks of domestic hot water (around 16 km). Such a solution allows the company to significantly reduce leaks of hot water and increase the service life of pipelines by several times.

All equipment purchased was installed at operational sites and commissioned.

An indirect effect should be noted: today the population is coming to understand a need and utility of using borrowed funds to rehabilitate municipal district heating systems. At the same time quality of heat supply is significantly improved, with the tariff unchanged. It creates significant preconditions for conducting a reform of the housing and communal services sector.

It should be also noted that experience gained by the sub-borrower during the implementation of this sub-project creates preconditions for implementation of other energy saving projects.

Archangelsk

Eight contracts in the amount of $4.6 mln dollars were concluded under this subproject. As of January 2003, a two-pipe heat network 0.8 km long; heat mains, diameter 1000 mm, 10 km long; boiler equipment with a total output of around 10 MW as well as a mobile diagnostic laboratory were commissioned.

General information about actual economic effect, fuel savings and reduction in CO2 emissions in all participating cities of the Energy Efficiency Project is provided in the table.

Sub-borrower	Actual annual economic effect from activities conducted $1000	Actual fuel savings 1000 tons of reference fuel	Actual reduction in CO_2 emissions, 1000 tones
Kaliningrad	1,072.6	27.5	47.1
Ryazan	424.4	1.3	2.1
Semenov	1,973.6	25.8	30.7
Archangelsk	299.8	2.8	7.5
Total	3,770.4	57.4	87.4

Based on the aforesaid, we can say that technical objectives of the project implementation in Semenov, Ryazan, and Kaliningrad are mostly achieved. As for Archangelsk, by the Loan Closing Date some equipment had not been commissioned, mostly due to a lack of local counterpart funds, but there are objective reasons to state that all activities in this city will be implemented within this year. The Russian Ministry of Energy places these facilities under special control through agencies of the State Energy Inspectorate.

Procurement arrangements under the Project and results of introduction of the practice of competition-based procurement.

- Percentage share of procurement under the Project conducted on a competitive basis (in % to the total cost of goods, works and services procured under the Project) is 100%;
- Participating rate of Russian contractors in tenders under the Project and, consequently, the percentage share of Russian contractors that won tenders (in % to the number of tenders conducted) exceeds 35%;
- A reduction in the price level obtained through bidding compared with the estimated price (in % and million USD) is around 20% or $4,360 mln.

Technical assistance to support the Project implementation

Nine contracts were fulfilled under this part and $1,036,000 were disbursed. The funds were used to pay for work of the consulting company, training of regional participants of the Project, purchase of computers for participating cities and payment for audits.

4. Priority Areas of Using Results of the Work

Over the past years the situation in the municipal district heating system significantly deteriorated. It was especially clear during severe winter of 2002/2003. In many cities of Russia the district heating systems were damaged and in a number of regions they were practically shut down.

In this situation experience gained during the implementation of this Project becomes especially relevant. Use of borrowed funds to rehabilitate district heating facilities of cities is of great significance.

The Russian Ministry of Energy proposes to step up activities to roll out positive experience of the Project implementation.

In a number of regions the implementation of the Project initiated attraction of commercial funds to implement energy efficiency programs.

Using experience gained, the administration of Nizhny Novgorod jointly with the Nizhny Novgorod Technical University and the Regional Energy Saving Foundation has developed and is successfully implementing more than nine regional programs with use of financing from different sources, including borrowed funds. This experience is being rolled out in other regions too.

Experience gained during the Project implementation allowed the Administration of Kaliningrad to conduct successful negotiations with the European Bank for Reconstruction and Development to rehabilitate the municipal district heating system.

Experience gained during the Project implementation will be used during implementation of other investment projects of the Russian Ministry of Energy.

Lessons Learned

1. Terms of Loan Agreement No. 3876 RU placed Russian suppliers/manufacturers in unfavorable conditions compared to foreign suppliers/manufacturers. In spite of domestic preferences provided to local tender participants, we have to note that there were a whole number of unresolved issues, namely:

- The IBRD does not have a clear agreed approach to issuing letters of credit for Russian suppliers. The only possibility for issuing such letters of credit is the use of funds from the Special Account, which leads to a situation when money is frozen in such accounts for a long period of time (which is not encouraged by the IBRD either), when it is impossible to use special accounts for other purposes and it also leads to significant risks both for the buyer and the seller. The IBRD does not issue special commitment for such letters of credits.

- All foreign expenditures on supply of goods, regardless of the profile and degree of participation of a foreign supplier in the manufacture of goods supplied are financed 100%. In case of local suppliers, it is only supply of goods on ex-factory cost terms that are financed 100%; only 70% all other local expenditures are financed from the loan proceeds.

  Local transportation for Russian suppliers is not financed from the IBRD loan funds, while foreign supplies under CIP (final point of destination) are 100% financed from the loan proceeds. It leads to disruption in cofinancing, as it increases budget payments, which are difficult to reallocate quickly.

- The IBRD does not have a clear agreed and effective mechanism for supplying goods from abroad by Russian suppliers. In such cases the issue of implementing customs procedures by the buyer or the issue of payments to suppliers/manufacturers causes significant difficulties.

2. A lack of skilled specialists capable of providing a rapid assessment of the situation and proposing

effective ways of addressing problem situations concerning logistics of goods, resolution of customs issues, legal processing and support of contracts and amendments to contracts. Limited resources of the PIU in implementing supervision over supplies of equipment locally and its commissioning.

3. Costs and Financing

Originally total costs of the Project were estimated as 70 mln in dollar equivalent. It was planned to disburse $60 mln under Part B of the Project. Some costs related to technical assistance under Part B of the Project amounted to $2 mln, Goods accounted for $47.5 mln, and unallocated amount was $10 mln. Subsequently the loan amount was reduced to $30 mln. Out of $30 mln $25.6 mln were to be allocated under Part B of the Project, including $1.36 mln for technical assistance under Part B of the Project, $19.223 mln for Goods, and $0.6 mln for PIU operational costs.

As of the Loan Closing Date, $18.5 mln were disbursed under part B, i.e. 96% of funds allocated, including $16.6 mln for Goods, i.e. 86% of funds allocated.

4. Project Implementation Supervision

The Russian Ministry of Energy, the Russian Ministry of Finance, and the Russian Ministry of Economic Development, the FCPF and the IBRD conducted regular supervision over the Project implementation.

In 1999-2000 the Ministry relaxed control over the Project implementation, this led to its suspension. It created certain difficulties for sub-borrowers and delays in implementation of planned activities. In September 2000 the Project management arrangement was restructured, after which the situation went back to normal. There were periodical delays in approval of operational budgets.

5. Conclusions

The Russian Ministry of Energy believes that objectives and tasks of the Project were well defined. All works and activities included into terms of reference and feasibility studies under concluded consulting contracts and sub-loans were mostly fulfilled.

Project implementation experience demonstrated that in case the work is well organized its results are extremely important.

In the course of implementation of such projects financed by international financial institutions and implemented by the Ministry, a key role in overall management and supervision over the project must be assigned to an interagency supervisory board.

The most efficient and rational arrangement of the Project implementation envisages establishment of the interagency supervisory board that carries out overall supervision, a competent project implementation unit for management and monitoring of implementation of all contracts. It is advisable that consultants' involvement be limited to expert and specialized activities.

Before subprojects are implemented, it is necessary that all procedures related to the Project implementation be reviewed and approved.

Adequate and timely local cofinancing is a key issue for successful project implementation, as it has a direct impact on the project performance.