

Document of
The World Bank

Report No: 32186

IMPLEMENTATION COMPLETION REPORT
(FSLT-70150 TF-23679)

ON A

LOAN

IN THE AMOUNT OF US\$ 38.2 MILLION

AND A GLOBAL ENVIRONMENT FACILITY GRANT

IN THE AMOUNT OF US\$ 5.4 MILLION EQUIVALENT

TO PEC GEOTERMIA PODHALANSKA, S.A.,

POLAND

FOR THE

PODHALE GEOTHERMAL DISTRICT HEATING AND ENVIRONMENT PROJECT

October 11, 2005

CURRENCY EQUIVALENTS

(Exchange Rate Effective July 22, 2005)

Currency Unit = Polish Zloty (PLN)

PLN 1 = US\$ 0.295

US\$ 1 = PLN 3.392

(Exchange Rate Effective April 1, 2000)

PLN 1 = US\$0.242

US\$1 = PLN 4.132

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

BLP	Base Load Plant	KP	Kyoto Protocol
BREC	Baltic Renewable Energy Centre	mg/m ³	Microgram per cubic meter (a measure of ambient concentration of a pollutant in the air)
CAS	Country Assistance Strategy	MoE	Ministry of Environment
CHP	Combined Heat and Power	MoF	Ministry of Finance
CO ₂	Carbon Dioxide	MT	Metric Ton
DEPA	Danish Environmental Protection Agency	MW	Megawatt
DH	District Heating		
		NFOs	National Fund for Environmental Protection and Water Management
ECA	Europe and Central Asia Region	NO _x	Nitrogen Oxides
		NPV	Net Present Value
		PAD	Project Appraisal Document
EIRR	Economic Internal Rate of Return	PAN	State Academy of Sciences (Krakow)
EMP	Environmental Management Plan	PCF	Prototype Carbon Fund
EOY	End of Year	PEC	PEC Tatry S.A. (former coal/coke based heating plant in Zakopane)
		PEC/GP	PEC Geotermia Podhalanska, S.A.
ER	Emission Reductions		
EU	European Union	PLN	New Polish Zloty
EU	Support Program of the European Union		
PHARE	for Central Europe	PLP	Peak Load Plant
FIRR	Financial Internal Rate of Return		
GEF	Global Environment Facility		
GJ	Gigajoule	PM ₁₀	Particulate Matter Less than 10 Microns in Diameter
GoP	Government of Poland	PMR	Project Management Report
GP	Geotermia Podhalanska S.A.	PSR	Project Status Report
GW	Gigawatt		
GWh	Gigawatt Hour	PV	Present Value
HOB	Heat Only Boiler	S.A.	Spolka Akcyjna (Joint Stock Company)
IBRD	International Bank for Reconstruction and Development	SO ₂	Sulfur Dioxide
ICR	Implementation Completion Report	TJ	Terajoule
IDC	Interest During Construction	TSP	Total Suspended Particulate Matter
IRR	Internal Rate of Return	UAC	Unit Abatement Cost
JI	Joint Implementation	USAID	United States Agency for International Development

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POLAND
PODHALE GEOTHERMAL DISTRICT HEATING AND ENVIRONMENT PROJECT

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<i>Project ID:</i> P037339	<i>Project Name:</i> PODHALE GEOTHERMAL DISTRICT HEATING AND ENVIRONMENT PROJECT
<i>Global Supplemental ID:</i> P057993 (<i>Fully Blended</i>)	<i>Supp. Name:</i> Podhale Geothermal District Heating and Environment Project
<i>Team Leader:</i> Helmut Schreiber	<i>TL Unit:</i> ECSIE
<i>ICR Type:</i> Core ICR	<i>Report Date:</i> October 11, 2005

1. Project Data

Name: PODHALE GEOTHERMAL DISTRICT HEATING AND ENVIRONMENT PROJECT *L/C/TF Number:* FSLT-70150

Country/Department: POLAND *Region:* Europe and Central Asia Region

Sector/subsector: District heating and energy efficiency services (100%)

Theme: Pollution management and environmental health (P); Climate change (P)

KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>PCD:</i> 04/22/1998	<i>Effective:</i> 07/27/2000	07/27/2000
<i>Appraisal:</i> 10/25/1999	<i>MTR:</i> 05/15/2003	05/15/2003
<i>Approval:</i> 05/11/2000	<i>Closing:</i> 12/31/2004	12/31/2004

Supplemental Name: Podhale Geothermal District Heating and Environment Project *L/C/TF Number:* TF-23679

Sector/subsector: District heating and energy efficiency services (100%)

Theme: Pollution management and environmental health (P); Climate change (P); Environmental policies and institutions (P)

KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>GEF Council:</i> 03/01/1999	<i>Effective:</i> 07/27/2000	07/27/2000
<i>Appraisal:</i> 10/25/1999	<i>MTR:</i> 05/15/2003	05/15/2003
<i>Approval:</i> 05/11/2000	<i>Closing:</i> 12/31/2004	12/31/2004

Borrower/Implementing Agency: PEC GEOTERMIA PODHALANSKA, S.A. (PEC/GP)

Other Partners: National Fund for Environment, Polish Ecofund, Municipality of Zakopane, other municipalities, Ministry of Environment

STAFF

	<i>Current</i>	<i>At Appraisal</i>
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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)

Rating

<i>Outcome:</i>	U
<i>Sustainability:</i>	L
<i>Institutional Development Impact:</i>	SU
<i>Bank Performance:</i>	S
<i>Borrower Performance:</i>	S

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

For ratings explanations see chapter 7 and Annex 6. We understand that a new category of marginally satisfactory (MS) will be introduced in future ICR ratings and would use that as the most appropriate rating for the Bank and Borrower Performance. Absent that rating, satisfactory has been chosen as the most representative of the currently available rating options.

Note: There was no QAG review at entry. Rather a quality assurance review internal to the ECA Vice Presidency was prepared and rated S.

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

3.1 Original Objective:

The Project's primary development objective was to reduce local air pollution in full compliance with the national priorities as identified in the CAS of April, 1997. The associated global objective was to reduce CO₂ emissions that contribute to global warming in accordance with Poland's signing of the Kyoto Protocol in November, 1998.

These objectives were to be met by developing a new geothermal district heating system in an environmentally sensitive area of southern Poland that borders a National Park and which is noted for tourism. The new geothermal heating system, supplemented with gas-fired peaking boilers, was intended to displace district heating boilers, large load boilers, and individual home heating systems that were fuelled primarily with coal, coke or oil. Local benefits were expected to include reduced incidence and severity of respiratory disease, reduced damage to biota in the National Park, increased visibility, and increased volume and quality of tourism in the area. Global benefits were also anticipated based on reductions in CO₂ emissions.

3.2 Revised Objective:

The original development objectives for the Project have not been changed, although the target heat market connections were revised downward based on early results and subsequent decisions to reduce the size of the network.

3.3 Original Components:

The completed Project was to include the following components:

- (1) Production and Transmission of Heat
 - (a) a geothermal Base Load Plant (BLP) in Banska Nizna
 - (b) the expansion of a gas-fired Peak Load Plant (PLP) in Zakopane
 - (c) a PLP in Nowy Targ
 - (d) hot water transmission pipelines from BLP to Zakopane and to Nowy Targ
 - (e) two gas transmission pipelines to BLP and PLP (Nowy Targ)
 - (f) electric connections and pumping stations
 - (g) acquisition of land for drilling and building sites, construction of buildings

- (2) Heat Distribution Network Development
 - (a) construction of DH networks in Zakopane and Koscielisko
 - (b) construction of partial networks in five small communities near the transmission pipeline
 - (c) connections in Nowy Targ to a new PLP and to a network supplied by three old coal-fired boiler houses
- (3) Provision of Heat Exchangers, Meters and Connections To End Users
- (4) Facilities, Tools and Vehicles for Implementing Company
- (5) Project Management Support, including technical assistance (TA) and specialized services such as marketing, financial management and auditing
- (6) Monitoring and Evaluation (M&E) including TA for monitoring and evaluating global environmental benefits in terms of reduced carbon emissions.

3.4 Revised Components:

Failure to attract the expected amount of geothermal load, coupled with some serious delays in project execution led to financial losses, which caused the main shareholder NFOS to change the company management abruptly in 2003. NFOS also imposed a freeze on any further investments, and insisted on a complete new assessment of the Project. As a result, Project components were only partially complete at the end of 2004 as indicated in Table 3.1 and the notes that follow.

Table 3.1: Project Components, Estimated & Actual Costs, and Remarks

Project Components, Costs and Remarks (Costs in US\$ Million)	Estimated	Actual	Actual over	Remarks
	2000-2004	2000-2004	Estimated	
Comp.1: Heat Production and Transmission	32.5	18.2	55.8%	Smaller capacity, no third doublet, no heat pumps, no transmission to Nowy Targ, two gas engines not foreseen originally
Comp.2: Distribution Networks	21.1	13.2	62.4%	Zakopane 80% complete, no networks in Koscielisko and villages
Comp.3: Heat Exchangers and Miscellaneous	3.1	2.0	65.2%	Much lower costs due to smaller number of connections
Comp.4: Project Management	0.5	0.4	92.1%	Market Studies not done
Comp.5: Monitoring & Evaluation	0.4	0.3	73.0%	2005 M&E Study not done
Total Project Costs	57.6	34.1	59.1%	

Component 1 (Heat Production and Transmission): Nowy Targ (NT) decided to build its own PLP. Despite a firm letter of commitment to the World Bank at appraisal, and major efforts by PEC/GP, NT never signed a heat off-take agreement, because NT and PEC/GP could not agree on a heat sales price, which would satisfy both parties. Without an off-take contract the Transmission Pipeline to NT could not be pursued.

Additional Wells and Expansion of the geothermal BLP: Because of uncertainties regarding NT and slow network development in Zakopane, no additional wells have been drilled and no absorption heat pumps have been installed.

New Gas Engines: PEC/GP bought three gas engines (PLN 9.22 million), which were not in the original project scope. Installed at the PLP in Zakopane, they provided gas-based heat to the DH system and electricity for own use and for sale to the regional grid. From 2002, the rising gas price and lowered tariffs

to the grid made operation of the gas engines uneconomic. PEC/GP plans to re-install them at the BLP, which will allow using electricity at the geothermal pumping station, thereby avoiding costly purchase of electricity.

Component 2 (Heat Distribution Networks): Smaller than anticipated network density and development of potential areas in Zakopane; No, or smaller than expected networks in other municipalities.

Component 3 (Heat Exchangers and Misc.): The number of connections was smaller than estimated. Some miscellaneous cost items were bigger than expected.

Component 4 (Project Management): Danish TA funded by a grant from Denmark was fully used. TA funds to strengthen management, notably its FMS system were not fully used, as envisaged software (FOXPRO) to work as an interface between the company accounting system and the PMR system was never fully installed. The PMRs show inconsistencies and unexplained issues.

Component 5 (Monitoring and Evaluation): All planned M&E studies were completed, except for the last study that was scheduled in 2005. Monitoring is done on a regular basis at a number of measuring points in the Zakopane area. Evaluation of data through the end of 2004 shows excellent improvement in local air quality due, in part, to the Project.

3.5 Quality at Entry:

An internal review by the ECA Quality Unit was conducted prior to finalization of the PAD. Questions were raised regarding the priority character of the project, the market risk, the competitiveness of geothermal energy as compared to other fuels such as coal, coke, fuel oil and gas, the tariff structure in the heat market, and the proposal to privatize the Project. The appraisal team provided detailed answers to these questions and amended the PAD to reflect these concerns prior to Board presentation. At that point, project preparation was deemed satisfactory. Subsequent developments, as detailed below in Section 7.1, have revealed weaknesses in the project preparation effort that suggest an ex-post rating of unsatisfactory.

3.6 Project Design:

Two forms of Bank assistance were designed to meet the Project objectives. Initially, the project was prepared with the intent of securing a Global Environment Facility (GEF) grant that would compensate the project based on its incremental economic costs. Incremental economic costs were compared to a baseline development scenario that featured gradual conversion of heating systems in Zakopane to gas and continuation of the status quo in the other villages and for part of the Nowy Targ district heating system. The incremental cost study justified \$8.4 million as a GEF grant and \$5.4 million was eventually offered. When the project faced difficulties due to the lack of available investment capital on a predictable schedule, a World Bank loan was offered both to provide backbone financing and to mobilize financing from other sources. The World Bank loan was for \$38.2 million.

These two distinct forms of assistance led naturally to two different project definitions. Replicability was an important issue in attracting GEF to the project. Thus, the GEF Project was based on the entire development effort from 1995 through anticipated completion of investments in 2004. The Bank Loan, however, was solely intended to support investments during the 2000 through 2004 period. Therefore, the Bank Project, which was appraised in 1999 and negotiated in 2000, treated pre-2000 investments as sunk costs and focused only on the incremental costs incurred and benefits earned from 2000 on. Throughout this report these two distinct project definitions are referred to as the GEF or total project (1995-2004 investments) and the Bank or incremental project (2000 – 2004 investments). For both Projects, the assumed operating life was through 2024 although the wells are expected to allow much longer operation.

The cost estimate for the GEF Project included the following components:

Production and Transmission of Heat	US\$43.2 million (PLN175.3 million)
-------------------------------------	-------------------------------------

Heat Distribution Network Development	US\$24.3 million (PLN 98.6 million)
Provision of Heat Exchangers, Meters, etc.	US\$ 4.6 million (PLN 18.7 million)
Project Management	US\$ 0.5 million (PLN 1.7 million)
Monitoring and Evaluation	US\$ 0.4 million (PLN 1.6 million)
Physical Contingencies:	US\$ 6.0 million (PLN 24.4 million)
Price Contingencies:	US\$ 2.6 million (PLN 10.5 million)
Total Project Cost (1995 to 2004)	US\$81.6 million (PLN330.8million)
Incremental Working Capital	US\$ 9.0 million (PLN 35.2 million)
Interest During Construction	US\$ 6.2 million (PLN 28.0 million)
Total Financing Required 1995 to 2004	US\$96.7 million (PLN394.0 million)

Of the \$81.6 million for the GEF project, \$24.0 million were spent between 1995 and 1999 financed with grant funding from local and foreign sources as well as equity from the National Fund for Environmental Protection and Water Management (NFOS), the local municipalities and some minor private investors. This left \$57.6 million as the project cost for the Bank Project which had total financing requirements of \$69.6 million.

3.7 Risk Assessment Ex Ante:

The appraisal considered a wide spectrum of risks, which could interfere with project implementation, successful start-up and operations including:

- Market penetration
- Uncertainty regarding the future costs of competitive heating fuels
- Financial vulnerability to insufficient or late market development
- Geothermal reservoir performance
- Cost overruns and implementation delays
- Insufficient capacity to implement the Project

The Project was recognized as an aggressive, and therefore risky, attempt to demonstrate effective use of geothermal resources for district heating over a very large, low heat density area to substantially improve the local air quality. The overall risk rating given the Project was “Medium”. In retrospect, the risks associated with the complex financial plan, related delays in Project implementation, company capacity to implement, and the inability to penetrate local heating markets were underestimated.

4. Achievement of Objective and Outputs

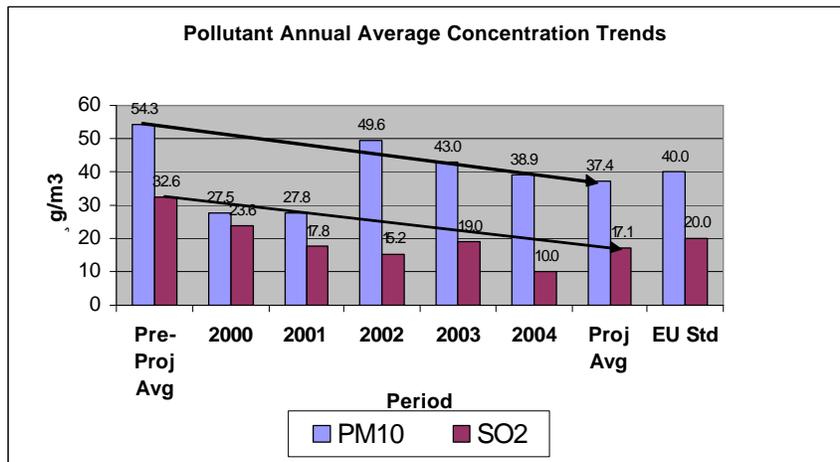
4.1 Outcome/achievement of objective:

The quantitative measures of project environmental performance established at appraisal included physical tracking of concentrations of particulate matters (PM₁₀), Sulphur Dioxide (SO₂), and Nitrous Oxides (NO_x) at Zakopane to assess contributions to the improvement of the local environment and reductions in Carbon Dioxide (CO₂) emissions to evaluate contributions to the global objective.

Primary Environmental Objective – Reduction of Local Pollution. The impact of the shortfalls in connected geothermal load on achievement of the primary project objectives is neither simple nor proportionate. Obviously, less fossil fuel combustion has been displaced than was anticipated in the project design. However, reductions in local air pollution depend critically on the mix of fuels displaced and the ambient concentrations of pollutants at the specific locations of the displacement. While approximately 70% of the design heat loads were located in or near Zakopane, almost 94% of the actual connected load is in this most sensitive environmental area where all health and visibility benefits were located. The Project has replaced inefficient coal-firing with geothermal heat supply in 28 old district heat boiler houses located

in the center of Zakopane. Given the large loads that were converted to geothermal, many of the largest polluters in Zakopane have been cleaned up. Since point source monitoring was not available historically, project environmental monitoring was designed at appraisal to track concentrations of PM10, NOx and SO₂ in Zakopane. Indirect evidence of project impacts on concentrations of these pollutants is provided in the following graphic analysis. By 2004 concentrations of PM10 were reduced by more than 30%; of SO₂ by almost 50%; and of NOx by about 55% in spite of dramatic increases in local automobile traffic in the past five years. By 2004, Zakopane was in full compliance with EU standards for PM10 and SO₂ and within 3.0% of the standard for NOx. Of course, other factors may have contributed to this improvement but the project has had an undeniable beneficial environmental impact in Zakopane.

Chart 4.1. Decline of PM10 and SO₂ from before the Project to 2004



Estimates have been made of the Project impact on PM10 and SO₂ concentrations in Zakopane using the same methods developed to estimate environmental benefits in the PAD.^{1/} Annex 3 provides the 2004 fuel displacement estimates for households, large loads and the Tatry boiler houses in Zakopane compared to their pre-Project usage. Conversion of the displacements of each type of fuel to reductions in pollutant concentrations shows that the Project was directly responsible for an improvement of 10.8 micrograms/m³ of PM10 and 10.0 micrograms/m³ of SO₂. This represents 63.9% of the total PM10 improvement and 64.5% of the SO₂ improvement that is shown in the graph above.

Based on the specified monitoring indicators, the achievement of the primary development objective is rated satisfactory. Even though the results have been well below the design levels that were anticipated at appraisal, achieving compliance with EU standards within four years in Zakopane is a notable accomplishment in a critical area. The geothermal Project alone accounted for nearly two-thirds of this achievement for both PM10 and SO₂. Although the Project goal was never explicitly stated in these terms, an appraisal claim that this Project would move this far toward full EU compliance within four years would almost certainly have been deemed a notable and welcome achievement in 2000.

Secondary Environmental Objective – Reduction of Global Emissions of CO₂. The global objective was focused on the reduction of CO₂ emissions and supported by a GEF grant. The following three critical indicators of the Project achievement of its global objective are relevant:

- Reduced tons of CO₂ emissions
- The GEF cost per tonne of reduction achieved or unit abatement cost (UAC)

- Exemplary impact on promotion of geothermal district heating technology in the region and beyond.

Not surprisingly, CO₂ reductions have been heavily impacted by the failure to connect Nowy Targ and more households in the rural areas since these loads constitute a disproportionate share of coal combustion among the design heat loads. Annual reductions of CO₂ emissions in 2004 were 22% of the anticipated level. Depending on the future development of the Project, the life cycle reductions through 2024 are expected to range between 22% (584,300 tonnes for Case 1) and 31% (817,500 tonnes for Case 2) of appraisal estimates.

The GEF interest in the Project can also be evaluated in terms of the unit abatement costs (UAC) since this was a primary criterion used to justify GEF funding. The incremental cost analysis of the project justified a GEF grant of \$8.4 million. In recognition of the Project risks, GEF offered a grant of \$5.4 million. As the shortfalls in market penetration became evident and the Nowy Targ component became much smaller and less certain, the grant was limited to \$3.2 million. The UAC estimated at appraisal (including the \$400,000 that was added for public relations) was \$3.16 per tonne. The actual UAC based on the \$3.2 million that was paid is now expected to range between \$3.90 and \$5.45 per tonne depending on future development of the Project. While these unit costs range from 23% to 72% above appraisal estimates, they can also usefully be compared to the following benchmarks:

- The Prototype Carbon Fund (PCF) and their downstream national counterparts are now regularly offering prices between \$4.00 and \$6.00 per tonne for CO₂ reductions in Joint Implementation (JI) projects.
- The market price in the EU trading system continues to increase and has reached levels between \$25 and \$35 per ton.

Finally, it should be noted that the public relations efforts that were supported by GEF were significant. The Project has been visited by numerous interested parties from many Eastern European countries. The Prototype Carbon Fund selected Zakopane as the site for their annual meeting, in part, to visit this Project. The Project is widely known in the region. It cannot be proven but it would not be unreasonable to believe that some indirect carbon reductions will occur in the future based on the demonstration effect of this investment.

Considering all three measures of the global objective, it is clear that appraisal expectations of the total CO₂ reductions will not be met. However, the GEF grant was set below the justified amount initially in recognition of project risks. Proactive supervision limited the grant to 59% of the committed amount soon after it became clear that major blocks of carbon displacement were no longer likely to be achieved. The effective result was to keep the GEF Unit Abatement Cost (UAC) within a reasonable range compared to expectations and still very competitive with subsequent prices being paid for carbon reductions. Given wide dissemination of Project results, interest in geothermal district heating has been stimulated and many lessons, both positive and negative, have been learned from this Project. Still, because of the shortfall in expected reductions, the project outcome can not be seen as satisfactory. It now appears that the maximum achievable reduction in life cycle CO₂ emissions will be 31% of appraisal estimates which suggests that the overall rating on this objective should be unsatisfactory.

4.2 Outputs by components:

At the end of 2004, the Bank project was expected to be complete with sales of 1,202 TJ of heat to 4,446 consumers during 2005 and each year thereafter. As shown in Table 3.1, cumulative project investment was 59% of the appraisal estimates while the distribution network and heat meters were less than

two-thirds complete. Heat market penetration has not kept pace with completion of the production and delivery system. The shortfall in market penetration varies widely by heat market sector as shown in the following table:

2004	Appraisal	Actual	Actual/Design
Households			
Consumers	4,243	584	13.8%
Sales GJ	372,550	36,188	9.7%
Use Per	87.8	62.0	70.6%
Large Loads			
Consumers	172	162	94.2%
Sales GJ	474,144	154,857	32.7%
Use Per	2,757	956	34.7%
Tatry Boiler Houses			
Consumers	28	28	100.0%
Sales GJ	96,547	69,973	72.5%
Use Per	3,448	2,499	72.5%
Nowy Targ DHBH			
Consumers	3	0	0.0%
Sales GJ	235,000	0	0.0%
Use Per	78,333	0	0.0%
Total			
Consumers	4,446	774	17.4%
Sales GJ	1,178,241	261,018	22.2%
Use Per	265	337	127.3%

The following conclusions are evident from this simple comparison:

- Geotermia Podhalanska S.A. (GP) has been most successful in connecting large loads such as hotels and Tatry district heat boiler houses.
- The Tatry boiler houses were coal-fired and major contributors to air pollution in Zakopane which is the most critical area from an environmental perspective. The large loads are also heavily concentrated in Zakopane. Most were oil fired and also contributed heavily to local air pollution.
- The Nowy Targ load may still be connected to the geothermal system although that cannot be done without both more geothermal production capacity and significant additional transmission line. No significant system investments have been made as yet to serve this load.
- Despite the admirable market penetration for large loads in Zakopane, both these loads and even the Tatry boiler houses have used much less geothermal heat than was anticipated based on their reported former use of fossil fuels.
- Geothermal heat has not come close to the design targets for the households and the households that have connected have lower usage than anticipated. Slightly more than half of the connected households are in Zakopane where restrictions on air emissions from new heating installations have made geothermal more attractive.
- In focusing on the causes of these variances, it is important to recognize that less than 50% of the geothermal production capacity and only about 75% of the distribution network has been completed. Thus, significant potential load has not yet been offered geothermal service.

Range of Plausible Future Project Outputs. Since all appraisal measures of project performance were based on operation of the project through 2024, comparative ex-post analyses require assumptions about future operation of the project. At this point, the final development of the project remains dependent on

decisions by the NFOS which is the primary project investor. Bracketing ex-post assessments can be made of the implemented project as of the EOY 2004²⁷ and based on the maximum incremental development which is currently being considered. Steady state heat sales for the already installed system are estimated at 317 TJ (26% of design) per year (Case 1). With the maximum incremental development that is now being considered, this could reach 600 TJ (50% of design) per year (Case 2). (See Annex 8.)

4.3 Net Present Value/Economic rate of return:

For projects such as Podhale, where environmental improvement is the primary objective, the EIRR including externalities is the only indicator that attempts to monetize traditional savings, local environmental benefits and global benefits in a single metric. Financial analyses will not capture these impacts unless and until all externalities are monetized and fully synchronized in magnitude and time through the grants provided to the project.

The EIRRs calculated at appraisal were used to justify the World Bank loan to the project. In this context, the life cycle of the project was defined for the period from 2000 – 2024 with all prior investments treated as sunk costs. Externalities that were quantified in the Appraisal EIRR determination included improved health and visibility in Zakopane. Known benefits that were not quantified included favorable impacts on biota in the National Park near Zakopane and the value added from incremental tourism in this popular ski resort area.

The results of the ex-post EIRR calculations for Cases 1 and 2 are detailed in Annex 3 and summarized below in Table 4.1. For Case 1, the actual EIRR is now expected to be 9.3% or about 36% of the Appraisal figure.^{3/} For Case 2, the EIRR would fall to 8.6% although net benefits would still increase compared to Case 1. While these results are significantly below appraisal expectations, they are not decisively outside the acceptable range. If tourism and biota benefits were quantified, it is highly probable that both Cases 1 and 2 would reach attractive levels of economic return for projects of this kind. Still, from an economic perspective, the project achievements are deemed unsatisfactory.

Although the additional investment and related CO₂ reductions included in Case 2 have very beneficial impacts on GEF unit abatement costs, the economic gain is much less clear and must be weighed carefully against the risks of drilling another doublet and of attracting the additional load that is assumed in this scenario.

Table 4.1: Economic Internal Rates of Return Ex Ante and ex Post

Economic Internal Rates of Return	Appraisal	Case 1	Case 2
Ex ante and ex post	Ex ante	Ex post, 317 TJ	Ex post, 600 TJ
EIRR w/o local & global benefits	15.9%	4.4%	3.3%
EIRR with local & global benefits	26.6%	9.3%	8.6%

4.4 Financial rate of return:

The two most telling determinants of project financial performance from 2000 through 2004 are:

- Cumulative investment costs of US\$34.1 million (nominal) were 59% of the appraisal expectations for this period.
- Cumulative operating costs were US\$11.2 million (in 1999 \$) or 85% of appraisal expectations.

The investment outlays were favorable considering that about 65% to 70% of the total system has been completed. However, the financial problems faced by Geotermia Podhalanska become immediately apparent when both the investment costs and the operating costs are compared to the heat sales that were only 22% of design levels in 2004. Although the system that has been built is substantially underutilized, operating costs have almost equaled appraisal expectations. The obvious result has been that revenues have not been sufficient to cover operating costs and debt service on the World Bank loan once the grace period was exhausted. The deteriorating financial performance of GP is documented in the financial statements for 2000 through 2004 provided in Annex 3. The final result was that GP could not possibly cover the debt service payments to the World Bank and NFOS needed to intervene with additional equity investment to repay the World Bank loan.

At the time of appraisal, the after tax financial internal rate of return (FIRR) was 11.5% and the before tax FIRR was 14.0%. With costs close to expected levels and sales and revenues so far below expectation, the FIRR would not be favorable under either of the future scenarios that have been considered.

Table 4.2: Financial Internal Rates of Return Ex Ante and ex Post

Financial Internal Rates of Return	Appraisal	Case 1	Case 2
Ex Post and Ex Ante	Ex ante	Ex post, 317 TJ	Ex post, 600 TJ
FIRR before Tax	14.0%	-4.0%	1.9%
FIRR after Tax	11.5%	-5.5%	0.0%

Financial criteria for conventional Bank projects are generally defined in terms of the FIRR being sufficient to attract commercial investors to similar projects. For environmental projects, it is much more difficult to establish minimum acceptable FIRRs. It is generally recognized that such projects can remain attractive with lower rates of return when the project focuses on social or environmental objectives and project benefits are not fully recognized in the prices that can be charged for project outputs.⁴¹ The economic analysis above shows that local and global environmental benefits were substantial components of project benefits as one would expect from the declared project objectives. However, the PAD for this project did suggest that it would be desirable for this project to ultimately move from dominant public ownership to private ownership. It is obvious from the FIRRs above that this project cannot achieve this objective without a substantial write-down of the investment or substantial increase in sales even above the Case 2 levels. For these reasons, the achievement of the financial objective must be considered to be unsatisfactory.

The most useful financial analysis for the NFOS at this point would address whether or not it is better to continue the operation of the project as is, expand the project, or to terminate the project. These questions can be answered by considering past investments as sunk costs and then calculating FIRRs on the incremental options that are available. In that analysis, it is also useful to illustrate the impact of the unanticipated 2.0% property tax that was imposed on all assets of the project after appraisal and to test the gains from plausibly extending operation by five years. Table 4.3 reports FIRRs for Case 2 under these assumptions. With annual sales of 600 TJ and incremental investment of 80 million PLN, the project offers attractive after tax returns with the property tax in place (12.6%) and very attractive returns (16.4%) for a heating company if the property tax were to continue being forgiven over the entire future period. Of course, this scenario offers no return of historic investment but it does demonstrate that it is reasonable to assume that the project will continue operation at some level between cases 1 and 2 since this offers attractive returns compared to termination.

Table 4.3: Alternative Financial Internal Rates of Return for CASE 2

CASE 2: FIRRs under Alternative Assumptions	2005 to 2030 With Prop.Tax	2005 to 2030 No Prop.Tax
IRR before Income Tax	15.5%	20.2%
IRR after Income Tax	12.6%	16.4%

Economic vs Financial Results. The shortfall of Project performance compared to appraisal expectations is evident in both the economic and the financial analyses with the EIRR falling 17.3% below the appraisal estimate and the FIRR falling 17.0% below target based on Case 1 analyses. However, the EIRR remains at marginally acceptable levels while the FIRR does not. The major differences between the economic and financial analyses include:

- The economic analysis attempts to measure the value of the Project to Poland while the financial analysis only captures the value of the Project to PEC/GP.
- The economic analysis excludes all taxes since these are simply transfer payments to other Polish agencies. The financial analysis, of course, must include all taxes that the Company must pay.
- The economic analysis is conducted solely in PLN with conversion to USD for Bank and GEF evaluation purposes. The actual financing selected included a World Bank loan denominated in EURO while all Project revenues are earned in PLN. The devaluation of PLN vs EURO was severe while PLN remained relatively strong vs USD.
- The economic analysis includes local environmental benefits based on reduced health costs and improved visibility plus global benefits from reduced carbon emissions. Unless such benefits are fully monetized through grants and/or premium pricing for clean heat, they are not fully reflected in the financial analysis.
- The economic benefit analysis includes the full avoided costs based on life-cycle analysis of the fuel, O&M, and replacement costs for the heating systems that are replaced by the Project. The financial analysis reflects regulated heating prices that are set based on approved embedded costs without regard for the savings to the consumers. Consumers may well underestimate the full economic cost of existing heating systems especially if the GP marketing effort does not emphasize the possible savings.^{5/}
- Full quantification of these differences would be difficult but some indicative evidence can be offered from what has already been documented.
- Although Table 4.3 is based on Case 2 with operation extended through 2030, it provides some indication of the impact of both income and property taxes on Project returns. With no taxes, the FIRR would be 20.2% while inclusion of both taxes lowers that FIRR to 12.6%. For this case, taxes have reduced the return by a total of 7.6% compared to the total difference or 8.6% between the FIRR (0.0%) and EIRR(8.6%) for Case 2. This comparison is exaggerated based on the additional five years of operation but remote future years should not have significant impacts on these results. Thus, taxes appear to have a very large impact on the FIRR relative to the EIRR.
- The impact of unfortunate exchange rate developments is known to have accounted for almost half of the cumulative financial losses of the Project through 2004. The full impact of exchange rate changes on economic returns is not easily determined but it depends only on PLN/USD exchange rates rather than PLN/EURO rates. Between 2000 and 2004, the PLN/USD rate declined by 16.1% while the PLN/EURO rate increased by 12.7%. Obviously, exchange rate moves have been decisively more damaging to the FIRR than to the EIRR.
- The influence of grants as financial compensation that allows monetization of environmental benefits is not easily addressed since many of the grants were tied to purchases of specific equipment and were not the equivalent of fully liquid funds. The time pattern of receipt of grants is completely different from the time stamp of the environmental benefits received. Standard

discounting does not solve the problem since global benefits are normally not discounted. Rough calculations show that the grants received from 2000 through 2004 had a present value of about \$9.3 million in 1999 using a discount rate of 11.0%. The present value of local and global benefits for the Bank Project on the same basis is \$7.4 million for Case 1 and \$9.4 million for Case 2. Thus, this does not appear to be a major cause of differences between the EIRRs and FIRRs. Of course, inclusion of tourism and biota benefits would change this conclusion as these benefits have clearly not been monetized.

- GP market research has not been able to determine the true willingness to pay of potential consumers. It is likely that consumers are not aware of the total economic cost of their present heating systems. Although this cannot be quantified, it is probable that the prices received by PEC/GP are less than the avoided economic costs and that this contributed to the differences between the FIRR and the EIRR. If consumers were fully cognizant of the economic cost of their present heating systems, market penetration should have been much greater than has been achieved.

4.5 Institutional development impact:

The Podhale Project has been the leading geothermal district heating development in Poland and in Eastern Europe over the past five years and has fomented both supportive and punitive policy positions among the various Polish institutions that have had central roles in its development. The key institutions reviewed here include: the Ministry of Environment (MoE); the major shareholder NFOS; the Municipality of Zakopane; and the Executing Agency PEC/GP.

- **Ministry of Environment (MoE):** The MoE has enthusiastically supported the Project from the start and has provided the following *assistance*:
 - Provided early grants for well drilling and technical assistance
 - Established a geothermal database for Poland to identify candidates for replication
 - Opposed geothermal “royalty” payments which seriously constrain the financial viability of district heating projects. Unfortunately, such royalties have again been introduced by law in 2005.
 - Streamlined concession procedures to facilitate Polish geothermal development.

In response to this leading Project, MoE has recognized the environmental benefits of geothermal heating and has done what it can to facilitate additional development.

- **National Fund for Environmental Protection and Water Management (NFOS):** NFOS has been a strong supporter of the Project and has provided critical injections of additional equity investment to allow continuing operation. Although NFOS is neither designed nor ideally suited to micro manage projects, as the primary owner of the Project, NFOS filled the management void created when the PEC/GP Board resigned in 2003. NFOS continues to play a central role in determining the extent to which the project will be further developed. The de facto result of this intimate relationship between NFOS and the Project has developed acute awareness at NFOS of the strengths and perils of geothermal district heating projects.
- **Zakopane and other Municipalities:** Zakopane has been the primary municipality supporting and promoting the Project through the following actions:
 - Granted an exclusive franchise for district heating in designated zones of the city to prohibit duplicative natural gas extensions.
 - Merged the municipal district heating company with PEC/GP which assured conversion of the polluting coal-fired boilers to clean geothermal heat supply. This move was significant in light of the related loss of employment at the district heating company.
 - Convinced neighboring cities to accept additional shares in PEC/GP in lieu of cash payments of the unanticipated and expensive local property tax.
 - Worked closely with NFOS and PEC/GP management to identify solutions to the company’s

financial problems.

- o Actively promoted geothermal conversions through public relations campaigns.
- o Zakopane has also developed acute awareness of geothermal development challenges and can provide useful guidance to their peers in Poland and throughout the region.

Other municipalities in the area have not benefited to the same extent as Zakopane from the Project to date and support has been less strong and uniform. In some instances, the road refurbishment required as a condition of gaining distribution system right of way became a significant constraint on profitable network extensions.

- **Executing Agency PEC Geotermia Podhalanska (PEC/GP):** PEC/GP was formed by the merger of a small geothermal development company and a small municipal district heating company. The company became responsible for a very large and complex project in terms of technical requirements, financial structure, institutional sponsorship, and market transformation. In general the geologic and geothermal challenges were met effectively by PEC/GP with Danish and U.S. technical assistance. The district heating system has operated reasonably in spite of low loading and can be further optimized when the SCADA system is fully implemented. In 2003 the original Academy of Science well from before 1990 became corroded and had to be closed. This closure increased reliance on expensive natural gas but financial constraints have prohibited repair before 2005. The visible support facilities for the Project are architecturally suited to this special area and are uniformly admired by visitors.

The resignation of the PEC/GP management Board and team in 2003 was followed by a period of paralysis in project development as new leadership was sought and future directions were considered. The new management team completed a study in October 2004 that convinced NFOS to eliminate PEC/GP debt through a major increase in equity funding. The PEC/GP team has then prepared a reconstruction plan that has been accepted by the shareholders in December 2004 (for more details see Annex 8).

Based on the extensive experience (both good and bad) gained by these four agencies in this single project, the capacity for Poland to successfully plan and implement new geothermal district heating projects has grown dramatically. On this basis, the institutional development impact is ranked as substantial.

5. Major Factors Affecting Implementation and Outcome

5.1 Factors outside the control of government or implementing agency:

Procurement rules and delays: The complexity of the final financing plan led to a sporadic build out of the Project. The final financing plan involved two international grant donors, three bilateral grant donors, and two local grant donors. In addition there was a World Bank Loan and a local loan. Equity financing was limited in the incremental project to less than 2.5% so that there was little liquidity to cover variances from the ideal development plan. Procurement was a difficult and complex undertaking. As a result of mostly parallel financing, PEC/GP needed to follow the individual procurement rules of each donor, based on pre-identified packages. The learning curve resulted in substantial delays.

The transmission pipeline, linking the base load plant (BLP) with Zakopane, experienced a very serious delay caused by the specific rules of the EU and design problems. The EU made its funding available to the NFOS, which in turn had to coordinate between PEC/GP and the EU. As a result, the contract signature was delayed by over a year compared with the plan. Extra gas costs of about PLN 2.5 million resulted, as customers in Zakopane had to be supplied from the gas-fired PLP.⁶¹ This also contributed to reduced market penetration as some areas lost interest after waiting years for the promised geothermal option to actually become available. The delays also rendered much of the market data used to develop the project plan obsolete by the time the geothermal service was being offered.

5.2 Factors generally subject to government control:

A number of factors contributed to increased costs and delays during project implementation:

- **Imposition of property tax on DH system:** Shortly after appraisal, the Central Government introduced a law, which permitted local Gminas (municipalities) to impose an annual property tax of up to 2% of the **initial** book value of network investments. This was to compensate for a larger share of income taxes taken by the Central Government. Most Gminas immediately charged the full 2.0% that was permissible on all assets within their jurisdictions. This unanticipated tax is especially punitive for new, capital intensive district heating systems compared to all other heat supply systems. For PEC/GP the property tax rose to PLN 2.1 million in 2004, representing 20% of total heat sales revenues. Cumulative property taxes account for almost 17% of the cumulative losses for the Project through 2004. The implications of this unexpected financial burden was the subject of discussions between the municipalities, PEC/GP and NFOS. From 2005 the tax will be charged but converted into an increase in municipality shareholdings. NFOS has endorsed this approach, which will be maintained until PEC/GP has become profitable and can pay these taxes in cash.
- **Royalty on Geothermal Heat:** At appraisal, the Government had started to impose a royalty on the extraction of geothermal heat. The World Bank team and PEC/GP convinced the MoE that this tax was not helpful to promote renewable clean energy: The royalty was abolished. Recently, however, Poland issued a new Mining Law, which imposes a royalty on geothermal energy (between PLN 0.25 and PLN 0.75 per m³ of geothermal water used). For PEC/GP, this royalty will amount to PLN 0.6 to 1.9 million per year.
- **Timely Injection of Capital:** Due to financial losses and resulting lack of liquidity for funding certain procurement packages, the company requested capital increases from the NFOS, which were only provided after some delay. This forced PEC/GP to find expensive bridge financing. Funding to stimulate new connections was believed to be available from the EkoFundusz if the linkage between cost and results could be demonstrated but that potential funding was never tapped.
- **Imposition of complete street rehabilitation:** In some of the municipalities, the administration forced PEC/GP to resurface roads, opened for pipe-laying, according to new standards. Normally, only the ditch opened for the pipe would be resurfaced. In some cases the complete reconstruction of the surface across the width of the street led to expenses much in excess of normal expenditures and to delays in completing the network portions. The connection to Koscielisko, ready for contract signature, was abandoned due to the costs of road surfacing.
- **Delays and Frozen Project Development since 2003:** The Management of NFOS worried about the rising losses of PEC/GP. In mid-2003 NFOS management could no longer believe PEC/GP claims that the financial situation would be viable in 2005 when the full debt service payments became due. When the PEC/GP management resigned in 2003, no transition plan had been prepared. Since the end of 2003 practically no new contracts have been signed to continue Project implementation. NFOS remains fully committed to the project as evidenced by their willingness to pay off all outstanding loans but decisions on future Project expansion and operation remain pending at this time.⁷

5.3 Factors generally subject to implementing agency control:

- **Failure to Update Market Study:** The single most significant failure of PEC/GP has been the inability to accurately characterize the potential heat market or the approaches needed to achieve any predictable penetration of that market. Seriously outdated data continued to be used; market

penetration models that clearly revealed strong sensitivity to heat prices were never adjusted when tariffs were substantially redesigned; and no efforts were made to recalibrate the models to early experience. As a result, no early changes were made to the Project design; no significant revisions were made to the marketing approach or tariff designs; possible EcoFund funding to stimulate new connections was never obtained; and financial projections could not be reliably revised.

During supervision the World Bank team repeatedly proposed an updated market-study and intensified marketing activities. PEC/GP suggested that these could be undertaken by local personnel or consultants, rather than drawing on international expertise. Local expertise would have been helpful in better understanding local decision-making, but international consulting support may have carried more weight and led to more decisive responses. Networking with marketing experts from other successful district heating companies could also have strengthened the marketing effort.

Finally, forthright characterization of the linkage between market penetration and the financial performance of PEC/GP may have been used to support stronger local regulations such as the designation of smokeless zones or stronger emissions penalties to stimulate household connections.

- **Pending Well Repair:** The first geothermal well (PAN-1 doublet) from the late 1980's has experienced some corrosion damage and has remained out of operation since 2003. As a result, gas use has increased by about 0.75 million m³ per year at a cost of about PLN 0.65 million per year or 6% of revenues in 2004. This well urgently needs to be repaired. Decisions on this are complicated by a number of issues: (a) the Academy of Science (PAN) in Krakow owns PAN-1; and (b) PAN and PEC/GP could not agree on the best technical approach, with alternatives costing between PLN 3 to 5 million. Recently agreement was reached that the well will be repaired by PEC/GP at its own cost, which will amount to about PLN 3.5 million plus about PLN 1 million for well stimulation.
- **Other Issues:** Emphasis was always placed on the connection of large loads, and small household connections were acted upon only slowly. The unwillingness to do pro-active marketing further compounded this problem so that crucial network density was delayed and sometimes network dimensioning was miscalculated.

Technical teething problems with the transmission pipeline and its three important pumping stations contributed to delays in start-up and increased use of costly gas. These delays were, however, comparatively small, as PEC/GP drew on foreign technical assistance when needed for technical issues.

Only a few large contractors were used for civil works and pipe installations of the networks, which were poorly supervised. In the beginning, these contracts had unrealistically short execution times with working time set at 270 days per year, which could not be maintained. When contractors incurred delays and some cost increases, penalties could not be enforced.

5.4 Costs and financing:

The Bank Project (2000 – 2004 Investments) was appraised based on total investment costs of \$57.6 million and a total financing requirement of \$69.6 million. Outlays by the end of 2004 were \$34.1 million (59% of appraisal) while interest during construction and incremental working capital added \$2.9 million (24% of appraisal). Financing was provided by grants (\$14.0 million), equity (\$5.7 million) and loans (\$16.5 million) which was diminished by negative cash flows from operations. The World Bank loan of \$38.2 million disbursed \$14.5 million with the remaining balance canceled. The GEF grant of \$5.4 million was reduced to \$3.2 million when it became apparent that carbon reductions would be lower than anticipated. Details are provided in [Annexes 2 & 3](#).^{8/}

The Financing Plan for the Bank Project envisaged coverage of the total financing required of \$69.6 million with 55% debt (World Bank loan), 27% in the form of grants, 15% internal cash generation, and 3%

equity. This heavy reliance on internal cash generation rather than initial equity provided weak protection from the failure of the market to develop at the pace that was envisaged at Appraisal. Actual results of the financing plan are shown in Table 5 of Annex 3. The World Bank loan only covered 39% of total funding required, the grants provided 18%, equity 5.1% and other items (local loan, draw-down of inventory) the rest.

In addition to the weak equity position in the financing plan, GP/PEC suffered a foreign exchange loss of 11.3 million PLN at a critical juncture in 2003 due to their decision to denominate the entire World Bank loan in EURO. At the time the loan was being prepared many alternatives were offered that would shelter them against currency fluctuations but the cost of hedging was deemed to be too high.

6. Sustainability

6.1 Rationale for sustainability rating:

Likelihood of Continued Operation. The Project has resulted in a well-designed and environmentally attractive geothermal district heating system with proven delivery capabilities located in a well-known Polish tourist attraction. Sustained operation of the facility is now very likely as NFOS and the other shareholders have decided to continue the project.

- At present the already existing system is underutilized and additional heat can be supplied at low incremental costs. The only significant investment required to move to the Case 1 sales level of 317 TJ would be for the repair of the PAN-1 well.
- As shown in Table 4.3, the estimated incremental FIRR for expansion to Case 2 and operation through 2030 is between 12% and 16% depending on the assumed treatment of the local property tax. This is clearly preferable to Project termination.
- Current PEC/GP management has recommended system expansion with incremental investments of 80 million PLN and expects steady state annual sales of 670 TJ compared to the 600 TJ used in the analyses reported here.
- Most participating municipalities have indicated their continued support for the Project by agreeing to accept property tax payments in the form of PEC/GP shares until 2011 and NFOS has agreed with this approach.
- PEC/GP still has very good prospects of supplying base load heat of about 100 TJ per year to Nowy Targ but this component also requires additional investment and is not critical in the incremental financial analysis.
- There are significant numbers of large loads and households that made substantial recent investments to convert to geothermal heat. In addition all of the loads served by the 28 district heat boiler houses in Zakopane would now face significant increases in heating costs if geothermal supply were fully replaced with much more expensive natural gas.
- The improved air quality in Zakopane has been accompanied by a tourism boom which strongly impacts local incomes. The likely impacts of now terminating geothermal operation are not clear but any slippage vis a vis EU standards would not be well received. Increasing tourism may also lead to increased occupancy rates in the hotels and rooming houses that are connected to the geothermal system which would lead to increased sales per customer.

6.2 Transition arrangement to regular operations:

There are commitments from the MoE, the NFOS, its affiliated banking arm BOS Bank, the Municipalities and the EkoFundusz that the Project continues to deserve their full support. These institutions will facilitate the implementation of new investment components with funds (including equity and grants), speedy processing and moral support, as they want PEC/GP to become financially viable.

On the basis of the reconstruction plan of December 2004, the shareholders have decided to move ahead

with the project. NFOS (according to NFOS rules and as an institution, not as a shareholder) and BOS Bank will take a lead role in financing further investments and assisting PEC/GP in their efforts to reach a financially sustainable steady state level of operations. EkoFundusz should stand to its former commitment to provide grant funding for the connection of Nowy Targ to the geothermal system.

The new management of the company is committed to reduce operating costs, to continue to check the viability of all new investments and to take a pro-active stand in marketing its services. Efforts should be made to increase sales to existing customers; to increase connections where minimum system investment is required to do so; and to increase the geothermal share of heat production through repair of the PAN-1 well. To fulfill these commitments, the company will still need to determine and demonstrate the incremental sales levels that can be anticipated in response to additional investment and incentives.

The company has allowed for a time horizon of seven years (until 2011) to reach the steady state of operations envisaged in Case 2 which they expect will result in annual sales of 670 TJ. This would allow enough time to drill additional wells, expand the BLP in Banska Nizna, and expand the networks into the feasible areas.

6.3 Sustainability ranking:

Based on the levels of commitment and support that have been forthcoming from all major stakeholders in the project, the specific plans that have been developed for continuation, and on the strong objections that would likely be forthcoming if geothermal operation were terminated, continued operation of the system at levels between the Case 1 and Case 2 scenarios is considered highly likely.

7. Bank and Borrower Performance

Bank

7.1 Lending:

In retrospect, it is clear that the Bank underestimated the risk associated with this Project, accepted a financing plan that was insufficient to cover unforeseen developments, relied on outdated market forecasts that were neither updated nor validated, failed to fully synchronize financing with the environmental benefits that were anticipated, and relied on a very small and inexperienced organization to manage a very large and complex project on a tight timeline. While many of these decisions were client driven, stronger Bank insistence on an improved business plan would have helped the Project perform closer to expectations. For these reasons, Bank lending and Project preparation is rated as unsatisfactory.^{9/}

7.2 Supervision:

The Bank supervision effort focused centrally and appropriately on the financial performance of PEC/GP and the lagging development of heat sales compared to targets. Revised targets were established but on a largely arbitrary basis, without a meaningful update of the original market study. The marketing issues were never fully resolved with PEC/GP and NFOS, but the Bank financial alarms led to useful dialogues among the Bank, NFOS, Zakopane and PEC/GP. The Bank helped to secure the much needed equity injections from NFOS.

Close World Bank involvement after the resignation of PEC/GP management in 2003 assisted the new PEC/GP Management and NFOS to determine how to proceed with the Project. The World Bank team organized a major workshop with international experts in mid 2004 to help PEC/GP and NFOS proactively redefine the future Project plan. The revised 2004 Business Plan prepared by PEC/GP was sufficient to support the NFOS decision to pay off company debt in recognition of the environmental benefits that have and will be recognized from the Project. The reconstruction plan from December 2004 defined the specific level and form of that continued operation.

Since the Bank supervision effort raised appropriate alarms that triggered the actions needed to allow sustained operation of the Project, the Bank supervision effort is ranked as satisfactory.

7.3 Overall Bank performance:

The Bank finally provided critical lending that allowed development of an environmental project which was considered a high priority by national and local governments. Prior supports had been piecemeal and sporadic. This catalytic role in a project that has performed acceptably in meeting its primary objectives of local and global environmental improvement supports an overall Bank performance ranking of marginally satisfactory. The obvious failures have been in financial performance of the project which has been compromised by excessive operating costs and inadequate sales. The Bank has assisted the client wherever possible in continuing to identify and solve those problems but could never do so unilaterally.

Borrower

7.4 Preparation:

The Borrower managed from 1995 through 1999 to piece together the beginnings of a significant geothermal district heating project by attracting funding from NFOS, EkoFundusz, EU PHARE, and Danish, Swiss and US sources. In combination with the original Academy of Science well, this allowed completion of initial drillings that overcame the major geological risk barrier that plagues most geothermal district heating projects. The 1998 merger with Tatry brought some unwelcome issues regarding excess labor force but also provided the much needed authority to convert all of the coal-fired boiler houses to clean geothermal heat. While the early development was not required to operate on a fully commercial basis, project development did progress sufficiently to identify and overcome barriers, demonstrate commitment, and identify key policy issues that would impact the Project. The MoE and MoF agreed to waive the royalty fee for geothermal which, unfortunately, was reimposed in 2005.

These accomplishments were notable and merit a satisfactory rating for the Borrower during the Project preparation period.

7.5 Government implementation performance:

Polish government involvement in this Project has been most directly through NFOS and indirectly through MoE. The quality of project supervision by NFOS changed over time. Unintended NFOS involvement in early procurement, appointments of interim management teams, and approval of revised development plans has led to delays that have increased costly gas consumption and have lost market opportunities. However, NFOS ultimately provided strong leadership in replacing the original management team and injecting the equity investment necessary to secure the environmental benefits that have been achieved over the remaining life of the Project. In their present role as the major Project owner, NFOS is in the appropriate position to weigh the Project's environmental and economic value to the region and to Poland against the incremental costs and has decided to move ahead with the project. Because of the pivotal NFOS role in securing the environmental gains from the Project, their role in implementation is viewed as marginally satisfactory.

MoE has been generally supportive of the Project but has not been proactive on the key policy issues that have or will badly hurt the financial performance of the Project. MoE would logically provide the environmental voice on issues such as the new royalty fee on use of geothermal waters and possibly on the exemption of geothermal district heating systems from punitive property taxes that were not in place at project inception. MoE could also have provided useful guidance in showing how environmental benefits can be measured and monetized in ways that promote the overall Polish commitment to increased use of renewable resources. MoE has certainly helped the Project but has not yet fully exploited this experience to advance the environmental agenda in Poland. The MoE role in implementation is also ranked as marginally

satisfactory.

7.6 Implementing Agency:

The original PEC/GP management team overcame substantial barriers under very challenging circumstances in the early development of the Project. With substantial foreign assistance, the geologic and technical challenges were met with reasonable success and the resulting system seems to be sound and attractive. However, that team was not able to meet the marketing and financial challenges that it was presented in ways that could provide much needed relief. The primary responsibility for the financial problems of the company can only be assigned to PEC/GP.

The new management of PEC/GP has acted as it should and appears committed to cost-effective continued expansion of the system. Their ability to identify the incremental load that will be gained with incremental investment remains to be demonstrated but the proper philosophy has been established.

Both the successes and failures of the original management team are now well known. The new team under strong NFOS supervision appears to be moving to secure and possibly expand the operation of the system with the intent of improving financial performance to the fullest extent possible. Again, the record is mixed and can only be considered as marginally satisfactory.

Municipal Governments:

Zakopane has had the most significant municipal influence on the Project and has been a supportive force. Most critically they have helped to alleviate the punitive impact of the unanticipated property tax through their lobbying efforts with other municipalities. Other municipalities have not been as supportive and some have caused problems related to road repair and right of way issues. In general, the municipalities had the most direct opportunity to assist PEC/GP in the critical area of market penetration through imposition of smokeless zones and/or significant fines for emissions that are known to impact the health of residents and the regional economy through tourism. Although Zakopane has provided strong support for the Project, the other municipalities have contributed to the delays and financial problems of the fledgling company resulting in an overall unsatisfactory rating for the municipal governments.

7.7 Overall Borrower performance:

Based on this checkered evaluation, the range of performances for the various borrower stakeholders is from unsatisfactory to satisfactory. Earlier sections have shown that the Project has satisfactorily achieved its primary environmental goals and has been marginally satisfactory in terms of economic return measured by the EIRR. The Project has clearly been unsatisfactory in terms of financial performance. The Borrower shares in both the credit for the notable environmental achievements of the Project and the blame for the financial difficulties. On this basis, the overall ranking for Borrower performance is deemed marginally satisfactory.

8. Lessons Learned

The Project, among the largest and most modern DH projects in Europe based on geothermal energy, has experienced many successes and failures that offer most valuable guidance for similar future projects. Important lessons learned include:

8.1 General Lessons:

- Geothermal projects can bring major benefits, but are complex, with high up-front costs and significant geological risks. Careful geological studies of geothermal resources and careful market assessments, cost forecasts and financing plans are needed. These must be integrated to assure competitive heat prices, which will allow timely market penetration and commercial viability.

- It is critical for government at all levels to have a coherent strategy in support of renewable energy development. Policy coordination, legislative support, and grants that monetize externalities are needed for project success. Royalties on geothermal use and high property taxes on DH systems are counterproductive.
- A rational foundation for geothermal and other renewable energy projects can be provided only when grants are tied to external benefits that would otherwise not be monetized. Projects that do not receive support at this level cannot be expected to perform adequately in conventional commercial terms.
- Foreign exchange risk should be avoided in public municipal service projects, which only generate revenue in local currency. This issue should be addressed in Bank-financed projects.

8.2 *Geological Analyses:*

- Up-front geological risks, linked with drilling of the first geothermal doublet (production- & re-injection well) need to be mitigated by careful geological assessments, by attempts to obtain up-front partial grant funding and/or partial risk guarantees. On the other hand, promoters should commit resources of their own as well to avoid moral hazards.
- Thorough geological investigations must be checked and counterchecked. Ideally, existing wells from hydrocarbon exploration may confirm the presence and parameters of targeted geothermal deposit.
- The project concept should take account of estimated geothermal deposits, key characteristics (yield, temperature, geophysical and geochemical parameters), proposed concept and scope of a base load plant, link to DH networks, Delta T of geothermal doublet and DH network, and an investigation of running doublet and network on alternative Delta T configurations.

8.3 *Project Analyses and Feasibility Studies:*

- Geothermal projects require integrated analysis of geological, technical, environmental, economic and financial aspects.
- Feasibility Studies must rely on current market data and analysis. Revenue projections, and operating cost forecasts that are synchronized with the estimated evolving investment program should be conservatively estimated and substantial sensitivity tests should be presented. The economic analyses should guide the monetization of external benefits through grant or low cost financing, thereby improving return on investments net of grants.
- Project financing must be arranged in recognition of the inherent uncertainty of the pace and magnitude of development of the ultimate market to be served. Retail market development must be seen as an interactive process with full flexibility to adjust investment programs and the marketing programs to properly adapt to early experience.
- Geothermal projects that are designed simply to sell wholesale heat on a contract basis to an established DH company will normally have much lower risk that can be controlled by requiring off-take agreements as a precondition for loan approvals. As Nowy Targ indicates, however, securing such an off-take agreement is not always a simple matter and letters of intent are not binding.

8.4 *Market and Market Development:*

- Market demand is a function of relative costs of geothermal heat relative to other heating options, in addition to age and fuel composition of existing heating systems. Original market studies for this Project demonstrated that market penetration in the household sector would be sensitive to changes in relative cost and timing of potential geothermal connection of the intended service areas.
- When conditions failed to meet estimated parameters by wide margins, results varied widely from expectations. While shortfalls in market demands and market penetrations were noted in early supervision reports, revised estimates were not based on needed recalibration of the market models.
- Heat consumption for large loads was estimated using generally reasonable processes of converting

historic fuel use to equivalent geothermal use. However, fuel consumption data turned out to be distorted. Other methods of estimating may have led to excessive figures because the sampled loads were not representative; the special partial occupancy characteristics of Zakopane tourist facilities, and energy efficiency improvements that were not adequately recognized.

- Inertia effects are dominant in most technological choices. New technology must normally be introduced either by mandate (smokeless zones) or by incentives, which may raise the cost of traditional alternatives or enhance attractiveness of the new technology. Original market estimates assumed four different sets of heat price discounts tied to the level of usage, which were to be phased out over a five-year period. Failure to adjust penetration estimates when this incentive scheme was abandoned may have been the most important factor in overestimating household connections.
- Construction of a "green-field" district heating system is considered beneficial when there is a reasonable prospect of securing 2 to 3 MW of heat load per km of pipeline network. As the Podhale Project was primarily designed as an environmental project, these standards would obviously need to be adapted to recognize externalities but still could have provided useful Project guidance.

8.5 *Competing Heat Sources and Pricing of Geothermal Heat Sales:*

- Market assessment should include evaluations of consumer choice variables in selection of heating systems, current estimates of heating costs from existing systems, and likely end user efficiency improvements following conversion to geothermal heat.
- The city should make a basic policy decision as to the development of a geothermal DH system as opposed to a gas-based individual heating system. This should be based on a heating master plan that identifies areas to be served by district heating and by natural gas with full consideration of both environmental objectives and heat densities.

In the above calculations of costs of geothermal heat, grants, provided for monetization of environmental benefits of the geothermal system can be counted as reducing investment costs.

8.6 *Financing Plan:*

- The proposed financing plan will have to be designed for debt service levels that the operating company can support. Thus, sufficient levels of equity are required, supplemented by grant funding to monetize external benefits. Debt financing needs to be sufficiently long term to allow financial sustainability even during periods of sales shortfalls (warm winters).
- Contingent financing plans should be prepared for possible adverse situations. Additional equity contribution, low cost lending or other temporary and permanent measures need to be established and committed to avoid delays in project implementation.

8.7 *Project Timing, Preparation/Implementation:*

- A detailed implementation timetable, taking account of the phasing of project components and re-assessment prior to the next phase, is essential.
- In case of major new DH networks, the implementation of the geothermal project should proceed, to the extent possible, in phases. Development of an initial system on sound economic and financial grounds would provide both the critical mass of satisfied consumers to attract others and the experience needed to develop future service areas. However, care must be given to properly sizing key system components that must serve multiple areas within a total development concept so that such components are not undersized for profitable system expansions.
- The Podhale Project experienced considerable execution delays due to procurement issues and unrealistic contract execution timetables. A project must take account of procurement issues of different financiers. Contracts for the implementation of transmission lines and new DH network sections, assuming reasonable cost limits, need to allow for slow or no work in winter.
- Completed components require testing and elimination of teething problems. "Learning curves" limit early capacity utilization and resulting revenues and may have higher operating costs.

8.8 *Project Management:*

- Sound and experienced project management is key for the success of a geothermal project, as in any complex project. In particular, the management should include an experienced top manager, who is knowledgeable about major key aspects of geothermal projects. A geological expert, a marketing manager, a technological expert/manager, and a financial manager, all with supporting staff, should complete the management team.
- A very important tool for the operations management is a live data monitoring system (e.g. SCADA, THERMIS), which allows instant review of up-to-date operational performance, and the possibility to optimize operations.
- Full advantage should be taken of opportunities to network with managers of established district heating systems that have faced similar development challenges.

9. Partner Comments

(a) Borrower/implementing agency:

Please see Annex 8 for the unabridged Borrower's comments.

(b) Cofinanciers:

N/A

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

N/A

10. Additional Information

The following chapter provides answers to questions raised under the typical GEF Project Review Criteria.

(a) Implementation Approach. The Project was implemented in line with the very clear Project's Logical Framework Matrix (LFM; see Annex 1 of the PAD). As the actual implementation performance fell behind plans due to delays and overestimation of demand, the output indicators of the LFM were repeatedly revised during the course of project implementation (adaptive management). The actual outcome by end 2004 is reflected in the Indicator Matrix of this ICR (Annex 1). A few points should further illustrate the implementation approach:

- The LFM was used both for Project management purposes and in the supervision by the Bank.
- There were effective partnerships between the shareholders of the Project (NFOS, Municipalities), which worked reasonably well during Project preparation but experienced some problems during implementation (see Chapters 4 and 7 above).
- During Project preparation, lessons from a number of projects regarding heat supply, energy efficiency, energy substitution, and geothermal energy in Poland were taken into account. Heat demand estimates were drastically reduced (by over 25%) as compared to original estimates, but as it turned out in retrospect, still not enough to match reality. Project implementation schedules were prolonged by two years (one year at appraisal, one year at the second supervision mission), as compared to original ambitious plans of the Project promoters. Also these adjustments turned out to be insufficient.
- The regular M&E activities were continuously fed back into management of Project implementation. But the Project Company (PEC/GP) kept focusing on large loads and did not re-adjust its connection strategy when small loads were left unconnected.

(b) Country Ownership/Drivenness. Throughout preparation and implementation, the Project was considered a top priority by central and local government, NGOs and the Project sponsor. The LFM of the PAD clearly indicated Poland's national, regional and environmental agendas, including international

agreements and commitments. In this context, the Project was considered an important demonstration project by all stakeholders and actors, who from the beginning and mostly throughout implementation actively supported the project (see Chapters 3, 4 and 7).

Whereas the reduction of CO₂ from the Project in the national context was small (but important for demonstration purposes), its local environmental contributions (reduction of SO₂, NOx and PM10) were significant for the Podhale Region with its National Parks, recreational facilities and tourist attractions. Thus, the Project had a significant impact on the further development of that Region, as it helped the Region meet Polish and international (EU, WHO) environmental standards. The recent financial support from the NFOS to rescue the company and help it to develop remaining project components, clearly demonstrates the Government's continued commitment to the Project.

At appraisal, the Project teams of Poland and the World Bank managed to convince the Central Government that there should be no royalty imposed on the use of geothermal resources. Unfortunately, in 2005, a new mining law amendment introduced such a royalty, which will contribute to discourage potential investors into geothermal energy.

(c) Public Involvement. Information Dissemination: The PEC/GP, the originally sponsoring Academy of Science (PAN), as well as NFOS, central and local government repeatedly undertook public awareness campaigns (including press briefings, stakeholder meetings, exhibitions and information flyers), national and international geothermal conferences, and Project presentations to potential customers to help disseminate knowledge about the advantages of geothermal energy, and to promote the Project.

Consultation: During project preparation, consultation activities were particularly intense: As geothermal energy was little known in Poland during the early 1990s, the PAN organized a number of national and international geothermal workshops to disseminate first results, and to build on experience elsewhere. The MoE published a geothermal atlas in the mid-1990s and encouraged communities to exploit geothermal energy to feed their district heating systems. NGOs were invited to participate in these endeavors to help spread the word, and to deal with potential concerns of stakeholders. In the Podhale valley, the PEC/GP, mayors of the local communities, and NGOs held meetings with potential customers and other interested parties to consult on their interests and concerns.

Stakeholder Participation: The geothermal portion of the Project went well. Among others, this was due to an excellent networking among national (PAN, MoE, NFOS, PEC/GP, and drilling companies) and international geothermal experts, who assured that the geological investigations would be done correctly and results interpreted correctly, using state of the art methodologies and technologies. The commercial portion of the Project went not so well, due, among others, to the original overestimation of demand, but also due to the stubborn refusal of NFOS and PEC/GP to update the marketing study, to make use of international market- and marketing experts, and to change strategy to attract potential small customers (owners of individual housing). The latter had major expectations into the system, which eventually would not be fulfilled (timely connections, attractive terms).

However, the continuous cooperation between PEC/GP and stakeholders such as NGOs, the media, the local governments and other local groups helped present the environmentally highly beneficial aspects of the project at numerous occasions.

(d) Replication Approach. The Podhale Geothermal Project has put geothermal energy on the map of Poland and its neighbors (Czech Republic, Slovakia, Hungary). Although not the first geothermal Project in the region, it is the biggest, most visible and well known, and most complex (difficult topography). Through its demonstration effects and dissemination activities, it has contributed to spawning a number of small Projects, in part even in the private Sector (Stargard, Trvdosin in Slovakia) and project ideas

throughout the Europe and Central Asia (ECA) region. Today, Polish experts, who “trained on the Project”, are advising potential geothermal project investors throughout the ECA region.

(e) **Financial Planning.** As shown in Chapter 5, Annex 3 and the table below, the Project at appraisal was estimated to cost US\$69.6 million and would be funded by grants of US\$19.0 million, including the GEF grant, a World Bank Loan of US\$38.2 million, incremental equity of US\$1.7 million (essentially from NFOS), and internally generated funds of US\$10.7 million. Actual financing was much lower due to the limited implementation of the Project, with less than 60% of estimated expenditures actually realized. Actual financing could not rely on internally generated funds, but on the contrary had to cover even an internally generated loss (see table below). There were some reductions in the envisaged grants. Incremental Equity had to increase to cover accumulated losses, but the major funding reduction was in the World Bank loan, which would have covered components not yet executed.

GEF Co-Financing (Type/ Source)	GEF Grant		World Bank Loan		Government		Other	
	(million US\$)		(million US\$)		(million US\$)		(million US\$)	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Years 2000 to 2004	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Grants	5.4	3.4	0	0	0	0	13.6	10.6
Loans	0	0	38.2	14.5	0	0	0	2.0
Credits	0	0	0	0	0	0	0	0
Equity	0	0	0	0	0	0	1.7	5.1
Internally Generated Funds	0	0	0	0	0	0	10.7	-3.3
Other (Inventory Drawdown)	0	0	0	0	0	0	0	4.6
Totals	5.4	3.4	38.2	14.5	0.0	0.0	26.0	19.0

Financial controls were not fully adequate. At appraisal, agreement had been reached that a comprehensive reporting and cost control system was to be implemented, which would generate its reports directly from the accounting system. Repeated initiatives and efforts were undertaken to complete the system, but it never became fully functioning. The inconsistencies between capital cost reports referred to in Annex 3 are a result of this issue. Auditors pointed out problems in accounting, which the PEC/GP eventually corrected. The lack of regular up-to-date capital cost reports also prevented PEC/GP from updating the financial viability calculations of new components to be invested in.

Audits, in the early years, were not fully satisfactory to the Bank, but got corrected eventually. The auditors represented an important instrument to provide an ultimate control over Project expenditures as well as ongoing operations. There were no leveraged funds beyond those included in the financing plan at appraisal – if one disregards the incremental equity injections provided by NFOS to cover growing losses.

(f) **Cost Effectiveness.** Chapter 4, highlights the economic analyses (a) ex ante for the full Project 1994 to 2004 and the incremental Project 2000 to 2004, as appraised in 2000; and (b) ex post for two further development scenarios (as the Project status by end 2004 was incomplete). Table 4.1 illustrates the

EIRRs for these cases and shows, that when including local and global environmental benefits, the ex post EIRRs for both future development scenarios come close to 10%. Of course, the ex ante EIRR with environmental benefits was over 25%. Thus, including the major local environmental benefits and the admittedly much reduced global environmental benefits, the Project can be considered an economic success, albeit marginally so.

An important measure in this context is the achievement of the GEF objective of greenhouse gas reductions. Under the Project ex ante, the reductions were estimated at 2.66 million tons of CO₂eq over the life of the Project, at a cost of US\$3.0 per ton. Incremental costs would have allowed a GEF grant of US\$8 million, but only US\$5.4 million were granted (US\$2.0 per ton). As the Nowy Targ connection had not materialized by end 2004, only US\$3.4 million were actually disbursed.^{10/} The ex post evaluation of the case 1 scenario (present loads, plus connection of certain loads in the near term) shows CO₂ reductions of only about 0.6 million tons, however, at an incremental cost of US\$5.6 per ton, which is still low, and therefore cost effective, when compared to actual prices paid in Europe today. A benchmark approach used by GEF internationally, suggests an accepted threshold of US\$10 per ton of CO₂eq reduced.

(g) **Monitoring and Evaluation.** At appraisal, an M&E Plan was agreed between PEC/GP and the World Bank. Moreover, a number of M&E studies were agreed up front and executed to evaluate data on environmental performance (both local and global emission reductions). Comments on the M&E plan follow:

- The M&E Plan was detailed, well structured, and topical, highlighting project progress, among others, in terms of connections, sales by customer category, financial performance, as well as environmental parameters.
- The M&E Plan was updated regularly during follow-up visits and in the context of quarterly progress plans. The environmental parameters could not always be shown, as data from measuring stations was becoming available only at annual intervals. Here, the M&E Plan relied on the findings of the M&E studies.
- The M&E Plan served PEC/GP to control the speed of execution of connections, and to monitor sales and financial performance. But as the management started focusing on large loads at the expense of small loads, the related signals from the Plan were not taken into account any more. On the other hand, the excellent studies of environmental performance and related indicators were used regularly to demonstrate the significant improvements, which the Project was introducing into the Podhale valley and its surrounding biota.
- In mid-2004, when the new management of PEC/GP was in place, the World Bank organized a workshop with international consultants in Zakopane, to appreciate the performance of the Project to date (belated mid-term review). The assessment and evaluation of the Project led to important ideas and action plans, which helped the owners and management to restructure the company and to put the Project on a new track. As a result of that evaluation, the company produced alternative development scenarios for approval by its owners in end 2004, and is now completing work on a new business plan for the selected scenario.
- The M&E Plan and its related studies can serve as good example for other projects. The poor performance of the Project had its roots in the original overestimation of demand, which became apparent during the first two years of project implementation. The M&E Plan illustrated the growing shortfalls and resulting poor financial performance dramatically.

Endnotes:

^{1/} Appraisal analyses did not include comparable methodology for linking reductions in usage of specific fuels to reductions in NOx concentrations.

^{2/} The EOY 2004 situation is reasonably modified to include the known future addition of the Aqua Park in Zakopane. This addition and normal weather is expected to raise annual heat sales from the 261 TJ achieved in 2004 to 317 TJ without additional system expansion.

^{3/} It should be noted that the PAD reported a slightly higher EIRR than shown here. The slight change represents minor corrections that were made in the updated calculations.

^{4/} For example, the PAD for Second Rural Energy Project for Viet Nam which included a World Bank loan for US\$ 220 million and a GEF grant for US\$ 5.25 million was justified with an FIRR of 2.1% in real terms and 4.0% in nominal terms which was deemed “acceptable in view of the social aspect of the project.” (Page 17).

^{5/} The cost of procuring, storing, and handling coal plus the cost of disposing of ash, for example, may not be fully recognized by consumers when evaluating heating options. Also, the cost of future replacement of the existing system may not be factored into the customer perceptions of costs.

^{6/} The extra gas costs due to this delay account for more than 10% of the total cumulative Project losses for the 2000 through 2004 period.

^{7/} Although final decisions have not been reached regarding the final build out of the Project, the limits to likely development are known as previously explained. Thus analysis of Cases 1 and 2 reasonably define the future brackets needed to assess life cycle results for comparison with appraisal estimates.

^{8/} Where there were inconsistencies and discrepancies between the company’s financial statements and the Project Monitoring Reports (PMRs), as well as among PMRs these were “averaged out” to provide plausible results.

^{9/} As noted in Section 3.5, the lending effort was deemed satisfactory at entry. In retrospect, however, the weakness of the financing plan has become evident which leads to the ex-post rating of unsatisfactory.

^{10/} It should be noted that because of the substantial reduction of heat sales, as compared to the estimates at appraisal, the remaining funds of the GEF grant in end 2002 were tied to a connection of Nowy Targ. As this connection could not be agreed between the cities, these funds were cancelled by GEF in end 2004.

Annex 1. Key Performance Indicators/Log Frame Matrix

Outcome / Impact Indicators:

Indicator/Matrix	Projected in last PSR ¹	Actual/Latest Estimate
Project Development Objective Local ambient air pollution level in Zakopane: (a) Average concentration of TSP; (b) Average concentration of PM10 if available; (c) Average concentration of SO2. Local ambient air pollution level in Nowy Targ: (a) Average concentration of TSP; (b) Average concentration of PM10 if available; (c) Average concentration of SO2. Global Objective CO2 emissions achieved (calculated), tons/period. PAD projections: 437,975 tons by EOY 2004.	May 2005 (reporting results as of 31-Dec-04). Marked reduction in ambient concentrations of TSP/PM10 and SO2. May 2005 (reporting results as of 31-Dec-04). Significant reduction in ambient concentrations of TSP/PM10. Actual achieved by end 2004: 96,168 tons	Average for the Year 2004 in Zakopane: (a) Not available (b) PM10: 38.9 mg/m3 (c) SO2: 10.0 mg/m3 See graphs in Annex 3. Nowy Targ is not yet connected to the system. Actual Achieved by end 2004: 96,168 tons

Output Indicators:

Indicator/Matrix	Projected in last PSR ¹	Actual/Latest Estimate
Number of Geothermal Wells Energy Mix Ratio: Geothermal Energy Share in PEC/GP's Heat Production. Projected in PAD by EOY 2004: 7 wells, 85% Number of customers receiving heat: (a) Individual Households: 4243; (b) Large Loads: 172; (c) Former Tatry DH Boilers:28; (d) Nowy Targ DH Boiler Houses: 3. Annual Heat Sales: (a) To Individual Households: 323 TJ; (b) To Large Loads: 474 TJ; (c) Former Tatry DH System: 97 TJ; (d) To Nowy Targ DH System:235 TJ. (e) Former Tatry Non-geothermal Sales: 0 Total: 1179 TJ. Heat Tariff Level: (Stipulation in PAD: Tariffs to be kept at reasonable and competitive level) (a) To Individual Households; (b) To Large Loads; (c) Former Tatry DH Boiler Houses; (d) To Nowy Targ DH Boiler Houses. Project Management: (a) Project Management Reports ; (b) Audits conducted for company and project financial statements; Environmental Monitoring Reports produced. Monitoring and Evaluation of GHG Reductions: Annual Monitoring and Evaluation Reports produced. Financial Indicators for year ending	EOY 2004: 4 Wells: PAN-1 Well from pre-1989 requires repair. As of December 2004: 72.4 %. This is due to the damaged old PAN-1 Well, which needs to be repaired. Results as of end 2004: (a) 584 (b) 162 (c) 28 (d) 0 Projected in PAD for EOY 2004: (a) 36.2 TJ (b) 154.9 TJ (c) 70.0 TJ (d) 0 TJ (e) 0 TJ Total 261.1 TJ Heat Tariff levels varying for different groups of customers, averaging PLN 40.4 per GJ (a) PLN 32 to 45 per GJ (b) PLN 38 to 42 per GJ (c) PLN 38 to 42 per GJ (d) Not Applicable Results at 31-Dec-04 (a) 17 (b) 2000-2003 audits for company and project completed; statements 2004 prepared and undergoing audit (c) 2000 - 03 environmental monitoring reports, 2004 report nearing completion. Dec. 31, 2004 2001 - 2003 M&E report completed, 2004 report nearing completion.	EOY 2004: 4 Wells PAN-1 Well from pre 1989 requires repair. As of December 2004: 72.4%. This is due to the damaged old PAN-1 Well, which needs to be repaired. Results as of end 2004: (a) 584 (b) 162 (c) 28 (d) 0 Results as of 31-12-04: (a) 36.2 TJ (b) 154.9 TJ (c) 70.0 TJ (d) 0.0 TJ (e) 0.0 TJ Total 261.1TJ Heat Tariff levels varying for different groups of customers, averaging PLN 40.4 per GJ. (a) PLN 32 to 45 per GJ (b) PLN 38 to 42 per GJ (c) PLN 38 to 42 per GJ (d) Not Applicable May 2005, reporting results as of 12/04: (a) 17 (b) 2000-2003 audits completed; 2004 audits nearing completion; (c) 2000 to 2003 env. monitoring reports completed, 2004 report nearing completion. M&E Reports 2001 -03 completed. 2004 M&E report completed.

12/31/2004:	For year ending 31-Dec-04	For the Year ending 31-Dec-04:
(a) Operating ratio (expenses /revenues): Not higher than 75%;	(a) 124%	(a) 124%
(b)Debt-service coverage ratio (cash flow/debt service requirements): not less than 1.0;	(b) 0.5	(b) 0.5
(c) Debt-to-equity ratio: Not greater than 55% to 45%;	(c) 56% to 44%	(c) 56% to 44%
(d) Cash (internal funds) generation ratio: Not less than 35%	(d) -0.2	(d) -0.2

¹ End of project

Annex 2. Project Costs and Financing

This section addresses costs and financing for the incremental (Bank) Project, which included only the investments scheduled for 2000 through 2004. Investment costs and financing prior to 2000 are only relevant from a GEF perspective on the total Project.

Table 1 provides costs by major components as estimated at the time of appraisal (physical and price contingencies included) and as actually realized, with a comparison of actual over appraisal estimate. Component 1 is further grouped into major subcomponents in the table below, but excludes contingencies of US\$ 5.4 million in the appraisal column:

Table 1: Capital Costs and Financing Required for the Incremental Project (2000 to 2004)

Capital Costs & Financing Required	Appraisal	Actual	Act./Appr.
	00 to 04	00 to 04	Percent
	US\$ M.	US\$ M.	(%)
Component 1: Heat Product.& Transmsn.	32.5	18.2	55.8%
Component 2: Distribution Networks	21.1	13.2	62.4%
Component 3: Heat Exchangers and Misc.	3.1	2.0	65.2%
Component 4: Project Management	0.5	0.4	92.1%
Component 5: Monitoring & Evaluation	0.4	0.3	73.0%
Total Project Costs	57.6	34.1	59.1%
IDC	5.8	1.8	31.0%
Front-End Fee	0.4	0.4	100.0%
Incremental Working Capital	5.9	1.1	19.6%
Total Financing Required	69.6	37.0	53.1%

Detail for component 1	Appraisal	Actual	Act./Appr.
<i>Component 1: Heat Production and Transmission</i>			
Wells	5.7	2.4	41.5%
Geothermal Base Plant	2.6	0.6	24.1%
Heat Pumps	3.2	0.0	0.0%
Gas Line	0.6	0.0	0.0%
Peak Plant Zakopane	0.4	3.2	812.1%
Peak Plant Nowy Targ	0.5	0.0	0.0%
Transmission	11.8	7.7	64.9%
Pumping Stations	0.6	0.6	100.8%
Land	0.1	0.0	0.0%
Buildings	1.0	1.2	119.6%
Electricity Line	0.0	0.4	
Scada System	0.0	0.7	
Other	0.6	1.3	226.1%
Total Heat Production Units	27.1	18.2	66.9%

The financing plan for the incremental (Bank) Project is shown in Table 2.

Table 2: Financing Plan for the Incremental Project (2000 to 2004)

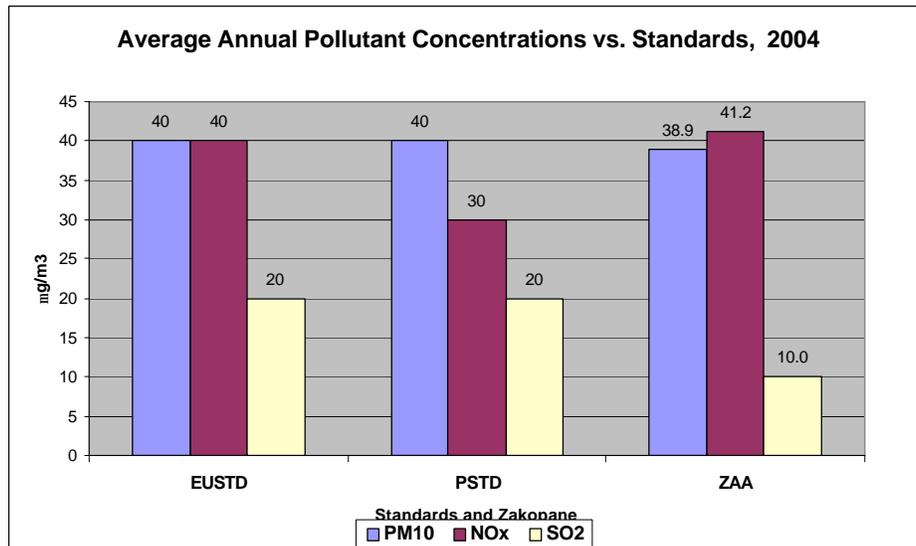
Financing Plan, Increm. Project for the Years 2000 to 2004	Appraisal US\$ Million	Actual US\$ Million	Variation %
Internally Generated Funds	10.7	-3.3	-30.6%
Equity	1.7	5.1	299.4%
Grants	19.0	14.0	73.9%
<i>Phare I</i>		1.1	
<i>Phare II</i>	10.5	7.0	66.7%
<i>GEF</i>	5.4	3.4	63.8%
<i>USAID</i>	2.5	2.0	79.3%
<i>DEPA</i>	0.6	0.5	85.8%
Local Loans	0	2.0	
World Bank	38.2	14.5	38.1%
Draw-down of Inventory	0	4.6	
Total Financing	69.6	37.0	53.2%

Annex 3. Economic Costs and Benefits

Environmental, Economic and Financial Analysis:

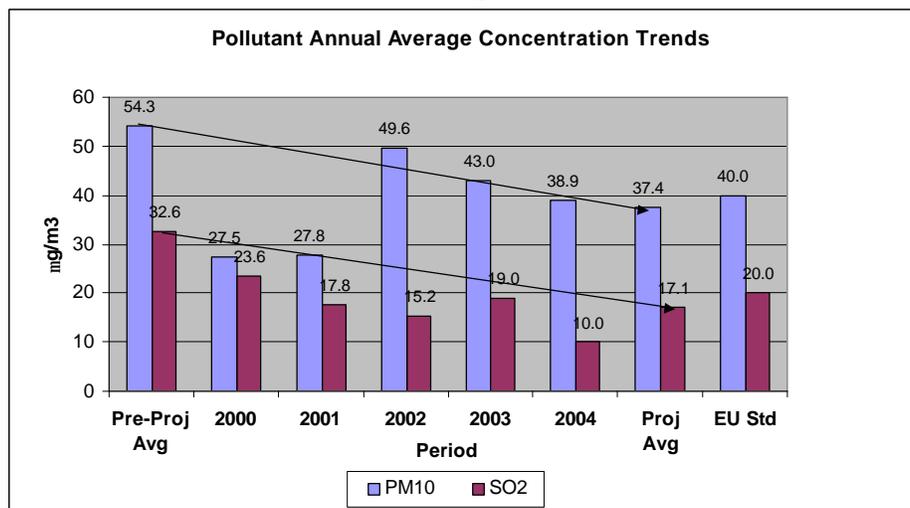
Environmental Objectives. The graphs below illustrate the performance of the project in meeting the *primary development objective*:

Graph 1: Zakopane 2004 Annual Average Concentration (ZAA) for PM10, NOx and SO₂



EUSTD: EU Standards, PSTD: Polish Standards, ZAA: Zakopane Average Concentration for SO₂, NOx and PM10

Graph 2: Decline of PM10 and SO₂ from before the Project to 2004



These graphs show the changes over time in the pollution measures that were defined at appraisal as outcome indicators. Of course, changes in average annual concentrations are impacted by all emitters and do not provide clear evidence of the changes that are directly attributable to the Project. The 2004 fuel displacement for connected loads has been estimated as shown in the following table. The figure shown for the Tetry boiler houses represents their average consumption in 1995 and 1996. Conversion of these fuel displacements to micrograms per m³ shows that the reductions directly attributable to the project were 10.8

for PM10 and 10.0 for SO₂. Thus, in both cases, about 64% of the total reduction shown in the graph is directly tied to Project impacts.

	Units	Households	Large Loads	Tatry BH	Total
Wood	GJ	5,200	0		5,200
Coal	GJ	4,160	11,112		15,272
Coke	GJ	9,013	97,309		106,322
Oil	GJ	11,503	92,530		104,033
Gas	GJ		9,729		9,729
Coke/Culm	GJ			207,606	207,606

Regarding the *global objective*, the Project has contributed to reducing CO₂ levels (reduction of almost 100,000 tons from 2000 through 2004, as opposed to 438,000 tons estimated at appraisal). The actual level of only 22% of projected reductions is proportionate to the shortfall in heat sales. The expected life cycle reductions are now expected to range between Case 1 and Case 2 outcomes which are 585,000 tonnes to 818,000 tonnes of CO₂. These figures represent between 22 and 31% of the appraisal figure.

As noted in the main text, the achievement of the global objective can also be measured in terms of the actual unit abatement cost (UAC) that GEF incurred. The UAC was one of the key values that was used to justify GEF participation in the Project. Simple comparison of achieved versus expected carbon emission reductions provides no recognition of the actions taken to keep UACs at attractive levels despite the difficulties encountered in implementing the Project at the envisaged scale. Simple comparisons also do not recognize the demonstration effects of the Project which should provide additional indirect, but unquantified, benefits over time. It is the UAC that ultimately determines whether GEF made a wise investment in this Project or not. At this time, the Project UAC seems reasonable vis a vis the costs that have subsequently materialized in JI and European trading markets.

Although total GEF incremental costs were estimated to be \$8.4 million, just \$3.2 million was ultimately disbursed to the Project. That amount translates to a unit abatement cost between \$3.90 and \$5.45 per tonne depending on whether Case 2 or Case 1 is chosen as the future scenario for the Project. While these UACs are between 23% and 72% above the appraisal estimates they are still very competitive with today's market prices for CO₂ reductions. Based on the likely UACs, the global outcome would be deemed satisfactory. Based solely on the reductions achieved compared to appraisal expectations, the result would be deemed unsatisfactory.

Economic Return. Economic justification of the World Bank loan was based primarily on the EIRR which included traditional cost savings for heating with fossil fuels plus local and global environmental benefits. Quantified local environmental benefits included reduced health and mortality costs plus improved visibility. Beneficial impacts on biota and tourism are thought to be large but were not included in the EIRR analysis. Global benefits included reductions in CO₂ emissions.

The economics of the Bank Project can only be reasonably assessed over the full life cycle, which has conservatively been assumed to run from 2000-2024, even though the geothermal wells are expected to produce longer than that. Thus, any calculation of project returns depends centrally on the future development of the project, which is presently not firmly established. For purposes of this report, two bracketing scenarios have been assumed based on options now defined by PEC/GP (Cases 1 and 2; see chapter 4).

The ex-post economic analyses reflect the actual history of project investment and operating costs and data from PEC/GP that indicate the actual prior fuel mix of the loads that have been connected. For consistency with the economic analyses in the PAD, all present values have been calculated as of 1994 using a real

discount rate of 11.0%. Fuel costs reflect border prices for gas and oil plus allowances for delivery costs to Zakopane. The analyses of economic unit costs for fuels that were developed for the PAD have not been updated for this report. Comparisons of nominal fuel prices at Zakopane between 1998 and 2004/2005 indicate increases of 1.9 times for fuel oil and 1.5 times for natural gas. This suggests that economic values should also be increased. A conservative adjustment of 1.25 times has been made in both fuel oil and gas prices to reflect this increase. Although nominal coke prices have increased by more than 2.0 times and coal prices by 1.2 to 1.5 times, no adjustment has been made in the economic values for these fuels. Since avoided fuel costs are a sizeable portion of the traditional economic benefits, the results reported here are believed to be conservative.

Case 1: Table 1 below summarizes the results for Case 1. The first column provides results for the entire project from the GEF perspective (1995 to 2004), while the second and third columns adopt the Bank perspective (2000 to 2004) that was used to evaluate the loan to the Project. The final column indicates the ratio of actual to Appraisal results. The findings are discussed in Chapter 4.

Table 1: Appraised vs. Actual Project Economics: Case 1

Case 1 - Steady State Sales 317 TJ				
	Actual		Appraisal	Ratio
	1994 PV @ 11.0% 1995 - 2024 Full Project	1994 PV @ 11.0% 2000 - 2024 Bank Project	1994 PV @ 11.0% 2000 - 2024 Bank Project	2000 - 2024 Actual/Appraisal
Project Investment	\$ 33,955	\$ 16,373	\$ 31,096	0.53
Project Operating Costs	\$ 15,182	\$ 9,870	\$ 15,522	0.64
Traditional Project Costs	\$ 49,137	\$ 26,243	\$ 46,618	0.56
CO2 Emission Costs	\$ 406	\$ 189	\$ 552	0.34
Total Project Costs	\$ 49,542	\$ 26,432	\$ 47,170	0.56
Project Benefits				
Household Total Benefits	\$ 5,905	\$ 5,354	\$ 17,940	0.30
Traditional Avoided Costs	\$ 5,811	\$ 5,273	\$ 17,262	0.31
Avoided CO2 Costs	\$ 94	\$ 81	\$ 678	0.12
Large Load Total Benefits	\$ 11,088	\$ 10,065	\$ 27,295	0.37
Traditional Avoided Costs	\$ 10,830	\$ 9,813	\$ 26,417	0.37
Avoided CO2 Costs	\$ 259	\$ 251	\$ 878	0.29
Water Park	\$ 593	\$ 593	\$ -	-
Traditional Avoided Costs	\$ 578	\$ 578	\$ -	-
Avoided CO2 Costs	\$ 15	\$ 15	\$ -	-
Tatry Boiler Houses	\$ 10,310	\$ 5,135	\$ 4,794	1.07
Traditional Avoided Costs	\$ 9,903	\$ 4,961	\$ 4,611	1.08
Avoided CO2 Costs	\$ 407	\$ 174	\$ 182	0.95
Nowy Targ	\$ -	\$ -	\$ 5,813	-
Traditional Avoided Costs	\$ -	\$ -	\$ 5,344	-
Avoided CO2 Costs	\$ -	\$ -	\$ 469	-
Total	\$ 32,310	\$ 25,055	\$ 67,204	0.37
Traditional Avoided Costs	\$ 27,122	\$ 20,625	\$ 53,634	0.38
Avoided CO2 Costs	\$ 774	\$ 521	\$ 2,207	0.24
Local Environmental Benefits	\$ 4,413	\$ 3,908	\$ 11,363	0.34
B/C Ratio @ 11.0% Real	0.65	0.95	1.38	0.69
Net Benefits	(17,232.51)	(1,377.10)	20,033.39	(0.07)
EIRR	2.4%	9.3%	25.7%	0.36
MT CO2 Reduced	584,509	565,526	2,660,414	0.21
GEF Payment	3,186,000	3,186,000	-	-
Cost Per Ton CO2	\$ 5.45	\$ 5.63	\$ (2.64)	-

Case 2: Results for Case 2 are contained in Table 2 below. The findings are discussed in Chapter 4.

Table 2: Appraised vs Actual Project Economics: Case 2

Case 2 - Steady State Sales 600 TJ				
	Actual	Actual	Appraisal	Ratio
	1994 PV @ 11.0% 1995 - 2024 Full Project	1994 PV @ 11.0% 2000 - 2024 Bank Project	1994 PV @ 11.0% 2000 - 2024 Bank Project	2000 - 2024 Actual/Appraisal
Project Investment	\$ 38,876	\$ 21,294	\$ 31,096	0.68
Project Operating Costs	\$ 16,310	\$ 10,998	\$ 15,522	0.71
Traditional Project Costs	\$ 55,185	\$ 32,292	\$ 46,618	0.69
CO2 Emission Costs	\$ 446	\$ 230	\$ 552	0.42
Total Project Costs	\$ 55,632	\$ 32,521	\$ 47,170	0.69
Project Benefits				
Household Total Benefits	\$ 9,417	\$ 8,866	\$ 17,940	0.49
Traditional Avoided Costs	\$ 9,253	\$ 8,715	\$ 17,262	0.50
Avoided CO2 Costs	\$ 164	\$ 151	\$ 678	0.22
Large Load Total Benefits	\$ 11,575	\$ 10,500	\$ 27,295	0.38
Traditional Avoided Costs	\$ 11,306	\$ 10,238	\$ 26,417	0.39
Avoided CO2 Costs	\$ 269	\$ 262	\$ 878	0.30
Water Park	\$ 584	\$ 593	\$ -	
Traditional Avoided Costs	\$ 569	\$ 578	\$ -	
Avoided CO2 Costs	\$ 15	\$ 15	\$ -	
Tatry Boiler Houses	\$ 10,310	\$ 5,135	\$ 4,794	1.07
Traditional Avoided Costs	\$ 9,903	\$ 4,961	\$ 4,611	1.08
Avoided CO2 Costs	\$ 407	\$ 174	\$ 182	0.95
Nowy Targ	\$ 1,409	\$ 1,409	\$ 5,813	0.24
Traditional Avoided Costs	\$ 1,376	\$ 1,376	\$ 5,344	0.26
Avoided CO2 Costs	\$ 32	\$ 32	\$ 469	0.07
Total	\$ 38,797	\$ 31,497	\$ 67,204	0.47
Traditional Avoided Costs	\$ 32,407	\$ 25,869	\$ 53,634	0.48
Avoided CO2 Costs	\$ 887	\$ 634	\$ 2,207	0.29
Local Environmental Benefits	\$ 5,502	\$ 4,995	\$ 11,363	0.44
B/C Ratio @ 11.0% Real	0.70	0.97	1.38	0.70
Net Benefits	(16,835.00)	(1,024.06)	20,033.39	(0.05)
EIRR	2.9%	8.6%	25.7%	0.33
MT CO2 Reduced	817,512	798,530	2,660,414	0.30
GEF Payment	3,186,000	3,186,000	-	
Cost Per Ton CO2	\$ 3.90	\$ 3.99	\$ (2.64)	

Table 3 provides a summary comparison of the EIRRs for the Incremental Project both with and without environmental benefits.

Table 3: Economic Internal Rates of Return Ex Ante and ex Post

Economic Internal Rates of Return	Complete Project	Incremental Project	Incremental Project	Incremental Project
Ex ante and ex post	Ex ante Appraisal	Ex ante Appraisal	Ex-Post Case 1	Ex-Post Case 2
EIRR w/o local & global benefits	8.6%	15.9%	4.4%	3.3%
EIRR with local & global benefits	12.6%	26.6%	9.3%	8.6%

Financial Analysis. The Project Appraisal Document (PAD) distinguished between the overall Project (1995 to 2004) and the Incremental Project (2000 to 2004). The Overall Project included investments made between 1995 and 1999 as well as investments to be made under the Project under consideration, and foresaw total financing required of US\$96.7 million equivalent (or PLN 394 million).

Through 1999, a total of US\$27.1 million equivalent had been spent, with project costs for components 1 to 3 covering US\$24 million, and US\$3.1 million for incremental working capital. The proposed Project covering the period of 2000 to 2004 was estimated to require incremental financing of US\$69.6 million, including project costs of US\$57.6 million, and the remainder for interest during construction, and incremental working capital. The following table provides actual costs incurred through 1999 and compares actual with expected project and financing costs for the incremental project.

Table 4: Projected Project Costs - Appraisal vs Actual Costs

Project Costs & Financing Required	Actual	Projected	Total Project	Actual	Act./Appr.
(US\$ Million)	1995 – 99	2000-04	1995-2004	2000-04	Percent
Component 1: Heat Product.& Transmsn.	16.1	27.1	43.2	18.2	55.8
Component 2: Distribution Networks	6.0	18.3	24.3	13.2	62.4
Component 3: Heat Exchangers and Misc.	1.9	2.7	4.6	2.0	65.2
Component 4: Project Management	0.0	0.5	0.5	0.4	92.1
Component 5: Monitoring & Evaluation	0.0	0.4	0.4	0.3	73.0
Total Base Costs	24.0	49.0	73.0	34.1	59.1
Physical Contingencies	0.0	6.0	6.0		
Price Contingencies	0.0	2.6	2.6		
Total Project Costs	24.0	57.6	81.6	34.1	59.1
Fin. Fees & Interest during Constr.	0.0	6.2	6.2	1.8	29.0
Incr. Working Capital	3.1	5.9	9.0	1.1	19.6
Total Financing Required	27.1	69.6	96.7	37.0	53.1

Project costs were lower than anticipated both because the full design has not been built but also because of favorable pricing that was achieved for the components that have been completed. The lower construction costs also allowed significant savings in the financing costs. In total, only 53.1% of the amount estimated at appraisal has been required to take the project to its present stage.

The Financing Plan at appraisal envisaged coverage of total financing required of almost US\$70 million by 55% debt (World Bank loan), 27% in the form of grants, and 15% internal cash generation. The remaining amount would be provided by equity (almost 3%). Actual financing is shown in Table 5. The World Bank loan covered 39% of total funding required, grants and equity covered 52%, with the rest provided by local loans and draw-downs of inventory. Internal cash generation turned out to be negative.

[Note: The actual financing is taken from constructed fund flow statements, which are based on actual income statements and balance sheets. There are some inconsistencies among them, as well as significant discrepancies with the IVth Quarter 2004 PMR.]

Table 5: Project Financing - Appraisal vs Actual

<i>Financing Plan</i>	Projections at Appraisal		Actual at the End of 2004	
For the Years 2000 to 2004	PLN Million	US\$ Million	PLN Million	US\$ Million
Internally Generated Funds	50.1	10.7	-13.4	-3.3
Equity	7.3	1.7	20.9	5.1
Grants	80.8	19.0	57.5	14.0
<i>Phare I</i>			4.5	1.1
<i>Phare II</i>	45.0	10.5	28.7	7.0
<i>GEF</i>	22.6	5.4	14.1	3.4
<i>USAID</i>	10.5	2.5	8.1	2.0
<i>DEPA</i>	2.6	0.6	2.1	0.5
Local Loans	0.0	0	8.3	2.0
World Bank	168.0	38.2	59.6	14.5
Draw-down of Inventory	0.0	0	18.9	4.6
Total Financing	306.2	69.6	151.7	37.0

The annual income statements for PEC/GP shown in Table 6 show early losses but steadily improving results through 2002 when the first positive margin was achieved. Progress did not continue in 2003, however, when the losses were 15.1 million PLN. Of this loss, 11.3 million was due to foreign exchange

losses. As the results for 2003 became more apparent, NFOS lost trust in PEC/GP management and project development was basically frozen. Cumulative losses through 2004 were about 23.5 million PLN with a financing plan that relied on internal cash generation for more than 15% of the total financing. Almost half of this cumulative loss could have been eliminated if the foreign exchange risk had been completely hedged.

Table 6: PEC/GP: Income Statements 2000 to 2004 and Plan for 2005

	YEAR	2000	2001	2002	2003	2004	Plan 2005
Revenues			1.50	1.34	1.22	1.08	1.09
Heat Sales Total		4,014	6,010	8,076	9,825	10,571	11,558
Geothermal		2,904	5,414				
Fossil		1,110	596				
Sales of Heat Exchangers/Electricity		433	1,766	772	700	765	302
Other Operating Income		233	1,923	576	79	635	0
Total Revenues		4680	9,698	9,424	10,604	11,971	11,860
Operating Expenses							
Total Energy and Material Costs		2,826	2,797	2,115	3,273	3,805	4,333
<i>Electricity</i>		250	237	195	1,303	1,227	1,490
<i>Gas</i>		2,117	2,123	1,569	1,738	1,877	2,326
<i>Oil</i>		336	178	82	100	129	511
<i>Other (inclg. Water)</i>		123	259	268	131	572	7
Total Op.Taxes and Duties		139	401	655	863	2,128	2,219
<i>Property tax</i>		129	393	578	766	2,095	2,203
<i>Pollution Tax</i>		10	8	12	13	14	16
<i>Extraction Fee</i>		0	0	0	0	0	0
<i>Excise Tax</i>				65	84	19	
Maintenance and Services		415	395	510	1,535	1,523	6,603
Total Labor Costs		2967	3,160	3,028	2,989	3,121	3,248
<i>Labor Costs</i>		2,511	2,669	2,551	2,511	2,597	
<i>Social Insurance, etc.</i>		456	492	478	478	525	
Material and Services Marketing		320	763	643	516	692	617
Other Operating Costs		849	1,329	549	4,859	3,590	2,003
Total Operating Expenses		7516	8,846	7,500	14,035	14,859	19,023
Operating Income bef.		-2836	853	1,924	-3,431	-2,888	-7,164
Depreciation							
Depreciation		2,223	3,281	3,061	3,189	7,788	6,333
Operating Income		-5059	-2,428	-1,138	-6,619	-10,676	-13,497
Financial Costs and Revenues							
Income on Cash balance		114	150	126	83	165	281
Other financial Income		0	5	0	0	6,605	0
Interest on loans		2,809	2,194	1,064	1,362	980	502
Other financial costs		209	4	129	11,280	16	0
Total Financial Costs and Revenues		2904	2,042	1,067	12,559	-5,774	221
Revenues							
Net Income before Grant Transfer		-7962	-4470	-2205	-19179	-4902	-13718
Adjustment and Taxes							
Adjustment from Grant Transfer		1,034	1,869	2,266	4,358	6,802	4,493
Net Income before Taxes		-6928	-2,602	62	-14,821	1,900	-9,225
Income Taxes		0	0	-283	283	1,254	0
Net Income after Tax		-6928	-2,602	345	-15,104	646	-9,225
Cumulative Margins		-6,928	-9,530	-9,185	-24,289	-23,643	-32,868

Financial Internal Rates of Return ex ante and ex post. The after tax FIRR estimated at appraisal for the incremental Bank Project was 11.5% based on 20 years of steady state operation through 2024. Sensitivity analyses showed that a 10% reduction in sales revenues would reduce the FIRR by 1.5% ceteris paribus. Project risks were perceived as medium.

The ex ante FIRR calculations have been contrasted with two ex post evaluations:

- Case 1: Minimal new investments with steady state sales of 317 TJ from 2007 on.
- Case 2: New investment of MPLN 80 and steady state sales of 600 TJ from 2012 on.

The following results were obtained when applying an 85% ratio to geothermal heat over total heat sales. This is justified after the repair of the PAN-1 well. Costs and revenues are then projected according to the two Cases above. The numbers are initially expressed in 2005 terms with different inflation rates then applied to different cost and revenue streams as follows:

- General Inflation: 2.5% per Year;
- District Heat Inflation: 3.5% per Year;
- Gas Inflation: 3.5% per Year;
- Electricity Inflation: 3.0% per Year;
- Labor Inflation: 3.0% per Year.

The time horizon has been kept to 2025 as at appraisal, but in Case 2 has also been extended to 2030. In Case 2 this is fully justified as the steady state of 600 TJ is only reached in 2012 after 7 years of additional investments. Operating costs, other than gas and electricity are based on historic company experience, although it is believed that there is further scope of reductions of some of those cost items.

Capital Costs are the actual costs experienced by PEC/GP in the period through 2004. In Case 1, the only remaining costs are the repair of the PAN-1 well, some retention payments under recent contracts, and some connections to reach the level of 317 TJ. In Case 2, a total of PLN 80 million is spent over the period 2006 to 2012 to cover additional distribution network costs, a new doublet, the transmission pipeline to Nowy Targ and increases of capacity at the base load plant in Banska. Table 7 presents the capital cost estimates for expansion of the system to accommodate sales of 670 TJ per year.¹⁷ This calculation assumes the full PLN 80 million of investments that PEC/GP estimates would yield 670 TJ per year in sales. To keep the projections conservative, however, the steady state sales forecast has been reduced to 600 TJ per year.

Table 7: Capital Cost for Case 2 Project Scope

<i>Capital Costs for remaining components</i>	Economic Scope (670 TJ)	
	PLN Million	US\$ Million
Total and Economic Scope		
Zakopane DH Network Completion	34.1	10.6
Koscielisko Connection	0.0	0.0
Koscielisko DH Network	0.0	0.0
Expansion of Base Load Plant (with Heat Pumps)	0.0	0.0
Expansion of Base Load Plant (with New Doublet)	25.0	7.8
Nowy Targ Connection (Transmission Pipeline)	17.9	5.6
Nowy Targ DH Network	3.5	1.1
Szaflary Connection	0.0	0.0
Szaflary Network	0.0	0.0
Other villages Connections and networks		
Total Costs (using new doublet in Base Load Plant)	80.4	25.1

The results of the analysis for the two Cases are presented in Tables 8 and 9.

Table 8: CASE 1 - 317 TJ - Ex Post FIRR

IRR before Income Tax (2000 to 2024)	-4.0%
IRR after Income Tax (2000 to 2024)	-5.5%
IRR before Income Tax (2005 to 2024)	14.0%
IRR after Income Tax (2005 to 2024)	11.4%
Without Imposition of Property Tax	
IRR before Income Tax (2005 to 2024)	26.2%
IRR after Income Tax (2005 to 2024)	22.2%

For the ex-post comparison, FIRRs on the full Bank Project are negative. However, the incremental analysis shows reasonable returns (11.4%) with very attractive returns (22.2%) if the property tax were to remain forgiven. While these results do not justify the original investment, they do show that continued operation is more likely than termination regardless of the future decisions on the property tax.

Table 9: CASE 2 - 600 TJ – Ex Post FIRR

	To 2025		
IRR before Income Tax (from 2000)	1.9%		
IRR after Income Tax (from 2000)	0.0%		
		To 2030	To 2035
IRR before Income Tax (from 2005)	13.7%	15.5%	16.2%
IRR after Income Tax (from 2005)	10.5%	12.6%	13.5%
Without Imposition of Property Tax			
IRR before Income Tax (from 2000)	3.8%	6.1%	7.1%
IRR after Income Tax (from 2000)	1.7%	4.3%	5.5%
Without Imposition of Property Tax			
IRR before Income Tax (from 2005)	19.0%	20.2%	20.6%
IRR after Income Tax (from 2005)	14.8%	16.4%	16.9%

The results for Case 2 are similar. The FIRR is insufficient to justify the total investment but the incremental results continue to suggest that the Project is likely to continue to operate regardless of future property tax decisions. Only with indefinite property tax forgiveness and extended operation to 2030 or 2035, the FIRRs on the total investment (4.3 to 5.5%) begin to approach marginally acceptable levels for public investment in environmental projects.

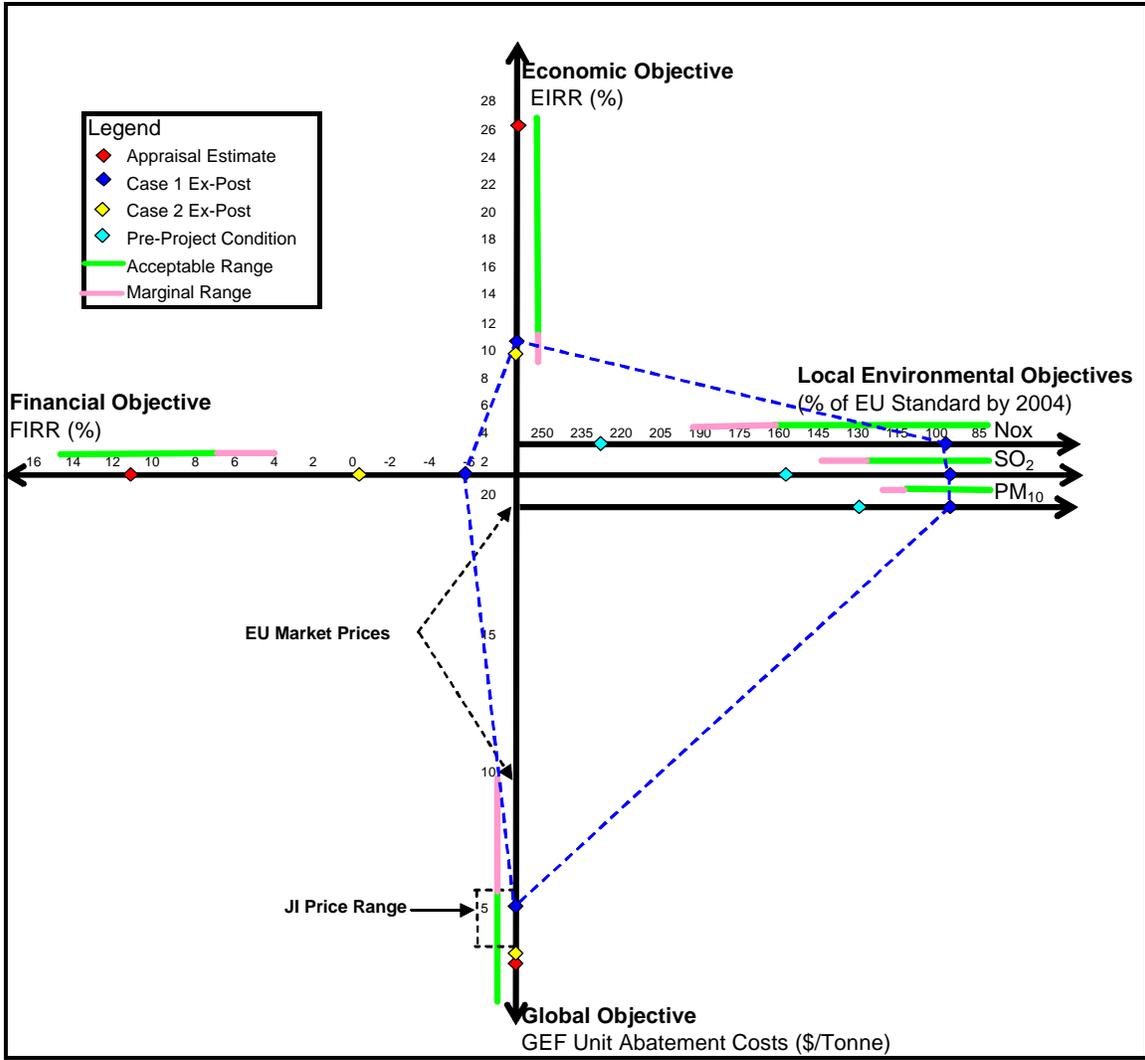
Finally, based on cursory analysis of cost variations in response to load changes and on PEC/GP estimates of the investments required to reach various steady state load levels, approximate analyses of the break-even levels can be developed. Results of these analyses are presented in Table 10. From this we can conclude that operating costs can be covered if sales remain at the Case 1 level. To cover all operating costs and to recover all historic investment, sales would need to rise to 780 TJ/year which does not appear feasible at this time. That figure would be reduced to 650 TJ if the onerous property tax were forgiven. All operating costs and all new investment can be covered if sales are increased to 550 TJ. These options would need to be analyzed in greater detail to support any firm decisions but they do provide indicative benchmarks that should be helpful in establishing the future development plan for the Project.

Table 10: Results of Break-Even Point Analyses

	Type of Break-Even Point	Sales Level (TJ)
1	Operating Break-Even Point (operating costs but no depreciation)	325
2	Full Break-Even Point (operating costs & depreciation on old & new Inv.)	780
3	Full Break-Even Point (as in (2)) but no tax on property	650
4	Break-Even (full operating costs and depreciation of new Investment only)	550

Consolidated Project Evaluation. The Project has been evaluated in terms of its achievement of both its primary and secondary environmental objectives and in terms of the economic and financial rates of return. The following figure summarizes these findings in a single chart and attempts to establish quantitative criteria for establishing Project achievements on each performance measure. The overall Project ranking can then be assessed based on the summary data shown in this figure.

The four axes portray each of the measures against which Project achievements were evaluated both at Appraisal and in the ex-post analyses presented in this report. The Project Appraisal formally declared the primary objective to be the improvement of the local environment and the secondary objective to be reductions in CO₂ emissions to improve the global environment. The economic and financial measures are common performance indicators for World Bank projects.



The local environmental objective was formally defined at appraisal in terms of annual average concentrations of PM₁₀ and SO₂ in Zakopane. This made comparative monitoring of the pre- and post-project periods possible based on available monitoring programs and historic data. It also allows comparison of conditions in Zakopane to the EU standards that now apply in Poland. The light blue diamonds on the Local Environment axis show the pre-Project condition for each pollutant. SO₂, for example, was 163% of the EU standard while PM₁₀ was 136% and NOx was 233%. By 2004, Zakopane had reached EU compliance for both SO₂ and PM₁₀ and was within 3% of compliance on NOx. The acceptable performance range, indicated by the green lines, have been arbitrarily set at 50% of the improvement needed to satisfy the EU standard in the belief that most environmental authorities would have been pleased to see such improvements over just four years. The marginally acceptable range, indicated in pink, has been similarly shown to reflect 25% of the needed improvements. **Regardless of where these ranges are set, it seems reasonable to argue that achieving full compliance in this short period in this critical location is a satisfactory result.**

Achievement of the global objective has been shown on the downward axis in terms of the unit abatement cost that GEF is expected to incur on a life cycle basis through 2024. The appraisal estimate of \$3.16 per

tonne is shown as the red diamond. Since the future development of the Project remains unclear, the range of likely futures is shown as a dark blue diamond and a yellow diamond. The blue point is Case 1 which requires minimum additional investment while the yellow point is now seen as the maximum likely future. The green acceptable range has been defined by current price ranges for JI purchases of CO₂. The pink marginal range extends to the lower end of the recent price range in the EU trading market.^{2/} ***Case 1 falls in the acceptable or satisfactory range and Case 2 comes quite close to the appraisal expectation. Both cases are very competitive with other purchases that are now being made on a regular basis in carbon markets. This would suggest a satisfactory ranking on the global objective if the UAC is chosen as the relevant measure. Sole reliance on CO₂ reductions delivered would suggest an unsatisfactory rating on the global objective.***

The EIRRs that measure economic achievement are shown on the upward axis with the same color coding as the global objective. Bank economic methodologies would define the hurdle rate in terms of the opportunity costs for investments in Poland but Bank conventions would typically define the hurdle rate as 10% to 12%. The EIRRs on other investments by NFOS would also be of interest in defining the acceptable range here. Such NFOS data has not been obtained for this study but environmental projects will typically have somewhat lower hurdle rates if some known benefits are not included because of the difficulty in quantifying some externalities. Thus, hurdle rates as low as 8% could be considered marginally acceptable for an environmentally driven project. For this Project, the ex-post EIRRs are between 8% and 10% for the two future scenarios that have been considered without consideration of tourism and biota benefits. ***Using these definitions, the economic results for either Case 1 or Case 2 are seen as marginally acceptable despite the much more ambitious expectations at appraisal.***

Finally, the financial performance of the Project is evaluated on the left hand axis. For a private investment in a commercial venture in an unregulated market, an after tax hurdle rate of 15% would be reasonable. Utilities supplying electricity, heat, or water often benefit from some monopoly positions but have regulated prices and returns on investment as a result. Returns in the 7% to 12% range would typically be allowed for such sectors. Probably, that view helped to justify the Project at appraisal based on the expected FIRR of 11.6% (red diamond). As the Bank has focused more heavily on environmental and social projects, minimum acceptable FIRRs have been relaxed in some cases such as the 4.0% for the Second Viet Nam Energy project that was cited in footnote 4. Given the environmental objectives of this Project, FIRRs of 4% to 7% are shown as marginally acceptable. ***Regardless of these definitions of acceptable ranges, the Project clearly failed to meet the financial objectives regardless of the future scenario that materializes and must be deemed unsatisfactory on this metric.*** The critical incremental cost analysis that shows acceptable FIRRs for continued operation of the Project reflects a different basis and is not portrayed in the diagram.

The diagram attempts to evaluate the project on each separate objective but does not yield an overall project ranking. That would require some defined weights that would allow combination of these multi-measure rankings. The PAD clearly indicated that the primary Polish objectives in this project were environmental. It has been suggested that the Bank might weight the local and global environmental objectives in proportion to the size of the Bank loan (\$38.2 million) vs the GEF grant (\$5.4 million). Appropriate and comparable weighting for the EIRR and FIRR are more difficult to establish. The EIRR is the broader concept that attempts to provide a fully monetized measure of the value of the project to Poland although some key benefits are not estimated. The FIRR is critical in establishing the conditions for continued operation of the Project but ultimately the acceptable range for this can only be determined by NFOS which will determine the final fate of the Project. ***Given the primacy of the environmental objectives, the marginally acceptable economic results and the strong likelihood that the Project will continue to operate, a total Project ranking of marginally satisfactory is appropriate. At this time, the ICR template does not yet include a marginally satisfactory option. In the absence of that category, the***

most reasonable choice of an overall Project ranking would be unsatisfactory.

^{1/} PEC/GP also evaluated a more extensive plan that was expected to take sales to 970 TJ per year but concluded that the Case 2 expansion was more economic.

^{2/} The graph shows an EU price range from \$10 to \$20 per ton of CO₂. Subsequently, the EU price reached \$29 per ton before returning to the \$20 level.

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					
	8/9/1998	2	TEAM LEADER (1) ENERGY/ENVIR ECONOMIST (1)		
	11/1998	3	TEAM LEADER (1); ENERGY/ENVIR ECONOMIST (1); ENERGY ECONOMIST (1)		
	05/06/1999	2	TEAM LEADER (1); ENERGY/ENVIR ECONOMIST (1)		
Appraisal/Negotiation					
	10/25/1999	2	TEAM LEADER (1) ENERGY/ENVIR CONOMIST (1)		
Supervision					
	10/17/2000	2	TEAM LEADER (1); ENERGY/ENVIR ECONOMIST (1)	S	S
	02/08/2001	1	TEAM LEADER (1)	S	S
	12/11/2001	2	ENERGY ECONOMIST (1); FINANCIAL ANALYST (1)	S	S
	06/08/2002	2	ENERGY ECONOMIST (1), CONSULTANT (1)	S	S
	11/18/2002	3	TEAM LEADER (1); ENERGY ECONOMIST (1); CONSULTANT (1)	S	HS
	6/2/2003	1	FINANCIAL SPECIALIST (1)	S	HS
	11/18/2003	1	TEAM LEADER (1)	U	S
	4/12/2004	1	TEAM LEADER (1)	U	S
ICR					
	01/2005	3	TEAM LEADER (1) CONSULTANTS (2)		

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US\$ ('000)
Identification/Preparation		628,653.57
Appraisal/Negotiation		included above
Supervision		637,276.71
ICR		included above
Total		1,265,930.28

Staffweeks data is not available in SAP. SAP breaks down the \$ costs by LEN and SPN only. Total includes expenses for both IBRD project and for GEF grant.

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

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

	<u>Rating</u>				
<input type="checkbox"/> <i>Macro policies</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input type="checkbox"/> <i>Sector Policies</i>	<input type="radio"/> H	<input type="radio"/> SU	<input checked="" type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Physical</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Financial</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input checked="" type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Institutional Development</i>	<input type="radio"/> H	<input checked="" type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Environmental</i>	<input checked="" type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA

Social

<input type="checkbox"/> <i>Poverty Reduction</i>	<input type="radio"/> H	<input type="radio"/> SU	<input checked="" type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Gender</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA
<input type="checkbox"/> <i>Other (Please specify)</i>	<input checked="" type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Private sector development</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input checked="" type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Public sector management</i>	<input type="radio"/> H	<input type="radio"/> SU	<input checked="" type="radio"/> M	<input type="radio"/> N	<input type="radio"/> NA
<input type="checkbox"/> <i>Other (Please specify)</i>	<input type="radio"/> H	<input type="radio"/> SU	<input type="radio"/> M	<input type="radio"/> N	<input checked="" type="radio"/> NA

High Social Impact due to high reduction of local air pollution and its impact on tourism.
 Modest achievement of the Global Objective (CO₂ reduction).

Annex 6. Ratings of Bank and Borrower Performance

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

6.1 Bank performance

Rating

- | | | | | |
|--------------------------------------|--------------------------|------------------------------------|------------------------------------|--------------------------|
| <input type="checkbox"/> Lending | <input type="radio"/> HS | <input type="radio"/> S | <input checked="" type="radio"/> U | <input type="radio"/> HU |
| <input type="checkbox"/> Supervision | <input type="radio"/> HS | <input checked="" type="radio"/> S | <input type="radio"/> U | <input type="radio"/> HU |
| <input type="checkbox"/> Overall | <input type="radio"/> HS | <input checked="" type="radio"/> S | <input type="radio"/> U | <input type="radio"/> HU |

6.2 Borrower performance

Rating

- | | | | | |
|--|--------------------------|------------------------------------|------------------------------------|--------------------------|
| <input type="checkbox"/> Preparation | <input type="radio"/> HS | <input checked="" type="radio"/> S | <input type="radio"/> U | <input type="radio"/> HU |
| <input type="checkbox"/> Government implementation performance | <input type="radio"/> HS | <input checked="" type="radio"/> S | <input type="radio"/> U | <input type="radio"/> HU |
| <input type="checkbox"/> Implementation agency performance | <input type="radio"/> HS | <input type="radio"/> S | <input checked="" type="radio"/> U | <input type="radio"/> HU |
| <input type="checkbox"/> Overall | <input type="radio"/> HS | <input checked="" type="radio"/> S | <input type="radio"/> U | <input type="radio"/> HU |

For details, see Chapter 7 of the Report.

In the rating "implementation agency performance, two ratings should be given, which the template does not allow: the rating for the old management is U, and the rating for the new management is S.

We understand that a new category of marginally satisfactory (MS) will be introduced in future ICR ratings, and would use that as the most appropriate rating for the Bank and Borrower Performance. Absent that rating, satisfactory has been chosen as the most representative of the currently available rating options.

Annex 7. List of Supporting Documents

Project Appraisal Document (PAD) Number 20286-PL, dated April 14, 2000.

Project Monitoring Reports (PMRs - quarterly) from IVth. Qu. 2000 to IVth Qu. 2004

Project Status Reports (PSRs - semi annual) from mid 2000 to end 2004

PEC/GP Reports on Project Financial Statements 2000 to 2003 as audited.

PEC/GP Reports on Project Financial Statements 2004 (audit nearing completion).

PEC/GP Report on the Operational and Financing Plan 2005 (Polish Only).

PEC/GP Business Plan of Year 1999.

PEC/GP Reconstruction Plan, Zakopane, October 2004

KWI/EC BREC Report on Monitoring and CO2 Abatement 2003

KWI/EC BREC Report on Monitoring and CO2 Abatement 2004

Power Systems Engineering (PSE) Report: Lessons Learned – Heat Demand Projections July 04

Misc. Consultants at a Project Conference in July 2004: Consultant Note on the Status and Future of the Podhale Geothermal Project.

KWI Draft Final Report: Market Study on the Expansion of the District Heat Segment. July 2004

KWI Draft Final Report: Evaluation of the Wood Drying Segment. June 2004

PEC/GP Report of comments on the ICR, (ICR- PECGPeng) of May 31, 2005

Additional Annex 8. Borrower's Comments

These are the comments of the borrower in the original form.

Introduction

The main goal of Podhale Geothermal Project was to reduce air pollution emission coming from fossil fuels combustion in the local low-emission's coal and coke boiler houses. The assumption has been made that heat was distributed by district heating network and the main source of heat was geothermal with a support of gas-oil Peak Load Plant. Project had to be implemented within six municipalities (Zakopane, Poronin, Ko-cielisko, Bia-y Dunajec, Szaflary, Nowy Targ).

Reducing of the air pollution emission in the region has a significant impact both on the increase of touristic attractiveness of Podhale region and improving of the life comfort as well, and on the decrease of the negative results which air pollution effects on the all national parks, particularly Tatra's National Park.

Many difficulties have been met during implementation of the Project. The experience gathered so far with a support of ex-post analyses is a significant source of information in a scope of executing similar projects from the foundation, promotion and rational use of geothermal energy. These experiences are becoming more and more important particularly in confrontation to politics and law regulations concerning renewable energy sources in European Union and Poland.

PEC/GP has undertaken very ambitious task. The assumption has been made that significant part of heat energy market of Bialy Dunajec Valley was to be reached in a few years beginning from zero. In the initial phase enthusiasm and municipalities', organizations' and individuals' commitment went together with a dynamic Project development. After pilot phase implementation and many detailed Project analyses carried out (Market Study, Feasibility Study, Business Plan, Project Appraisal Document) strategic financing for the Project was completed. The main financial source for the Project implementation was IBRD loan with support of GEF donation and EU funds.

The assumptions on dynamic investment development and a significant heat sale increase were made. Beginning from 118 TJ of heat sale in 1999, there was planned 186 TJ in 2000, then 577 TJ in 2001, 902 TJ in 2002, 1143 TJ in 2003, 1196 TJ in 2004 and at least 1220 TJ in 2005. Year 2005 had to be the first year of steady heat sale which had to make profit in amount of PLN 11 mln.

During Project implementation it soon appeared that both fixed terms of execution and forecasted heat sale had not been achieved, and company still was not able to generate the profit. Following verifications of investments' plans seemed to be overestimated every time. The predicted heat sale was to increase significantly but it did not happen. Additionally, the drop of heat demand within customers' group already connected to the network was observed. Only 65 % of assumed heat sale was achieved in the year 2000. During next years the achieved results seemed to get worse (in 2001 – 28 % of estimated heat sale, in 2002 – 21 %, in 2003 – 21 %). We can hardly be surprised that company's financial stability was permanently threatened. In 2002 the heat demand verification was made and the beginning heat sale forecasts were lessen by the half. Therefore the company's financial plans still showed the possibility of generating the profit from which the debts could have been covered (particularly IBRD loan starting from 2005 and PEKAO credit).

In this situation the Supervisory Board has ordered to the external companies the implementation of PEC/GP's financial situation analyses. Both reports from 2002 "The company financial liquidity analysis in 2002-2013" – PONT Corporation LTD and report from 2003 "The opinion on actual financial situation of the company"-Independent Property Experts' Company pointed out the possibility of the financial liquidity loss and even bankruptcy. The lack of reliability of information which the Supervisory Board

received from the company management led to fundamental changes in the company. At the end of 2003 NFOS took a decision about the change of the PEC/GP management.

The new management took care of putting in order both financial and accounting aspects and organizational changes first. Without these changes the further Project management seemed to be impossible. Carrying out the reliable financial projections was indispensable, due to forthcoming terms of liabilities' payments. All these actions led to working out the Reconstruction Plan, which presents both the possibility of company's bankruptcy and a manner to overcome the crisis. The Reconstruction Plan was approved by the shareholders and adopted to put into execution in 2005.

Reasons of problems

Ineffective organization and inappropriate management system were the main sources of problems during Project implementation. The lack of correct approach to problems which have arisen was the main reason of implementation of temporary solutions without analyzing the underlying cause.

The style of management may be described as a centralized one. Lower organizational levels of the company had no significant influence on decision taking process and really limited access to the knowledge on content-related basis of the solutions accepted. The controlling system has not worked well also.

Detailed short-term plans due to realize in each company departments did not go together with the ambitious plan described in PAD. Obtained results were not analyzed au courant to define the reasons of appearing variances between the forecasted and actual data. The detailed analyses of variances would have allowed to verify correctly the assumptions and avoid the mistakes. Unfortunately there was no coherent verification system in operation from the beginning of the Project. The reports were made mainly for external receivers of information and were only the instrument to gain financial sources. It is hardly to be surprised that underlying causes of the problems were not analyzed well enough and probably were hardly identified. The facts which are presented by Bank today as the reasons of the variances between the forecasts (PAD) and actual state result from the mistakes related to an inappropriate Project management. The only exception was the property tax, that did not depend on the company.

Because of the inappropriate management many problems have accumulated and their effects became more and more apparent. All negative effects of inefficient decision taking process may be grouped into the following categories:

1. The investments

- **The investments' profitability**
The permanent pressure on prompt investments' executing and increasing of market penetration resulted in taking the investments' decisions without carrying out any profitability analysis. Therefore within so huge variances between the forecasts and actual state, paying back the debts have become more and more doubtful. Unfortunately, no verification of heat market, investment outlays and terms of execution was made. According to the World Bank's statement PEC/GP have focused on connecting mostly largeloads customers, omitting the individuals. However the World Bank did not ask if the income from the heat sale for individuals is enough to cover the loan from which the connections were financed.
- **The investments' contracts**
Because of the significant delays in the investment process, the request raises, if it was prepared in a proper way. The terms of contracts' completion imposed by PEC/GP were too short. The most of the executed contracts have exceeded the estimated time limit, but PEC/GP did not apply any penalties for delays, despite contract's agreements. Additionally the attention should be paid to significant expanding or changing the scope of contract by PEC/GP, what effected in further investments' delays.

- The delays in main transmission pipeline execution
The delay concerning main transmission pipeline construction which connects geothermal sources to heat customers in Zakopane effected in the increase of the usage and cost of gas at Peak Load Plant, just like it was described in ICR report prepared by the World Bank. The attention should be paid into very optimistic terms of this investment execution what was probably related to the lack of pre-investment analysis. Planning this investment, time consuming procedures (resulted from the EU requirements) were not taken into account.
2. accounting system
Tending to the profit may be observed even at price of accounting irregularity as follows:
- Delays in transferring the investments into fixed assets
 - Temporary booking the costs of gas (fuel) into investments
 - Decreasing of the depreciation's costs related to networks from 4,5% to 2,0%
 - Maintenance of worthless components of assets (lack of liquidation and reduction in prices because of accounting losses)
3. financial aspects
- the lack of financial risk management
Financing the investment from the loan sources was not supported with any protection from the exchange rate risk. The negative results of the exchange rate were strongly noticeable by the company in 2003. Additionally very inconvenient currency change within local loan from PEKAO SA was made (from PLN into Euro). This change was made in order to decrease the financial costs, but as a result of a very inconvenient exchange rate it effected in a significant increase of the credit amount.
 - The lack of reliable financial and management information
The PMR reports, the main instrument to control the money transfer by the World Bank, have been prepared improperly. The World Bank representatives paid attention to this fact in the beginning of 2005 (after completion of loan financing). Also the Supervisory Board have paid attention to discrepancies and irregularities within financial projection made by PEC/GP. Taking into account the irregularities mentioned above it was hardly to use the accounting data to the managing purposes.
 - The lack of controlling system
The controlling system was designed but has never been implemented.
4. technical aspects
- ineffective cooling of network water (delta T)
The coolings values (delta T) which were assumed are not achieved. Some investments' decisions have significantly worsen the coolings (for example installing a huge amount of bypasses – connections without heat receiving)
 - improper selection of dimensions,
In many cases the dimensions of pipes were selected improperly, without taking into account the future heat demand, and keeping the wrong assumptions concerning the coolings. The savings made on the stage of dimensions' selection will cause the necessity of additional costs of some pipelines exchange. There are also some overestimated dimensions of pipes operating with the bigger heat losses.
 - The lack of detailed analyses of particular investments
(1) gas engines installation, despite financing from donation, was inadvisable and generates additional costs currently (2) in many cases the heat exchangers were installed, what has unfavorable impact on district heating system because of ineffective cooling, (3) the lack of strategic analyses of the building development which in consequence causes problems with supporting enough heat power. (4) Geothermal system was constructed without

former detailed analyses of the corrosion of infrastructure related to geothermal water. The materials from which the components of the system were made, use up faster than estimated before.

5. formal-law aspects

- Aqua Park
Decision about building Aqua Park was taken without proper evaluation of all formal-law aspects. It appeared during the construction, that realization of the investment by the company with private shares is illegal with EU financing rules. The investment was stopped for many months and PEC/GP had to quit the donations beneficiary position.
- The heat tariffs
The heat prices for some groups of customers were lower than tariffs accepted by Energy Authority Office what was illegible and caused the decrease of basic level of the next prices calculation.

The lack of solving problems mentioned above, caused the delays in project implementation, the lack of possibility to reach the forecasted heat sale level and as a consequence Project ineffectiveness.

The Reconstruction Plan

The change of the company management was conducted in October 2003, because of necessity of rebuilding PEC/GP reliability and undertaking the reconstructive actions. From this moment many changes have been conducted, beginning from the organizational changes, putting in order the finances and through creating the reliable information system (e.g. implementation of controlling system). Having faced the bankruptcy resulted from the necessity (1) of paying back the property tax liabilities, (2) paying back of total amount of PEKAO Bank credit in January 2005 because of the lack of company's creditworthiness (3) coming soon the date of payment the IBRD installment, and (4) Aqua Park construction completion, made the Reconstruction Plan indispensable. In this matter common action with the World Bank were taken. Unfortunately it appeared that the World Bank can not pay for or prepare the Business Plan for the client. The World Bank pointed out that full responsibility for Business Plan working out is at PEC/GP's side. The study was called "The Reconstruction Plan" because of its character and it was completed in the second part of 2004. Different scenarios of Reconstruction Plan show the threat of company's bankruptcy but also the possibility of improving the company's financial stability and further development. During the preparation of the Reconstruction Plan, all data concerning heat market were verified, and also additional experiences gathered during Project implementation were taken into account. To be conservative, the level of operating costs was taken with some reserves (in case of unpredictable prices' increase). The Reconstruction Plan pointed out the manner to overcome the crisis and the possibility of reaching stability and financial independency by PEC/GP. Main assumptions of reconstructive process were : (1) total paying back of PEC/GP debts through injection of capital to the company by NFOS with the amount of 86 mln PLN, (2) conversion by shareholder municipalities of property tax into share capital till the breakeven point is gained, (3) usage the remaining GEF amount. It was proved that the further carrying on the investment will be possible and achieving the financial stability is planned in 2011.

Reconstruction Plan Implementation

Reconstruction Plan implementation has already met some difficulties in the beginning of 2005. Despite earlier assurances of the World Bank representatives there was no possibility of carrying on GEF donation because of the negative Project evaluation of the environmental effects achieved. Such late change of decision in a scope of financing sources has led to significant financial problems in PEC/GP. Fortunately, thanks to favorable Euro exchange rate, after paying back the debts from the amount of 86 mln PLN, also

paying back the liabilities is possible even after withdrawal of GEF financing. Thanks to NFOS engagement, PEC/GP has been cleared of debts and the further investments process is possible. Also municipalities from the Podhale region have a huge task to fulfill. The chosen way to stability and financial independency seems to be the most suitable but is strongly related to consequence implementation of the Reconstruction Plan by the municipalities.

According to the Reconstruction Plan the main assumptions necessary to reaching financial independency by PEC/GP are:

1. The capital injection with an amount of PLN 86,0 mln by NFOS, which is necessary to pay back The World Bank loan (PLN 69,0 mln), PEKAO S.A. loan (PLN 15 mln) and supplement special account IBRD and GEF (PLN 2 mln)
2. Conversion by shareholder municipalities of:
 - a. Overdue property tax together with legal interest
 - b. Conversion of the whole property tax – PLN 21 mln within years 2006-2011 into share capital until the breakeven point is gained
3. Handing the Aqua Park to “Polskie Tatry” S.A. Company. According to the change in the Competence Agreement, the “Polskie Tatry” S.A. Company becomes the beneficiary of the PHARE grant given towards the first stage of the building of the Aqua Park.
4. Continuation of the investments with the loans, credits and other grants being their financial source in amount of PLN 75 mln.

Ad. 1:

The capital injection to the company made by NFOS has been realized in amount of PLN 86 mln. It enabled to pay back the World Bank loan and PEKAO S.A. loan as well. The remaining sources will be spent on the following tasks:

- financing the tasks which were to be executed within the World Bank loan but there were significant delays in their implementation
- financing the retained amounts in frame of guarantee of investments’,
- financing tasks which had to be executed from GEF donation which was withdrawn in the beginning of 2005.

Thanks to lower Euro exchange rate, after paying back the debts from the amount of PLN 86 mln, from the remaining amount, the tasks which had to be financed from GEF donation are possible to be financed.

Ad.2:

The overdue property tax conversion has been realized only in a little scope. It should be emphasized that the assumptions resulted from the Reconstruction Plan are not put into practice in this case, what still is the important threat for the further company existing.

Ad.3:

Handing the Aqua Park to “Polskie Tatry” S.A. Company was successfully realized.

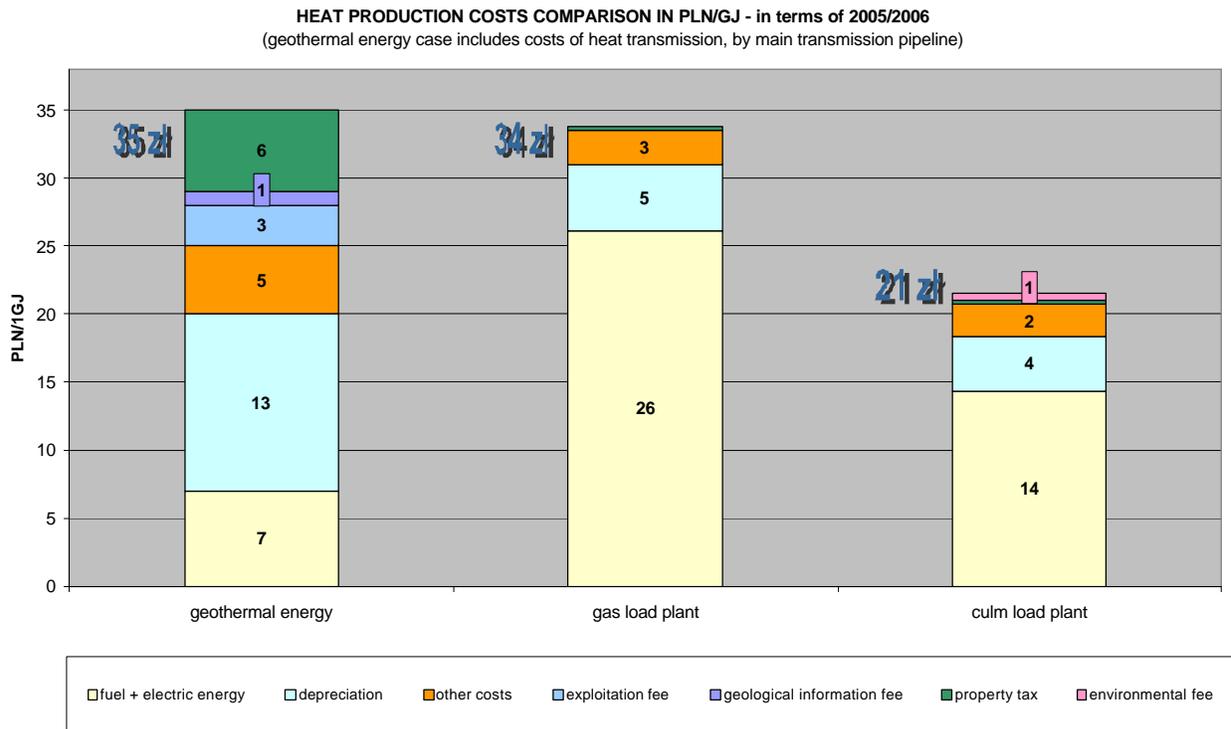
Ad.4:

Because of the lack of assumption no. 2 realization (regarding the conversion of the overdue property tax into company’s shares) the continuation of investments becomes impossible. The lack of conversion will cause the steady increase of tax liabilities of the company and as the consequence will lead to:

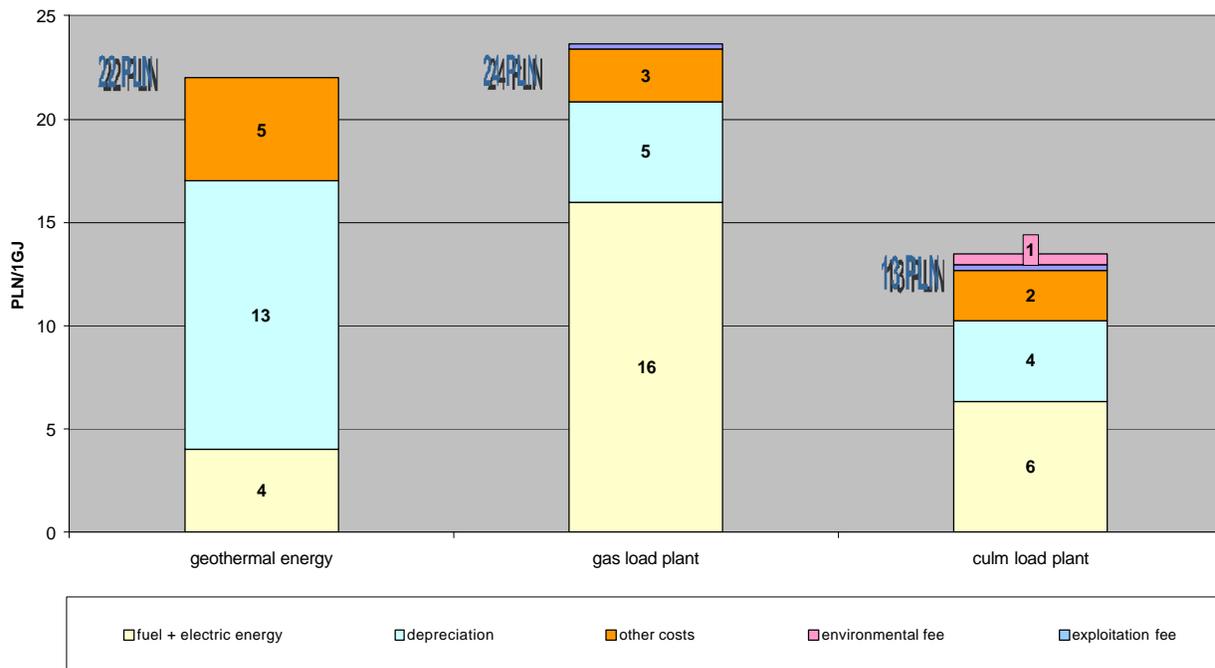
- the lack of company's creditworthiness (no possibility of continuation the investments with the loans, credits and other grants)
- the necessity of increasing of the heat energy prices what will effect in the decrease of competitiveness and the lack of possibility of further development and the present customers' disconnections.
- The loss of financial liquidity what may lead to bankruptcy

The analyses of Reconstruction Plan threats

The first threat mentioned above are the liabilities concerning the property tax. The additional threat appeared because of the new Polish Law regulations from April 22, 2005 (Geological and Mining Law and Wasting Law) which was signed up by the President RP on May 12, 2005. The new law regulations put the additional fee both from the thermal water exploitation and from geological information as well. The additional charge will effect in the huge increase of costs related to heat production from geothermal sources. Today, many analyses have been made and we can see the dramatic drop of geothermal energy's competitiveness because of the increase of heat production costs.



HEAT PRODUCTION COSTS COMPARISON IN PLN/GJ - in terms of 1999
 (geothermal energy case includes costs of heat transmission, by main transmission pipeline)



The specificity of the heat market in Podhale region is that 95% of PEC/GP heat sale comes from Zakopane, which is located 14 km away from geothermal source. That is the reason why the unit heat production cost contains the costs of transmission pipeline. The alternative solutions (supplying heat from gas or coal Load Plant) are relatively cheaper. It is easy to recognize, that in the year 1999, when Geothermal Project has started, the level of heat supplying costs from geothermal sources was significantly more convenient. It was competitive with gas-powered Plant. Unfortunately, the latest law changes in Poland made the ecological, renewable sources of energy, the most burdened with all kinds of taxes and additional fees. So now, in terms of 2005, taxes and fees present 28,5% of the total production costs. Even the ‘scale effect’ – after significant increase of the sale – makes the fees grow. Making profits and achieving the stability by the company will be possible only if the policy of the state will promote renewable sources of energy.

The nearest future

In the nearest future PEC/GP firstly is obliged to implement the Reconstruction Plan. Faced to threats which have appeared, the most important are actions concerning reducing geothermal heat production costs. PEC/GP and NFOS are to negotiate together with all municipalities, liquidation or conversion of property tax into company’s shares as indispensable condition of further company’s development. The stronger engagement into legislation processes concerning renewable energy sources (particularly geothermal) is indispensable. Also talks to the shareholders about the best company’s form will be carrying on. The further development depends on the results of these actions.

PEC/GP still wants to develop in scope of new investments and new customers’ connections, but only if the suitable rate of return is achieved.

To reach the goals concerning the company development in the future, the effective organizational system

should be built. In this scope intensive actions have been taken by PEC/GP. The new management system based on controlling method (enabled effective planning, controlling and fast correction actions taking both annually and in each month in each department) has been implementing. To find problems' solution as quickly as effectively the special team are grouped which take care of particular tasks. A significant amount of duties and entitlements is handed over to the lower organizational levels. To improve the information flow system in the company the implementation of Lotus Notes system has been planned. Difficult but indispensable action is to implement district heating management system which will bring real savings concerning to better technical control and will be a significant support for the optimization and further system development.

The further future

Podhale is the region very attractive for tourists because of its location, taking care of environmental protection and creating the possibilities to balanced development of the whole region. The villages located in the Bialy Dunajec Valley have many merits which should still be expand, but only common engagement may make significant profits. Only in cooperation with the municipalities, local societies, other companies and institutions PEC/GP can fulfill the positive and unusual role in the scope of life and rest quality improvement. In the future company should still develop innovative and ecological district heating system, balneology, education within environmental protection and other activities related to promotion of ecology.

