European Bank
for Reconstruction and Development

SUMMARY OF SPECIAL STUDY

EVALUATION OF ENERGY EFFICIENCY IN BANK PROJECTS

PROJECT EVALUATION DEPARTMENT

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PREFACE

The subject of this special study is the independent evaluation of the Bank's performance to enhance the energy efficiency in its projects and other activities. It covers a sample of 15 projects in sectors with high potential for energy saving, and other activities of the EBRD to promote energy efficiency, since the Bank's foundation. This thematic and impact study aims to identify the Bank's impact in the region and help to improve its future performance in energy efficiency.

The sectors with high potential to improve energy efficiency include Power & Energy, Energy Efficiency, Industry and Manufacturing, Municipal and Environmental Infrastructure (MEI), and Natural Resources sectors.

A great deal of the findings in this study is based on the recent Special Study, "Evaluation of Environmental Performance of EBRD" that included 39 project evaluations; many of these projects comprised significant energy efficiency components.

The author of this special study was Jouni Eerikainen, Senior Environmental Evaluation Manager in Project Evaluation Department whose position is funded by the Finnish TC fund. He also carried out the field surveys and desk studies.

The field survey evaluations are based on on-site visits and discussions carried out between September and November 2001 with representatives of the clients, energy organisations, and NGOs. The Operation Leaders, Banking Teams, and especially the staff of Environment Department have offered their help and experience in form of several discussions and workshops.

The findings in the report relate to the specific projects sampled, as do the lessons learned. Some general inferences for the Bank's future operations in similar sectors have also been made.

1. BACKGROUND

The projects involving energy saving are important from an environmental point of view to reduce the use of natural resources and abate atmospheric emissions, greenhouse gases, and other environmental damages arising from energy production and use. In addition, energy saving is a crucial issue for transition economies to reduce the cost of energy conversion, distribution and use, because they still use much energy to produce goods and services, resulting to high energy intensities.[1] Although high energy intensity in some countries can be partly explained by the high energy demand for heating in cold climate, long transport distances, and other factors like energy intensive industrial structure, low energy efficiency as a result of high energy losses and wasteful use of resources is evident throughout the Bank's region. In advanced transition countries, energy intensity is still four times higher than in Western Europe, although it is improving. In intermediate and early transition countries, and in Russia, energy intensity is more than ten times higher than on average in Western Europe.

2. OBJECTIVES, APPROACH AND METHODOLOGY

The recently published Transition Report 2001 of EBRD, "Energy in Transition" analyses the transition in energy resource management, energy conversion, and use, and the energy sector reform in the Bank region. This Special Study concentrates in finding the energy efficiency performance and impact of Bank projects.

The first objective was to discover the environmental impacts of a sample of Bank projects with significant energy savings, including ESCOs.

The second objective was to assess the institutional, financial, market, technological, and social barriers and opportunities in increasing the number and volume of energy saving projects.

The third objective was to determine key lessons to be learned from the Bank's, other IFIs, and EUs past experience, and how these lessons can be applied to improve the Bank's contribution towards energy efficiency in its countries of operation.

The methodology used in this special study comprises: (i) field survey with two site visits, (ii) 13 desk studies, based mainly on previous evaluations and the Special Study "Evaluation of Environmental Performance of EBRD",[2] and (iii) a literature survey.

2.1 CRITERIA FOR SELECTING A REPRESENTATIVE SAMPLE OF PROJECTS

The active and implemented Power and Energy, and Energy Efficiency Team projects (from hereon, called Energy projects) are presented by type and region in the table below:

Table 1 Distribution of Energy projects by type and region

	Type							
Region	Supply	District heating	Transmission & distribution	ESCO	Emergency investment	Sector improvement	Power & env. Fund	**Grand Total**
Advanced	4	2		10	3			**19**
Early/Intermediate	14	2	6	2	1	5		**30**
Russia	2							**2**
Regional							2	**2**
Grand Total	**20**	**4**	**6**	**12**	**4**	**5**	**2**	**53**

[1] Energy Intensity is defined as Ratio of Total Primary Energy Supply to GDP (TPES/GDP)

[2] OPER No: PE00-153S, May 2001

Most of the energy supply projects have been implemented in the early and intermediate transition countries and most of the ESCO projects have been implemented in the advanced transition countries. There are no ESCO projects in Russian Federation and overall only two energy projects, both in supply side, have been implemented there. The sampled 15 projects represent different types of Energy projects, and the main heavy industry, natural resources (oil development and mining) and Municipal and Environmental Infrastructure (MEI) projects, spread across the regions of different transition stages.

Table 2 Distribution of sampled projects by type and region

	Type							
Region	Energy supply	District heating	Transmission & distribution	Industry & manufacturing	Natural resources	MEI	ESCO	**Grand Total**
Advanced	1			2		2	*1	**6**
Early/Intermediate	1	2	1	1			*1+1	**7**
Russia					2			**2**
Grand Total	**2**	**2**	**1**	**3**	**2**	**2**	**3**	**15**

** Field surveys. Other sampled projects are desk studies*

2.2 METHODOLOGY OF PROJECT EVALUATION

The focus of the project evaluation has been to assess how the Environmental Action Plans (EAPs), especially in regard to energy efficiency issues, have been prepared, monitored and implemented, and how the projects have contributed to increased energy efficiency, abatement of atmospheric emissions, and energy sector reform. The evaluation issues are:

1. Environmental performance, with the focus and ratings in energy efficiency, and atmospheric emissions related to energy generation.
2. Extent of environmental change (also described as the environmental impact), as well as changes in energy efficiency and atmospheric emissions.

2.3 METHODOLOGY OF THE EVALUATION OF OPERATIONAL ENVIRONMENT

In order to identify and describe the barriers and opportunities to increase energy efficiency in the Bank's projects, the operational environment has been evaluated in Poland, Ukraine, and Russia. In 1999, these three most highly populated countries of operation in different transition stages represented 70 per cent of the total energy consumption in the Bank's region. The evaluation issues in these three countries comprise:

- Pollution in the country related to energy production
- Energy policy and regulatory framework, institutional and financial barriers and opportunities
- Energy supply and demand, commercialisation and competition, market barriers and opportunities
- Energy technology framework, technology barriers and opportunities
- Public awareness and acceptance, social barriers and opportunities

3. EVALUATION

3.1 THE BANK'S POLICIES AND VEHICLES TO PROMOTE ENERGY EFFICIENCY

3.1.1 The Bank's Energy Operations Policy

The energy operations policy of the Bank of 20 April 2000[3] covers power generation, transmission, and distribution, heat generation and distribution, gas distribution and utilisation of power, heat and gas, including energy consumers as well as energy utilities. The challenges for the Bank in the Power and Energy sector include:

- High energy consumption
- High wastage at the level of the end user
- Low operational efficiency and plant availability
- High losses in the transmission and distribution of electricity, heat, and gas
- Tariffs in many countries remain inadequate to cover operating costs
- Collection of revenues is low in many early and intermediate transition countries
- Subsidy mechanisms are ineffective in the heat sectors causing cash shortfalls for district heating suppliers and weakening incentives for users to save heat
- Poor environmental, health and safety management in most countries of operation results in high environmental damage from emissions of sulphur and nitrogen gases and ash dust, soil and water contamination and high accident rates
- High risk and ageing Soviet-designed nuclear power
- EU Accession and substantial need of resources to meet the Acquis Communautaire

It can be concluded that the Energy Operations Policy of the Bank is well designed and addresses properly the challenges in the region. It covers all essential sector reform and investment priorities, and defines the objectives and operational approach, as well as financial instruments in an adequate manner. Based on experience of some projects, however, it would be adequate to study more carefully the regional energy supply and demand scenarios to make sure, that investment in extensive new power generation capacity is really needed. An alternative to new large investments could be investing in better Demand Side Management to reduce the energy demand. In the energy sector, the Bank could market and select the projects with more emphasis in regional energy strategy and significant energy saving potential.

3.1.2 The Environmental Policy and Procedures to promote Energy Efficiency

Energy efficiency is an important part of the Bank's environmental policy. The wider environmental objectives in the policy aim to attach particular importance e.g. to operations, which promote energy and resource efficiency, and use of renewable resources.

The energy efficiency issues are addressed in Environmental Due Diligence (EDD) and monitoring. The Environmental Audit procedures (Version 3, June 1996) contains request for the consultants to collect information on energy supply and consumption, energy management and planning, measurement of energy supply, planned measures to save energy, and opportunities for energy conservation. However, there are no specific guidelines on how to report energy supply and demand in quantitative terms, and especially to benchmark the energy efficiency against the best industry practices. Due to the nature of EDD to clarify the main environmental risks, liabilities, and regulatory compliance, it is not possible to address the global issues like Greenhouse Gas emissions and prepare an in depth Energy Audit as a part of EDD. In large energy sensitive projects, the energy issues and Energy Audit are usually a part of the Environmental Action Plan (EAP), that is requested in loan covenants to be implemented by the client.

[3] Board Document "*Energy Operations Policy*", BDS00-10 (Rev2), 20 April, 2000

The energy efficiency issues are also an important part of the in depth environmental evaluation guideline of PED. It requests analysis on power and heat consumption, as well as production specific consumption, to assess the energy performance of the project and the improvement in the energy efficiency as a difference of the energy indicators before the project started and at the time of evaluation.

There are, however, some unutilised opportunities in the Bank's procedures and practices to promote the energy efficiency in the mainstream projects. In general, the Bank has not always had a complete picture of the client's needs to improve energy efficiency. For instance, during the past years, the scope of Environmental Audits has increased, but the timeframe for the consultants to conduct the Environmental Audit and identify energy efficiency improvements in the report has been reduced. Energy efficiency is still a relatively minor topic in the Environmental Audit agenda and report.

3.1.3 The Bank's Policy to use Carbon Credits in its Projects

EBRD, as a large direct investor in a region, which accounts for 14 per cent of the World's greenhouse gas emissions[4], is in an excellent position to use Carbon Credits to mitigate project risks and improve transition impact.[5] Prices for one tonne CO_2 currently range between $1 and $8.[6] A study for the French government (October 2001) estimates that the market for JI projects in Central and Eastern Europe could result in foreign investment of EUR 7 billion involving 180 million tons of CO_2 annually by 2010.[7]

Trading of Carbon Credits offers the Bank a possibility to enhance project structure in energy supply and DSM projects by enlarging investment plans, pre-financing the investments, establishing risk reserves, enhancing equity returns, improving terms of sovereign borrowing, and creating marketing opportunity to find new project sponsors.

The Bank could be adviser/facilitator or take ownership of the project involving Carbon Credits, or play both roles. In the first role, the Bank would facilitate the sale of credits between the project company and a buyer without taking any title to the credits (e.g. Andijan District Heating[8]). In the second role the Bank takes ownership of credits, i.e. it receives title to credits in the project documents to enhance the creditworthiness of its projects. The legal aspects, and Bank's role as either an "owner" or "broker" of credits are under discussion; these roles could be tested through pilot projects, using existing expertise within the Bank. The Bank could also negotiate terms with the public buyers who have already approached with a proposal to buy Carbon Credits, e.g. the Dutch Government. The Bank could also establish a "Carbon Credit Working Group" to develop Bank policy, disseminate information and provide support to the Banking teams in structuring the projects.

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4 Source: *IEA, Key World Energy Statistics from the IEA, 2001 Edition*, http://www.iea.org/statist/key2001/keyworld-2001.pdf

5 Source, CO2e.com, a subsidiary of Cantor Fitzgerald, and Natsource, two of the largest brokers specialising in environmental trades.

6 Price is a function of the risk associated with acting ahead of legislation, plus risks and quality factors associated with the underlying project. These include primarily delivery risk (project financial and operational risk) and country risk.

7 Other studies suggest that the CEE's gains from trade in Carbon Credits (among Annex 1 countries) is USD 1.5 billion (permit sale of 28 million t C) by 2010 and USD 10 billion (permit sale of 162 million t C) for the FSU by 2010.

8 In this district heating project, a total of 2 million tons of CO2 ('til 2012 and further 2 million until the end of the project) have been sold to the World Bank's PCF for $5 million to provide additional cash for the financing plan. The project receives a small up front cash infusion and additional cash flow upon delivery of the emission credits. Negotiation time: 4 months.

3.1.4 The Bank's additional vehicles to promote Energy Efficiency

In addition to the project investments, the Bank uses other instruments for promoting energy efficiency. These comprise the Bank's Technical Cooperation projects, the energy efficiency and sector reform components in the nuclear safety funds, and other funds aiming at energy efficiency, and the energy efficiency improvements linked to the Turnaround Management (TAM) projects. The Bank also houses Project Preparation Committee that aims at identifying environmental and energy efficiency projects to be jointly financed by IFIs and donors.

3.1.5 Tariff and sector reform

A stepwise approach, as described in the Transition Report 2001[9] is essential for a successful energy sector reform that should start from commercialisation of the industry and founding of an independent regulatory tariff authority, following with the entry of the private sector. The next steps would include a carefully planned tariff reform to achieve sustainable cost-recovery and justified compensation to the poorest part of the population, and finally the market liberalisation

3.2 IMPACT OF BANK PROJECTS

3.2.1 Bank's investments in the Power and Energy and Energy Efficiency projects

Total active and implemented investments in the 53 Power and Energy and Energy Efficiency projects were €3.99 billion by 2000. Funding approved by the EBRD was €1.67 billion, which amounted to 11 per cent of the total active or completed projects between 1991-2000. The breakdown of the investments and the EBRD funding by type and region is presented in the table below.

Table 3 Project investments and EBRD funding (mill €) of the 53 energy projects

		Type								
Region	**Total project costs and EBRD funds**	Energy supply	District heating	Trans mission	ESCO	Emergency	Sector	Fund	Total	%
Advanced	Total project cost	329	48		135	147			659	17%
	EBRD financing	156	21		55	97			328	20%
Early/ Intermediate	Total project cost	1,233	117	550	56	179	487		2,621	66%
	EBRD financing	644	61	158	30	14	211		1,118	67%
Russia	Total project cost	320							320	8%
	EBRD financing	148							148	9%
Regional	Total project cost							385	385	10%
	EBRD financing							77	77	5%
Total project cost		1,882	164	550	191	326	487	385	3,985	100%
EBRD financing		948	81	158	85	111	211	77	1,671	100%
Total project cost %		47%	4%	14%	5%	8%	12%	10%	100%	
EBRD financing %		57%	5%	9%	5%	7%	13%	5%	100%	

Funding by the EBRD has been highest (57 per cent of all types) in the supply side projects and in Early/Intermediate transition countries (67 per cent of all regions). These also comprise the majority of the sampled Power and Energy projects.

3.2.2 Power and heat generation

The main features that contribute to success in the power generation sector include a strong sponsor, well-defined environmental objectives, good public consultation – particularly important with large projects – and an EMS based on ISO 14001 and its certification. Good sharing of knowledge between a sponsor operating internationally in

[9] "*Transition Report 2001, Energy in Transition",* (2001), Chapter 5

the power sector and already applying certified ISO 14001 EMS in other power plants, and the borrower has been essential.

Energy sector investment in countries with a well-developed environmental regulatory framework, where the regulatory authorities put the emphasis on the client to implement efficient control and monitoring systems have usually been successful. It has also been important to define the objectives well and identify the most appropriate technology to achieve environmental goals; e.g. technology that is financially viable, within the capabilities of the clients expertise and acceptable to the regulator.

It can be further concluded from other previously reviewed energy sector projects that effective utilisation of the PPC mechanism for blending IFI and donor-financing has significantly enhanced environmental benefits. There are also often good prospects for mobilising grants within the framework of the Kyoto mechanisms for energy efficiency and power projects.

If over-optimistic demand development scenarios are assumed at investment appraisal to justify additional supply requirements, installed power generation over-capacities would for a considerable time in the future exceed significantly demand. A comprehensive energy sector study for the region including renewable energy, energy saving considerations and DSM, as well as other potential modes of energy supply, or retrofitting of existing facilities to find a least cost and energy efficient solution with high positive environmental impact is often necessary. A narrow technological focus on only one energy supply option at the outset may prevent the adequate exploring of other supply and DSM avenues, as for example in the geothermal project of Mutnovsky Independent Power Plant in Russia. This multiple TC project[10] failed to discuss the geothermal resources within a broader context, taking account of alternative supply options and load scenarios, as well as energy conservation measures. The Bank has started a study to identify renewable energy projects in the region.

3.2.3 District heating

In the Bank's region distribution losses may be 35-40 per cent, compared to 5-7 per cent elsewhere in the world in the district heating sector.[11] It has been found difficult to develop projects in the district-heating sector, because of low motivation among municipalities, and lack of sovereign guarantees for district heating investments; the Bank has implemented only four district heating projects, none of them in CIS countries. The World Bank has wider district heating project portfolio, with 14 ongoing and implemented projects in CEE/FSU.

Both World Bank and EBRD have had difficulties in designing and implementing district heating projects. The Bank experienced from the unsatisfactory Termocom Energy Efficiency project, which ended to the bankruptcy of the borrower, that for a successful tariff reform it is important to ensure that the independence of the regulator is enshrined in law and also covenanted in the loan agreement. The tariff reform must be based on full cost recovery calculation of the supplying energy, comprising operation costs, depreciation, and appropriate profit marginal. The subsidies to compensate increasing utility tariffs must be directed separately to the poorest part of the population. The project suffered from the volatile political environment in Moldova, which made reforming district heating company and increasing tariff politically unpalatable. The Bank learned that in such circumstances close dialogue with the Borrower and the Government in the sovereign guaranteed transaction is necessary in order to ensure acceptable tariff reform.

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[10] OPER No: PE01-174, "*Mutnovsky Independent Power Plant, Russian Federation"*

[11] These figures are based on the "*Energy Operation Policy*", 2000, of EBRD. The World Bank report *"Increasing the Efficiency of Heating Systems in Central and Eastern Europe and Former Soviet Union*", 1998, gives lower figures 15-25 % for CEE/FSU, and 5-10 % for Western Europe.

The project costs were estimated far too low. Therefore, it is advisable to develop a template for standardised TOR for feasibility studies to be used for District Heating projects, to do a "reality check" of work and cost estimates performed by consultants at appraisal, and to analyse cash flow estimate with the Borrower. If the Borrower stops requesting disbursing of the loan before the main part of investment is made, it risks bankruptcy and the planned energy savings and positive cash flow will not be obtained.

3.2.4 Power transmission and distribution

In some countries of operation, total power transmission and distribution losses are as high as 35-40 per cent in electricity networks, compared to the industry standard of about 4-5 per cent in Western Europe. Access of CHPs to power transmission networks improves the commercialisation of energy sector and brings the power competition closer to end-users. According to the Bank's Energy Operations Policy, the Bank has invested increasingly to power transmission, which are needed to increase power trade and system cross-support, as more economical alternatives to adding generation capacity.

In some Power and Energy projects, especially in Talas transmission network improvement project, the Bank has conducted successful dialogue with the government to enhance market liberalisation and privatisation, cost based energy pricing, and efficient tariff collection. When combined with good technical implementation, the long-term institutional and short-term technological impact of the projects to improve the energy efficiency has been substantial. The Bank has also been able to include its energy pricing and privatisation objectives in the sovereign loan covenants. However, the reluctance of governments and municipalities to rise tariffs because of anticipated public pressure and often short-sighted political reasons is still a serious barrier to improve energy efficiency with tariff driven economical incentives. The tariff increase should be associated with a social programme to protect the poorest part of the population. It is important to ensure that a sound regulatory framework is in place before privatisation to the strategic investors. Privatisation of distribution networks should occur before privatisation of power supply sector, when collection rate and payment discipline is problematic.

3.2.5 Industry and Manufacturing sector

The energy saving potential in large industrial facilities in the Bank's region is substantial. Based on the Tacis study,[12] the Russian steel mills consume on average 32 per cent more energy than the optimum in the EU, while the Ukrainian average was 100 per cent greater. The total annual energy saving potential in audited 16 steel mills in Russia and Ukraine was 402,000 TJ (9.6 Mtoe), representing nearly half of the total primary energy supply (TPES) in Denmark (20.1 Mtoe), and more than TPES in Lithuania (7.9 Mtoe) in 1999.

The industry and manufacturing projects comprised half of the 262 so called "environmentally sensitive projects" by the end of 2000. The high number of industry and manufacturing projects, and complexity of many large industrial restructuring projects that include outsourcing of the most energy inefficient and polluting operations offer huge potential and challenge to the Bank for energy saving.

In successful projects, due regard has been paid to the upgrading of auxiliary operations, such as energy production, with modern technology. Upgrading has lead to positive environmental change, as it has enabled closing down less environmentally sound and energy inefficient operations, or installing more efficient external pollution control.

The benefits of a comprehensive and well designed environmental management system, including training programmes for the management usually based at ISO 14001, have

[12] *"No cost and low cost energy saving measures for the steel industry",* Tacis 1995

been evident, and improved the energy management. The EMS is an essential tool to collect concisely all the necessary information on pollution loads and energy efficiency.

Recycling and waste minimisation have economic significance and assessing the potential for those has often been a part of environmental due diligence. For example, in a Bank's saw mill project, wood chip by-product has been recycled and sold to the pulp and paper industry, and bark and wood waste of low quality has been used as a fuel in a bio-boiler for energy production. This has had a favourable effect in the client's energy balance.

However, all industrial projects have not been successful in terms of energy efficiency. A few unsuccessful projects have been characterised by a low level of environmental commitment by their sponsors. Projects that have started from a low level of environmental and energy performance generally demand a strong and committed international partner to be successful. Sponsors need to be tied to energy efficiency objectives, methods of reporting and standards in the project agreement. Where investment decisions have been based on vague technical data and an inadequate Feasibility Study, this can result in an investment budget that is too low, constant changes in the investment program and a lack of awareness concerning the relationship between different process departments and energy optimisation as a whole.

3.2.6 Natural Resources sector

The main areas of energy conservation in natural resources projects comprise utilisation of associated gas and avoiding of flaring in oil drilling projects, and energy efficient ventilation in mining projects. In Russia, about half of the associated gas in oil drilling operations is flared due to high investments needed to gas transport pipelines and gas compression stations in remote areas, and unwillingness or high investments needed for re-injection of the gas to the oil formation. Gas flaring means wastage of huge amount of clean energy and enormous release of greenhouse gases.

In many projects with excellent and good environmental success, the international sponsor has engaged with the lenders to find solutions to gas utilisation. Corporate headquarters has worked alongside the company and provided expertise together with industry associations instead of just keeping up with industry practice. A cooperative and enthusiastic large client can enhance energy saving and the positive aspects of a project. The Bank should therefore make more of an effort to identify proactive clients with sound projects and increase additionality.

An oil drilling company, following an EBRD audit where a process engineer was required to review optimal gas utilisation, has since identified engineering improvements to increase efficiency, recover liquids and improve gas utilisation, instead of flaring the gas they cannot use. In addition, as a long-term solution, the company is investigating ways to access carbon reduction funds, which it intends to combine with loans to finance a gas pipeline. Engaging an external process engineer to regularly review energy efficiency programmes with a view to improving them and reduce pollution loads is therefore a useful procedure in oil drilling projects.

3.2.7 Municipal and Environmental Infrastructure sector

Many waste-water treatment plants in CEE countries were over-dimensioned during the Soviet era. While these increased investment costs, operating costs, (usually 30-40 per cent of the total) including energy costs decreased in 90s due to reduced flow resulting from the introduction of tariffs based on water metering and reduction of leaks.

Where a capable operator, with a good understanding of the treatment processes and the complex interaction between them, is managing a Waste Water Treatment Plant even plants which are in a less than satisfactory condition can perform energy efficiently.

Similarly, newly constructed or rehabilitated plants can fail to meet design performance where an operator lacks expertise or interest, or both. Optimisation of the waste water treatment process and proper operation of the energy consuming aerators may save much energy.

3.2.8 ESCO projects

The Bank has signed 12 projects with Energy Service Companies (ESCOs. It is difficult to develop projects especially in district heating sector because of low motivation among municipalities and lack of sovereign guarantees. Most of the ESCOs have under performed their business plans. An important factor in promoting ESCO type projects is energy pricing policy. Energy market deregulation and phasing out the energy subsidies is an important driving force to energy efficiency investments. Considering the low energy efficiency in the Bank's region, there is a huge potential to increase the volume of ESCO projects.

EET is developing a public sector ESCO concept. The aim is to select through open tendering a qualified private ESCO operator to implement investments and management improvement aimed at reducing energy consumption in public facilities and buildings. Ideally, savings on fuel purchases, operation and maintenance, and capex should exceed the cost of capital and ESCO overheads over the life of the EPC. Benefits to public entity would include reduced energy consumption and hence budgetary expenditure, off-budget financing, and demonstration effect in the long run of private sector operator involvement.

Dalkia, the sponsor of Prometheus in Hungary and Dalkia Termika in Poland, has a business plan to aim at quite narrow energy saving concept, based on fuel shift, replacing old inefficient heat boilers and distribution network with modern efficient boilers, and advanced temperature metering and control technology. The heat supply installations have been effectively implemented with substantial total energy savings and reductions of emissions. The only DSM feature seems to be installation of thermostatic valves. The investments in heat insulation of external walls, roofs, windows and doors usually have longer IRR than the standard investment package of Dalkia, dropping them to the bottom of the priority list. This approach may leave potentially viable DSM investments out of the scope of the investment programme, because they have not been carefully studied in an energy audit.

The only sovereign ESCO of the Bank, UkrESCO in Ukraine operates as the financier of mainly industrial modernisation projects with significant energy saving component. Because of the low energy prices in Ukraine and short payback of the loans, conventional Energy Performance Contracts are not applied. Thus, at present the revenues of UkrESCO are not based on metered energy saving, but to the Tacis grant, representing about 9 per cent of the loan. After the Tacis grant is used, UkrESCO needs to increase the interest rate or obtain other revenues to cover its operation costs and make profit. The guaranteed energy saving is monitored during performance tests in commissioning phase; data on energy saving of the sub-projects and total operations after commissioning seem to be insufficient, making the judgement on the total energy saving impact of UkrESCO difficult. Energy audits including recommendations to improve DSM, and Environmental Audits are prepared for each sub-project. The client benefits from the audits in developing of its EMS and identifying energy saving investments in DSM side.

The experience of Dalkia Termika shows that Poland still lacks competitive financial alternatives for ESCO projects. In low, subsidised energy price countries like in Ukraine, the revenues from Energy Performance Contracts only are too low to cover the operation costs of ESCOs. In such countries, there is no incentive for the western sponsors to start ESCO business. The experience on UkrESCO shows that a sovereign ESCO may operate

as financier of projects with significant energy saving component and benefit from the favourable financing terms (maturity, interest rate, grants) compared with other financing sources available for the clients. When energy market liberalisation and tariff reform proceeds, such ESCOs may shift their operations to be based on the conventional Energy Performance Contracts and attract western sponsors.

Negotiation and structuring of ESCO businesses should aim at adequate monitoring of regulatory compliance and achieved energy and financial savings and reduction of emissions, including CO_2 emissions, of the ESCO sub-projects. The Bank should develop and request coherent monitoring and reporting system from the ESCOs it finances. Reporting should continue until the last repayment from the client has been made.

3.3 SUMMARY ON ENERGY EFFICIENCY AND EMISSIONS OF SAMPLED PROJECTS

The changes in primary and secondary energy generation and consumption of the sampled projects are shown in the table below. The figures show the impact of the project as the difference before the project started and at the time of evaluation.

Table 4 Changes in energy generation and consumption, and atmospheric emissions

PROJECT	Production volume change	Primary energy		Power and heat				Atmospheric emissions					
		Fuel input change		Elec. energy change		Heat energy change		CO_2 change		SO2 change		NOx change	
	%	GWh/a	%	GWh/a	%	GWh/a	%	t/a	%	t/a	%	t/a	%
POWER GENERATION													
Bielsko Biala Co-generation Plant	-17[13]	na		-64	-17	-586.51	-32			-3,133	-42	-2,268	-64
Syrdarinskaya Power plant	na	na		na	na			nil				nil	
DISTRICT HEATING													
Thermal Energy Conservation Project (TCEP)[14]		-2,287	-43					-452,000					
Termocom District Heating	none	none		none	none	none	none	none	none	none	none	none	none
POWER TRANSMISSION													
Talas Transmission Network				-8	-15			na	na	na	na	na	na
INDUSTRIAL PROJECTS													
Celhart (Pulp & Paper mill)	-49	-30,041	-49	-38	-42					-100	-8	-36	-24
Pilkington Sandoglass (glass plant)	+40	-90	-20	na	na			-17,800		-6	-5	-148	-14
Slovalco (aluminium plant)	+119	na	Na	+1,103	+63					-7,537	-33	-1,030	-10
NATURAL RESOURCES													
Chernogorskoye (oil development)								na	Na	nil	nil	+4	+100
Buryatzoloto (gold mine)	+77			-10	-20					+31	+37	+21	+6
MEI													
Tallinn Water and Environment	na			na	na	na	na	na	Na	na	na	na	na
Municipal Utility Devel. Project. I	na			na	na	na	na	na	Na	na	na	na	na
ESCOs													
Ukraine Energy Service Company				-4		-8		-3,227		-33			
Dalkia Termika						-58		-36,000		-159			
Prometheus I and II						-63		-14,600					

In general, it can be concluded that reporting of the clients and monitoring by the Bank on energy efficiency and emissions is insufficient to find out the full quantitative energy savings, and atmospheric emissions in most of the projects. In addition, the sample is too small to compare the impact of the Bank on energy efficiency issues in different sectors. The Bank's impact is most likely highest in the industry & manufacturing sector that

[13] In Bielsko Biala CHP plant, power and heat generation were reduced because of decreased demand

[14] Energy saving (GWh/a) and CO2 reduction are based on expected 230 Mm3 annual natural gas saving in five regions after the project is implemented. Fuel input change (%) is based on the example of energy efficiency improvement in Oltenita region, defined as heat supplied to buildings divided by heat supplied to the system..

represented half of the environmentally sensitive projects by the end of 2000. Many of the industrial reconstruction projects have involved large facilities, such as steel mills, aluminium smelters, pulp & paper mills, cement plants, and glass and textile manufacturing plants, with substantial energy saving and abatement of atmospheric emissions. The projects in the energy sector have also had a substantial impact.

In most of the projects in the energy and industrial sectors, the power generation or production capacity and volume have been changed by the project; in such cases, it does not make sense to compare the absolute changes of energy generation or consumption (GWh/a) and atmospheric emissions (t/a). Therefore, the reasonable parameters to track the impact of the projects and benchmark the performance against best practices are specific, production related parameters, such as energy consumption (kWh/t product) and emissions (kg/t product) per unit production, and emissions per produced energy unit (mg/MJ).

Energy efficiency was "*good"* or "*excellent"* in 74 per cent of the sampled projects. The only "*unsatisfactory"* project was Termocom Energy Efficiency project in Moldova. The change in energy efficiency has been "*substantial"* or "*outstanding"* in 73 per cent of the sampled projects. Ratings of environmental performance and two of its components, energy efficiency and air emissions of the sampled projects are presented in the table below.

Table 5 Project ratings of energy efficiency, air emissions, and environmental performance

	Energy efficiency						
Change in energy efficiency	Unsatisfactory	Marginal	Satisfactory	Good	Excellent	Total	%
Outstanding				1	1	2	13%
Substantial			2	7		9	60%
Some				1		1	7%
None	1	1		1		3	20%
Total	1	1	2	10	1	15	100%
%	7%	7%	13%	67%	7%	100%	
	Air emissions						
Change in Air emissions	Unsatisfactory	Marginal	Satisfactory	Good	Excellent	Total	%
Outstanding				1	1	2	17%
Substantial			2	2	1	5	42%
Some	1		1	1		3	25%
None	1			1		2	17%
Total	2		3	5	2	12	100%
%	17%	0%	25%	42%	17%	100%	
	Environmental Performance						
Extent of Env'tl Change	Unsatisfactory	Marginal	Satisfactory	Good	Excellent	Total	%
Outstanding				1		1	7%
Substantial			1	6	1	8	53%
Some		1		2	1	4	27%
None	1			1		2	13%
Total	1	1	1	10	2	15	100%
%	7%	7%	7%	67%	13%	100%	

3.4 POLICY DIALOGUE WITH GOVERNMENTS TO PROMOTE ENERGY SECTOR REFORM

The Bank is conducting dialogue in energy policy with the governments of the countries of operation in connection with the sovereign loan projects, with direct high level meetings with the governments, and with frequent joint meetings comprising representatives of the governments, and local representatives of FIs, EU, and donor organisations.

The only organised energy sector policy discussion forum aiming at market liberalisation, privatisation of the energy sector, and tariff reform is the Task Force for Energy Sector

Reform in Ukraine comprising governmental organisations, EBRD, IMF and the World Bank. The cabinet of ministers of Ukraine founded together with the Bank in October 2001 an Inter-ministerial Joint Working Group with EBRD to identify and develop energy efficiency projects in Ukraine. The Working Group consists of the representatives of the relevant ministries and the State Committee of Ukraine for Energy Conservation, and four representatives from EBRD. The first tasks are to identify the sectors under Government ownership, control or regulation where the Bank's financing would be targeted. The Working Group would agree on a tentative Bank financing amount for the next years, project selection criteria and screening procedures, reform requirements related to pricing, subsidy systems, transparency, and possibly privatisation. In addition, the issues to be agreed comprise the mechanisms for selling Carbon Credits generated through the joint projects to third parties, TC support in formulating an energy efficiency policy, and sovereign support required for the projects.

4. CONCLUSIONS AND RECOMMENDATIONS TO ENHANCE ENERGY EFFICIENCY IN BANK PROJECTS

4.1 THE ENVIRONMENTAL AND ENERGY PERFORMANCE OF THE BANK PROJECTS

- The scope of the study and size of the sample of projects does not allow making general conclusions on the overall energy efficiency of the Bank's projects. However, looking to the outcomes of the 15 sampled projects, energy efficiency was "*good"* or "*excellent"* in 74 per cent. Common features for the successful projects, as seen in many other Bank projects, are: a committed and strong sponsor, well defined environmental and energy saving objectives, financially viable technology, successful public consultation, and a well implemented Environmental Management System. Well developed environmental regulatory framework, and cost-recovery based energy tariffs promote the environmental and economical sustainability of the projects. The two failed projects in the sample, rated *unsatisfactory* or *marginal* were mostly related to weak feasibility studies. In the municipal district-heating project that failed, unrealistic investment cost estimate together with weak commitment of the client and government to tariff and utility reform, and volatile political and economical environment have been the reasons for unsatisfactory performance.
- It is impossible to judge the quantitative impact of Bank projects on energy efficiency because the Bank does not collect systematic data on energy saving and consequent abatement of atmospheric emissions.
- The environmental performance of the two ESCO's in the sample has been "*good"* or "*satisfactory*" and their impact on energy saving and reduction of atmospheric emissions has been "*substantial*". Dalkia, the sponsor of Prometheus in Hungary and Dalkia Termika in Poland, has a business plan to aim at a quite narrow energy saving concept, based on fuel shift, replacing old inefficient heat boilers and distribution network with modern efficient boilers, and advanced temperature metering and control technology. The heat supply installations have been effectively implemented with good total energy savings and reductions of emissions. The only sovereign ESCO of the Bank, UkrESCO in Ukraine operates as the financier of mainly industrial modernisation projects with significant energy saving component. Energy audits including recommendations to improve Demand Side Management (DSM), and Environmental Audits are prepared for each sub-project. The client benefits from the audits in developing of its Environmental Management System (EMS) and identifying energy saving investments in DSM side.
- In general, the Bank has conducted active dialogue with governments and municipalities to push the energy sector reform forwards. Some energy projects, such

as Talas Network Improvement projects in Kyrgyzstan, have demonstrated that by covenanting the loan, the Bank can have substantial impact on market liberalisation, and energy sector and tariff reforms. A stepwise approach is essential for a successful energy sector reform that should start from commercialisation of the industry and founding of an independent regulatory tariff authority, following with the entry of the private sector. The next steps would include a carefully planned tariff reform to achieve sustainable cost-recovery and justified compensation to the poorest part of the population, and finally the market liberalisation. In many early and intermediate transition countries, the results of the policy dialogue and projects have been less successful; institutional constraints, political disputes, lack of funding, and guarantees, insufficient law enforcement, and poor investment climate have effectively barred the reforms. This has also been especially the case in Russia in the past decade; however, the Government's agreement in July 2001 to liberalise the power sector and previous plan to wipe out subsidies by 2008 are encouraging. However, the success will again depend on the enforcement of the good decisions. The World Bank has a wider public energy project portfolio in the region and more influence than EBRD to the governments to reform the energy sector.

- The use of the expertise of the EET specialists in the mainstream projects outside the Energy sector is not customary. The Bank has formed a new Energy Business Group comprising Natural Resources, Power and Energy Utilities, and Energy Efficiency. The objective is to develop a broader mandate for the Bank's energy efficiency commitment, including working with country and sector bankers, particularly to address energy saving opportunities of industrial energy users. The new organisational framework offers better opportunities to adequately address energy efficiency in Bank projects.

4.2 RECOMMENDATIONS TO ENHANCE ENERGY EFFICIENCY IN BANK PROJECTS

- When utilising the expertise of the EET it is important allowing their energy efficiency specialists short term presence in advisory positions in projects with high potential for energy saving. The Environment Department (ED) and the EET are in key roles in appraisal, implementation, and monitoring. The expertise of the EET in structuring the operations towards improved energy efficiency and ED's assistance in this respect should be better utilised in a wider range of projects.
- The environmental opportunities, including energy efficiency improvements, should be formally linked in the project appraisal and credit process, e.g. with a special paragraph in the "Summary Fact Sheet". The projects should be categorised (high/medium/low) according to their energy efficiency potential, as proposed by Environment Department. Up-front Energy Audits should be conducted for the projects with highest potential for energy saving to quantify the energy saving gains and costs, and environmental benefits.

4.3 DEVELOP MARKETING TO MAKE ENERGY EFFICIENCY INVESTMENTS ATTRACTIVE TO THE CLIENTS

- Energy saving investments often create a "win-win" scenario, with higher profit margins to the client and better debt service ratio to the Bank. However, the management of the local sponsor, accustomed to low priced energy, often does not recognise the benefits of Energy Audits and energy efficiency investments. Therefore, it is important to develop and market Bank's "energy service product" for high energy intensive industry sectors like forestry, metal, building material, and chemical industry, with powerful sales arguments to better demonstrate the cost savings and environmental benefits of the energy efficiency measures. The energy service product

would comprise an Energy Audit and a proposal for a financing package. The Energy Audits, tailored to industry specific needs should be reported with a standard format, including e.g. a transparent mass end energy balance, specific energy consumption figures, benchmarking the company against BAT, investment and operation cost estimate, and IRR and payback calculations. Using the knowledge of EET and ED, the Bank could structure various options, including an Energy Performance Contract tendered by a local ESCO, GEF funds, Carbon Credits, or simply increase the amount of the EBRD investment, to finance additional energy saving investments in its mainstream projects. The energy audits could be partly or totally financed by TC funds. The client's financing could be compensated, if the proposed energy saving investments are implemented. Brochures, Annual Report, Internet, and other media could be used for marketing of the proposed "energy service product".

- Marketing of energy efficiency investments is more effective to the existing than to new clients; during the second loan appraisal for the existing client, the energy saving potential should be studied and marketed more intensively

4.4 COOPERATE WITH OTHER STAKEHOLDERS IN SEARCHING AND DEVELOPING OF PROJECTS WITH POTENTIAL FOR ENERGY SAVING

- The evaluation of energy efficiency of the Bank projects has shown that there is a need to regional energy sector studies to prepare baseline for future energy supply investments, including Demand Side Management opportunities. Tacis financed technical assistance e.g. in regional energy sector studies could help the Bank in assessing the priority and feasibility of individual energy sector investments. Especially Tacis, Phare, and SYNERGY may allocate grant money for energy studies in the Bank's region.[15] These opportunities should be explored and presented to the clients as possible external sources to finance energy efficiency studies.
- The Bank is cooperating with other IFIs in harmonising the approach towards effective tariff, subsidy, and covenant policy. This cooperation is useful to obtain better joint impact in the energy policies in the region, and especially in Russia, that has recently started the power sector reform.
- There are opportunities to find more projects with high energy saving potential by utilising more the Project Preparation Committee (PPC), and the World Bank Carbon Fund in searching of energy projects.

4.5 INCREASE AND IMPROVE ENERGY AUDITS AND STUDIES IN THE MAINSTREAM OPERATIONS

- Energy Audits, requested in the EAPs and commissioned by the Sponsor, and the TC framework contract for energy efficiency studies have been useful to identify energy saving measures in project appraisal. However, energy efficiency is still a relatively minor topic in the Environmental Audit and the timeframe for the consultants to conduct Environmental Audit including identification of energy efficiency opportunities has shortened. To avoid missed opportunities in identifying feasible energy efficiency investments, the projects should be classified during the Environmental Due Diligence according to their energy saving potential. Energy Audits should be used more often and systematically for the projects with highest energy saving potential. Using of TC funding for Energy Audits should be promoted and the framework contract should be made sustainable with long term contract financing.

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[15] European Commission, "Energy Efficiency in the European Community-Towards a Strategy for the Rational Use of Energy" (1998) p.8.

- In large industrial restructuring projects, advanced energy optimisation analysis should be utilised. An example is PINCH[16] analysis that is widely used in process industry, for example in oil refineries, chemical and petrochemical industries, food industry, sugar manufacturing, and pulp & paper industry to identify energy efficiency improvements by optimising the heating and cooling streams and heat exchanger network of the process.

4.6 IMPROVE THE REPORTING OF ENERGY EFFICIENCY IN APPRAISAL, MONITORING, AND EVALUATION

- The energy efficiency issues should be reported in Environmental Appraisal, Energy Auditing, monitoring, and evaluation reports on a coherent manner, and the projects with high energy saving potential should be benchmarked against the Best Available Technology. This can be obtained e.g. from, European Integrated Pollution Control and Prevention Bureau (EIPPCB),[17] the Pollution Prevention and Abatement Handbook of the World Bank (1998)[18] or Council Directive 96/61/EC on Integrated Pollution Prevention and Control, and the recent EC study on best available energy efficiency on various industry sectors.[19] Energy Audit and monitoring reports should include a transparent mass and energy balance calculation and data on specific production related energy consumption to obtain the impact of the project in energy efficiency. For each project, monitoring information on energy efficiency and other environmental performance indicators should be stored in a Bank-wide database.

4.7 DEVELOP THE ENVIRONMENTAL AND ENERGY MANAGEMENT SYSTEM (EMS) OF THE CLIENTS

- Building of formal EMS should be more emphasised in the power and energy projects. The environmental aspects of the sector are often significant; therefore a formal EMS, preferably based on ISO 14001 would help the management to identify the environmental policy and environmental objectives of the organisation and to develop the structure and training of the environmental management. It is also an excellent tool to improve public consultation in environmental issues and environmental reporting. Good examples of Western power and energy companies, which have successfully implemented ISO 14001 and their environmental reports are available e.g. on the Internet.[20] The principal components in establishing an Energy Management System comprise.[21]
- *Energy audit* -quantifying how energy is used and identifying energy saving opportunities.
- *Responsibility and commitment* - assign management responsibility for energy and establish commitment of top management to the energy saving programme.
- *Implement initial no cost and low cost measures* - a programme to implement the first projects is developed with full support and participation of managers.

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16 Useful links: http://www.sucrose.com/energy.html, http://vs5.ws8.u-net.net/linnhoffmarch/www.linnhoffmarch.co.uk/Resources/Pinch.html

17 EIPPCB, European Integrated Pollution Control and Prevention Bureau, http://eippcb.jrc.es/pages/FActivities.htm

18 World Bank, "Pollution Prevention and Abatement Handbook", 1998, http://wbln0018.worldbank.org/essd/essd.nsf/docs/toc?opendocument

19 EC, "Study on Energy Management and Optimisation in Industry", (July 2000).

20 Useful links: http://www.corporateregister.com/cgi-bin/simple.pl?company=energy, http://www.helsinginenergia.fi/english/environmental.html, ,

21 The components are based on EU Tacis report, *"No cost and low cost energy saving measures for the steel industry"*,(1995), but may well be applied also to other than steel industry

- *Motivation and training* - operators and managers need training in good energy efficiency and new working practices.
- *Monitoring and targeting* - monitoring, reporting and target setting in relation to energy performance to evaluate and inform how savings are being made and maintained.
- *On-going energy saving plan* - a coordinated programme to sustain existing projects and to implement additional ones in a structured way.

4.8 ENHANCE POLICY DIALOGUE AND IMPLEMENTATION OF PROJECTS WITH HIGH POTENTIAL FOR ENERGY SAVING

- It is important to continue policy dialogue with the Governments, aiming at de-monopolising and reforming the energy sector, and support such projects, which will increase competition in such sectors that are suffering from a stiff and non-transparent monopoly, as for example in the gas sector in Russia.
- A comprehensive energy sector study for the region including energy saving considerations and Demand Side Management (DSM) is necessary in such cases, when a narrow technological focus on only one energy supply option at the outset may prevent the adequate exploring of other supply alternatives.[22]
- It is important to ensure that the independence of the regulator is enshrined in law and also covenanted in the loan or guarantee agreement as appropriate.
- The Bank should develop a template for standardised Terms of Reference for feasibility studies in district heating projects and ensure that cost estimates are realistic; they should be based on the agreed technical concept with the client and tenders of the main equipment.
- Outsourcing and privatising the energy supply in large industrial projects may accelerate the establishment of self-sustainable energy supply companies.
- It is useful to engage in complex industrial projects with high energy saving potential an external process engineer to regularly review energy efficiency programmes with a view to improve them and reduce pollution loads.
- Optimisation of the wastewater treatment process and proper operation of the energy consuming aerators may save much energy. The operators should be properly trained to understand the biological parameters and energy saving potential in wastewater treatment plants.

[22] see for example OPER No: PE01-174, Mutnovsky Independent Power Plant, Russian Federation.