



Case 26: Podhale region geothermal project

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Cultural Influences on *Renewable Energy Acceptance* and *Tools* for the development of communication strategies to promote ACCEPTANCE among key actor groups

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1. Introduction

The Podhale Trough (Niecka Podhalańska) is an important reservoir of thermal waters. The reservoir's coverage extends from the edge of the Tatras, where natural outflows of warm waters and caves are known and whose origin is associated with the thermal end, probably up to the structure of the Pieniny Mountains' rock belt which constitutes a natural barrier - the Northern boundary of the thermal waters reservoir. The region supplying the thermal waters reservoir of the Podhale region is the Tatra Mountains massif. The area of supply region may be estimated at about 350 km². Rain waters penetrate through the crack system deep into the towered Tatra Mountains massif and move, basically, northwards under waterproof complex of the paleogene sedimentary rock layers (schistose rocks and sandstone). When penetrating into the rock massif, the waters gradually warm up. In the depth of about 1000 meters in Zakopane the waters have about 260°C and in the depth greater than 2000m in the region of Biały Dunajec and Bańska they reach more than 800°C. At the same time the water mineralization increases as well as their pressure in the reservoir.

People became interested in making use of the geothermal springs in the Podhale region as early as in the half of the XIX century. Hot springs in Jaszczurówka near Zakopane became very popular. Their existence was connected with infiltration of rain waters into great depths where under influence of the Earth heat they were warmed up and lifted (along the tectonic cracks) due to hydrostatic pressure (the average temperature of water in a swimming pool was 18°C with the average annual air temperature in this region of 4.8°C). In the post-war period the scientists took the initiative to investigate the conditions of geothermal waters in a complex way. In the years 1981-1997 ten boreholes were carried out. In all of them geothermal waters were found; they had 58-95°C and productivity up to 800 m³/h. One of their great advantages when compared with waters exploited in other regions of Poland is their very low mineralization up to 3g/l and the fact that they flow out onto the surface due to their own pressure.



Figure 1.1 *Podhale region*

The Podhale Geothermal District Heating and Environment Project has its origins in the implementation of a geothermal pilot plant that was started in 1993, initiated by the Polish Academy of Sciences. In 1995, the heat supply for the nearby village of Banská Nizna started. In this year,

the World Bank also began its engagement in a much bigger heating project, finally leading to an important financial contribution with a loan of US\$ 38.2

The objective of the Podhale project was to serve large parts of the Podhale valley (the area between Zakopane and Nowy Targ) in the South Poland with energy for space heating and hot water purposes from geothermal energy. This large scale investment project, which was designed to serve some 4,400 customers with approx. 1,200 TJ of heat annually after its completion in 2004, attracted the attention not only of the World Bank, but also of other national and international financing institutions, leading to a total investment of 80.7 million US\$. The project was designed to serve 4,400 customers with approximately 1,200 TJ heat consumption a year.

In order to investigate the public acceptance of the project representatives of local self-governments were interviewed in 2002¹. Additionally, in order to investigate the public attitudes of potential customers the marketing research was carried out in 2002 among the group of 480 respondents - potential clients of geothermal DH plant².

2. Country context

The late 1990s mark the start of political interest in creating conditions for renewable energy development. The *Resolution on the Increase of Utilization of Renewable Energy Sources*³ approved by the Parliament in 1999 was a milestone. Subsequently the Parliament called on the Council of Ministers to prepare the Development Strategy of the Renewable Energy Sector in Poland and its harmonization with the energy- and environmental policies. The Strategy⁴ adopted by Parliament in 2001, is a key document supporting renewable energy in Poland. It stipulates short-, mid- and long-term objectives for renewable energy. The objective is to increase the share of renewable energy in Poland's primary energy balance to 7.5% in 2010 and to 14% in 2020. Biomass energy is recognized as the most promising and most important renewable energy source in the following 10-20 years. The objectives are expected to be met through the implementation of support programs for particular renewable sources and technologies.

¹ Ten full IDI interviews have been conducted with the representative of the boards and a few supporting talks with employees of the lower level of the following institutions: Urząd Gminy /Municipality Council/ Poronin, Urząd Gminy /Municipality Council/ Biały Dunajec, Urząd Gminy /Municipality Council/ Szaflary, Urząd Gminy /Municipality Council/ Kościelisko, Starostwo Powiatowe /County Office/ Tatrzańskie, Starostwo Powiatowe Nowotarskie, Urząd Miasta /City Council/ Zakopane, Urząd Miasta /City Council/ Nowy Targ, Zakład Usług Komunalnych /Enterprise for Communal Services/ in Nowy Targ and Przedsiębiorstwo Ciepłownicze /District Heating Plant/ which is its part.

² The only criterion for choosing responders was their refusal to get connected to the PEC Geotermia Podhalańska DH system. The questionnaires were directed to all customers who refused connection. 409 questionnaires were distributed among respondents, out of which 361 were evaluated as suitable for further analysis. Together with the marketing department of Geotermia, a questionnaire has been elaborated for the target groups. The scope of the questionnaire is as follows: (1) marketing questions: to investigate the reasons why the potential customers refused to connect to Geotermia. The most frequent reasons will be an indication on how to structure the marketing procedures in the future, (2) Geotermia customer database: data on the building, energy demands, ownership and other statistical data, (3) energy efficiency: to estimate how energy efficiency measures had and will have impacts on the heat demand in the investigated area, (4) tourist development: to estimate how changes in the tourism sector have an impact on the heat demand in the investigated area, (5) air quality: perception on the improvement of the air quality by the inhabitants during the last 5 years.

³ Polish Parliament. 1999. *Resolution on the Increase of Utilization of Renewable Energy Sources* of 8th July 1999.

⁴ Council of Ministers. 2000. *Development Strategy of Renewable Energy Sector*. Document No 2215.

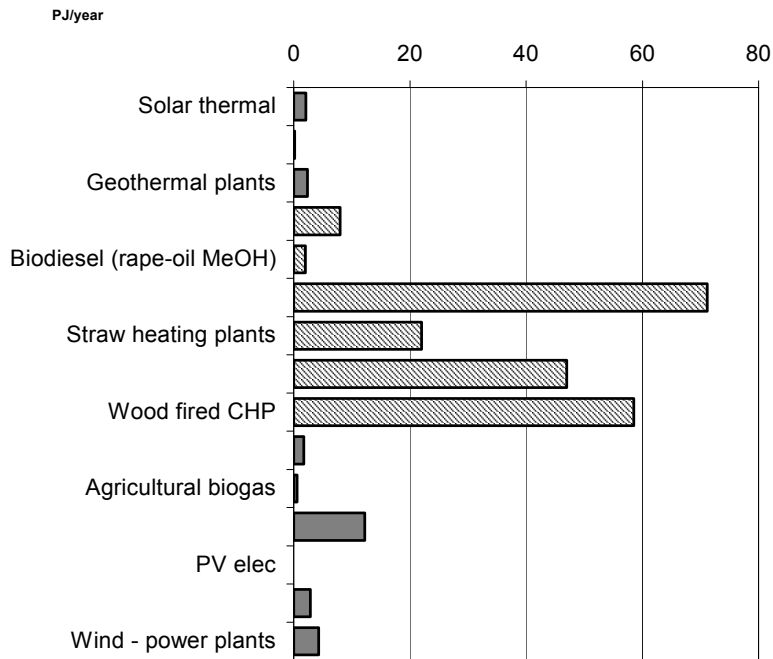


Figure 2.1 *Targets of renewable energy production in 2010 assumed in the Development Strategy of Renewable Energy Sector⁴*

The strategic goal of the Strategy is reaching the share of RES on the level of 7,5% in 2010 and 14% in 2020 in the total primary energy supply in Poland. Some of the main assumptions of the strategy were preparation and adoption of a separate legal act on the promotion of RES and RUE, implementation of the necessary changes in the energy law, preparation and implementation of the executive programmes for the development of different types of RES, assuring the financial support from public sources for RES on the level of approximately 50 MEur/a and some other supplementary issues concerning definitions, technical standards, dissemination of information and others. According to the Strategy the installed capacity for geothermal heating plants in Poland was supposed to increase to 400 MWth in the year 2010. producing 2,400 TJ (667 GWh) of heat.

Poland is among countries possessing the biggest resources of geothermal energy of low enthalpy in Europe. A wider interest in research and practical use of geothermal energy began in the 1980s. The first Geothermal Research Institute of the Polish Academy of Science was put in operation in 1992 in Podhale. The institute opened way for further activities: in 1996 the second geothermal space heating plant in Pyrzyce was commissioned and in 1999 a third space heating station was opened in Mszczonow. The construction of the biggest geothermal space heating network in Poland (and in Europe) in Podhale has been under way since 1995. The network is expected to deliver heat for Zakopane, one of the most famous mountain resorts in Poland. Also preparation of many profitability studies and projects of geothermal energy use have taken place in the last years. Below the operating geothermal district heating plants are presented.

Table 2.1 *Characteristic of the main geothermal plants in Poland* ^{Fout! Bladwijzer niet gedefinieerd.}

Plant	Year of opening	Reservoir T _{wellheads} TDS	Installed power (MW _t)		Working scheme	Remarks
			Geothermal	Total		
Podhale	1992/93	Carbonates, Triassic / Eocene 82-86°C, TDS<3 g/l	38	42	Geothermal, gas peaking	Under extension – target 80 MW _t , 600 TJ, 2 production +2 injection wells
Pyrzyce	1996	Sandstones, Jurassic 61°C, TDS 120 g/l	13	48	Integrated, geothermal + heat pumps + gas boilers	Completed - 2 production + 2 injection wells
Mszczonow	1999	Sandstones, Cretaceous 40°C, TDS 0.5 g/l	3.8	10.2	Integrated, geothermal + heat pumps + gas boilers	Abandoned well adapted for geothermal use; Cooled water for drinking 1- well system, no injection
Uniejow	2001	Sandstones, Cretaceous 60°C, TDS 8 g/l	3.2	5.6	Integrated, geothermal + gas boilers	Under extension, 1 well doublet
Slomniki	2002	Sandstones, Cretaceous 17°C, TDS 0.4 g/l	0.3	2.3	Integrated, heat pumps + peak gas boilers	Shallow aquifer, low investment costs; Cooled water for drinking, 1-well system, no injection

Geothermal waters of 20-62°C tapped from natural resources or extracted from holes are used in health care and recreation in seven resorts: Ladek, Cieplice, Duszniki, Cieplocinek, Konstancie, Iwonicz, Ustron and in Zakopane. In Duszniki Zdroj there is an installation for recovery of carbon dioxide from water of 20°C. In Iwonicz Zdroj curative and cosmetic salts are produced from brines of 21°C. It should be highlighted that Poland has a long tradition of using hot waters in health care and bathing - the oldest health resorts where such waters were used are Ladek and Cieplice, known already in the XIII century. The capacity, for heating purposes in these cases, was estimated at 6.75 MW_{th} in 2004. The energy produced from geothermal energy, without heat pumps, in seven health resorts was estimated at 7.48 GWh.

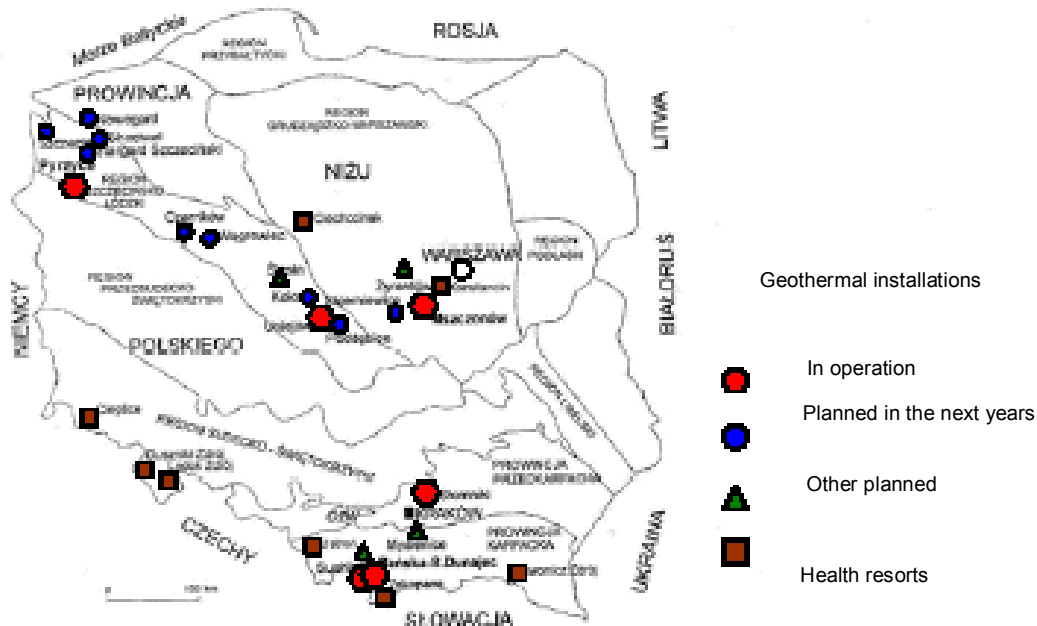


Figure 2.2 *Localisation of existing and planned geothermal heat installations*⁵.

In the last few years more and more widespread application of heat pumps for recovery and practical management of low-parameter geothermal energy contained in waters of shallow wa-

⁵ Nowak W., Stachel A. 2004. Geothermal Heat plants in Poland state of the art and planned investments in Czysta Energia monthly VII/VIII 2004.

ter-bearing horizons, ground and near-surface.. Such systems can be selected individually. Both great capacity units (of megawatt size) as well as small ones, operating to meet central heating and hot tap water demand in individual objects or their groups. Interest in these systems has been gradually increasing: two such pumps operate in previously discussed geothermal-gas heat stations in Pyrzyce (20.4 MWth) producing 40 TJ/y heat. In 1997 in the Upper Silesia a first heat pump of 0.06 MWth capacity was installed. It utilised down the ventilation air of 16-19°C from hard coal mine as a source.

Table 2.2 *Geothermal energy utilization in Poland*

Geothermal energy (GWh)	2003	2004*
Heat (except geothermal heat pump)	4.4	31.4
Heat (only geothermal heat pump)		39

* Estimation

There are a lot of foreign heat pumps present on the Polish market, mostly from Germany, Austria, United States, Japan. There are some Polish producers too, e.g. Vatra, Hibernatus, Nateo and Solis.

Considering the types of organisation it is to clarify that in Poland there are three levels of self-government:

- 16 provinces i.e. *voivodships* (województwo).
- There are 308 *counties* (powiat) and 65 towns with the county status. The main duties of the County are: water management, geodesy and cartography, forestry, management of county roads, emergency fire services, employment initiatives, construction and maintenance of roads at the county level, issuing passports, secondary education, social welfare and hospital management, geology, surveying, waste management, issuing building permits. The head of the County (Starostwo Powiatowe) is the Starosta i.e. the County president.
- 2,489 municipalities (gmina). Focus on meeting the collective needs of communities for public services and they include: water and heat supply, waste disposal and water treatment, primary education, kindergartens, local transport, environmental protection, road maintenance, basic healthcare, housing management.

3. Summary of the Project

IGSMiE of the Polish Academy of Sciences (PAN) built the Experimental Geothermal Plant Bańska Niżna-Biały Dunajec in the years 1989-1993. Several buildings from the nearby village Bańska Niżna were connected to the geothermal heat distribution network. Production of heat was carried out on the basis of two bore holes: Bańska IG-1 and Biały Dunajec PAN-1. By this it was proved that it is technically possible to heat houses with the heat coming from geothermal waters. In December 1993 Geotermia Podhalańska S.A. was established by the National Fund of Environment Protection and Water Management.

In 1995 the World Bank initiated its engagement in the Podhale District Heating and Environmental Project, which has its origins in a pilot plant of the Polish Academy of Sciences. This engagement led to a granted loan of US\$ 38.2 million. The objective of the Podhale DH project was to serve large parts of the Podhale valley (between Zakopane and Nowy Targ) in South Poland with energy from geothermal sources. Beneath the World Bank and other national and international financing institutions the Global Environment Facility has entered the project with a grant of US\$ 5.5 million. The GEF is taking its attention to the high amount of carbon dioxide (CO₂) to be reduced by switching from fossil fuels to geothermal energy. It was estimated that 110,000 tons of CO₂ annually and more than 2.6 million tons over the project lifetime would be reduced.

After the World Bank mission in 2002 it became evident that due to the so-far development of the project a revision of output targets was necessary. The grant of the GEF was approved in 2000 and based on the expected reduction of 2.6 million tons of CO₂ during the lifetime of the project at an incremental cost of about US\$ 3.00 per ton. The mission's conclusion at that time was that all output targets for 2002 - 2005 needed substantial downward correction. The World Bank noticed that the reasons were partly delays and partly lower than anticipated heat demand. Therefore Geotermia and the World Bank defined the "Revised Output Targets 2002". In order to justify the real amount of the support, a monitoring and evaluation (M&E) reporting was required.

The Project has been implemented by PEC Geotermia Podhalanska, S.A. (PEC/GP). PEC/GP was founded in mid-1998 as a result of a merge between Geotermia Podhalanska (GP) and the Tatry district heating company of Zakopane. Geotermia Podhalanska (GP) has been in operation as a corporation since 1994. After the merge, it is a relatively small company with about 70 employees and a three-members of the Management Board. PEC/GP was governed by a supervisory board consisting of six representatives drawn from the National Fund (3), the Municipality of Zakopane (2), and Hydrotrest (1). The company's majority owner is the Polish National Fund for Environmental Protection and Water Management. The present ownership of PEC/GP is shown in Annex 1.

In 2003 The Geothermal District Heating system consisted of:

- *District heating (DH) network*: The total length of the DH network amounted to some 60 km

Heat Boilers:

- *Geothermal Base Load Plant (BLP)*: located in Banska Nizna, installation of 3 heat exchangers with a capacity of 7.5 MW_{th} each, with 2 more heat exchangers to be installed if Nowy Targ. The BLP is located next to the production and reinjection wells, and includes the technological system comprising of a recirculating water treatment system, expansion system and circulation pumps with a capacity of 3x470 m³/h.
- *Gas fired Peak Load Plant (PLP)*: located in Zakopane, currently 2 gas-fired boilers with 10 MW_{th} installed capacity, together with economizers (1 MW_{th} each) for the condensation heat recovery from the combustion gases. 3 heat exchangers with 17 MW_{th} each to separate the primary system from the distribution system. Additionally, 3 gas engines have been installed in 2001 with a thermal capacity of 3x700 kW and an electric capacity of 3x550 kW, in addition to another boiler with a capacity of 14.7 MW_{th}, to be fired alternatively by gas or oil.
- *Former Tatry Boilers*: 28 boiler houses that have been taken over by Geotermia at the beginning of the project, and that have mostly been switched from fossil fuels (coal/coke, oil, gas) to receive heat from the geothermal system. At the end of 2003, only one boiler house ("Pardalowka") was not connected (using natural gas).



Figure 3.1 *The peak load boiler house*



Figure 3.2 *Balneology center*

4. STEP ONE: Vision of the project

The vision of the project was to serve large parts of the Podhale valley (between Zakopane and Nowy Targ) in South Poland with energy from geothermal sources. As previous efforts (1995-1999) had not provided satisfactory results, the new project also aimed to provide a realistic evaluation of demand and support for geothermal energy in the region, and to identify key measures for and obstacles to success, as well as to engage key partners (*e.g.*, municipalities) in the development.

5. STEP TWO: What were the various expectations of the case?

The actors involved in the project development can be subdivided into following groups:

- External actors: financing institutions, design center, research institutes,
- Local institutional actors: local self-governments, on-site district heating plant, local schools,
- Local population: inhabitants and tourists

Table 5.1 *Actors, their involvement and expectations in the project*

Name	Type	Involvement	Expectation
World Bank	External actor, Financing institution	Financing and supervision of project progress	Reduction of CO ₂ emissions, demonstration and implementation of commercially and economically viable geothermal projects in other regions in CEE.
National Fund for Environmental Protection and Water Management	External actor, Financing institution	Members of the Company Board	Wider use of RES, efficient and environmentally beginning use of heat in a region of environmental value, project demonstration and implementation in other regions in Poland
Technical offices	External actor, Designers	Design of the system	Design of the system, criticized for not being local designers with knowledge of local conditions
PEC Geotermia Podhalanska, S.A.	Local institutional actor, Commercially operated DH Operator	Heat production and sales, marketing of geothermal energy as an environmentally friendly option for the region, borrower of the capital for the project development, promotional events	Increase number of customers and quantity of heat sales, provide heat to the whole valley, fulfilling the assumptions for the monitoring indicators stipulated by donors, purchase of shares belonging to national Fund from initial dividends
Municipality of Zakopane	Local institutional actor, Stakeholder and client of PEC Geotermia Podhalańska	Submission of municipality owned boilers as input, public information: mediator of social anxieties connected with the project, collection (with possible withdrawal or reduction) of investment tax, incentives for others to connect by obligatory inclusion of public buildings, issuance of building permissions	Improvement of air quality, health benefits for inhabitants and tourists especially in winter, attraction of bigger number of tourists, regional promotion domestically and abroad, making heat prices not prohibitive for customers, revitalization of public built environment (buildings and roads), improvement of air quality, regional promotion domestically and abroad, increased number of job places through development of tourism, building facilities for indirect heat use (pools, drying)
Municipality of Nowy Targ	Local institutional actor, Stakeholder and potential clients of PEC Geotermia Podhalańska	Participation in the project conditional to economic viability, Assumed submission of municipality owned boilers as project input, collection (with possible withdrawal or reduction) of investment tax, building permissions	Cheap energy for inhabitants, poverty elimination in the region, revitalization of public built environment, improvement of air quality, Improvement of air quality, revitalization of public built environment (buildings and roads), regional promotion domestically and abroad, increased number of job places through development of tourism
Other municipalities	Local institutional actor, Stakeholders and clients of PEC Geotermia Podhalańska	Submission of municipality owned boilers as shares of the private company, mediator of social anxieties connected with the project, collection (with possible reduction or withdrawal) of investment tax, incentives for others to connect by obligatory inclusion of public buildings, building permissions	Improvement of air quality, revitalization of public built environment, regional promotion domestically and abroad, increased number of job places through development of tourism, building facilities for indirect heat use (pools, drying)
Enterprise for Communal Services in Nowy Targ	Local institutional actor, DH operator	Supposed to provide DH infrastructure for the project, Subsidizing heat sales from other communal services	Negotiations- expectations to remain independent from PEC Geotermia Podhalańska, low prices for heat sales
District heating operator in Zakopane	Local institutional actor, Converted to PEC Geotermia Podhalańska	Provided the company with DH infrastructure	Modernize the old coal boilers
Natural gas operator	Local institutional actor, Natural gas operator	Energy sale for peak energy to the Geothermal DH, competitor to PEC Geotermia Podhalańska for individual customers	Increased gas sales
Private and legal persons	Local actor, Stakeholders of PEC Geotermia Podhalańska	Personal involvement in geothermal business	Personal involvement in geothermal business
Public	Local actor, Clients, investors	Purchase of district heat Combined retrofits of heating system and energy efficiency measures	Increased comfort of use, price considerations, improved air quality, improvement of air quality, revitalization of public built environment, regional promotion domestically and abroad, increased number of job places through development of tourism, decrease heating costs especially while lodging tourists

Investors and donors: From the point of view of the investors the objective of the Podhale Geothermal District Heating and Environment Project was to provide geothermal heat to the entire Podhale valley in the South of Poland, from Nowy Targ to Zakopane. Implementation of the Podhale project has begun in 1995 involving several municipalities of the valley. According to the schedules, the project was supposed to be completed in 2006.

The Podhale project replaced heat from low-efficient and fossil fuel-operated household stoves, district heating boilers and heating facilities of large load customers with geothermal energy. Apart from the more direct benefits to the customers the project can be characterized by advantages which are based on the reduction of negative environmental effects (and thus also external costs) at local, regional and at global level:

- Space-heating boilers through increased utilization of clean energy resources such as geothermal heat and natural gas in the Podhale region of Southern Poland. This objective was supposed to be achieved by developing a geothermal district heating system with supplemental gas-fired peaking capacity to provide heat to seven municipalities of the Podhale area. This was to displace individual heating systems by connecting their users to an efficient district heating system supplied by clean and renewable fuels.
- Replacing polluting fuels will provide cleaner air and greater comfort for the inhabitants.
- Significant reductions in respiratory disease were anticipated from the decreases in emissions of particulates from coal and coke combustion. The proposed improvements would also reduce the environmental damage to the biota in the neighboring national parks and protected areas. The improved environmental quality of the Podhale area was also expected to make it more attractive for tourism.
- The associated global environmental objective was to reduce CO₂ emissions in order to help Poland meet its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The reduction of greenhouse gas (GHG) emissions such as CO₂ provides an additional motive for the Government of Poland to pursue the Project. It was expected that, for the whole area to be covered by the Project, CO₂ emissions would be reduced by 2.7 million tons over the period from 1995 to 2024⁶.

The prospect of the above benefits were the basis for the endorsements of loans and grants on behalf of national and international investors (banks, funds), which represented the interests of the Polish and of the international community.

First, the recognition of the role of local and global environmental benefits in justifying and financing the Project was an important precedent of internalization of such externalities in project selection. The tie between grant funding and environmental accomplishment was an important element that could materially impact the planning process for other projects in Poland and throughout Eastern Europe. The demonstration effect of commercial-scale introduction of geothermal energy was supposed to have a tangible impact on decisions made to support renewable energy development. The success of the Project was expected to generate confidence in similar renewable energy projects considered by local authorities in Poland and elsewhere in Eastern Europe.

⁶ The implementing company has prepared a set of monitoring indicators (physical/technical, rational, financial and environmental), including the key indicators which will be monitored and reported upon on a quarterly basis in the context of the Project Management Reports (PMRs). A list of monitoring indicators included:

1. Ambient concentrations of particulate matter and SO₂ in the project area (Zakopane and Nowy Targ).
2. Calculated CO₂ emission reductions and cost per ton of reductions on an annual basis.
3. The number of district heating customers.
4. Annual and cumulative heat delivery to customers.
5. Annual and cumulative heat production, gas and electric consumption of Geotermia Podhalanska.
6. Heat tariffs charged by Geotermia Podhalanska.

These stakeholders wanted to obtain confirmation on the development of the project in comparison to the forecast. Therefore, the project for the monitoring of the CO₂ abatement was started in 2001 to analyze the developments, evaluate the performance and propose corrective measures if necessary.

The second area related to the demonstration effect from the gradual reduction of governmental shareholding in Geotermia Podhalanska, as now represented by the National Fund. Both PEC/GP and the National Fund favored repurchase of the shares by PEC/GP out of the company's operating income before any dividends are paid. PEC/GP was expecting to operate on a commercial basis without need for any subsidies as long as the heat tariffs cover the costs. Hence, the company would gradually transfer to private ownership as National Fund shares are repurchased. This was supposed to make PEC/GP much more "private" than most district heating companies in Poland, which will ensure greater autonomy for the company and possibly attract additional private investment.

Public authorities: The idea of utilization of geothermal waters was highly appreciated among the representatives of public authorities, particularly in areas, where the investment has already been implemented. In some cases the representatives of public authorities were proud of having the most modern investment of this kind in Europe⁷. More tempered approaches were seen at public authorities where the investment was not started up or where the offer and its technical details were not properly specified by the Geotermia.

According to the representatives of public authorities mentioned following major advantages to the further development of the project:

- Environmental protection and its implications for the region.
- Positive impact on tourism.
- Fire safety and reduction of fuel handling in geothermal installations.
- Independence from the prices fluctuations on the international energy markets.
- Possibility to renew the communal infrastructure along the realization of the investment.

The main advantage of realization of the investment was described environmental protection, very important in areas where nature is protected and, which are considered as health resorts. The public authorities perceived the development of the geothermal investment as a general social advantage being aware that in the past this region had a much bigger role as a health resort compared to present time. Podhale have tried to restore its former function and to extend the offer towards creating conditions for longer stays in sanatoria thanks to improvement of air quality. It was supposed to become a big benefit for the development of the region.

Improvement of quality of the environment translates into increased attractiveness of the region for visitors who more often consider the ecological standards while selecting the place for their vacation. Therefore, the aspect of the geothermal investment was supposed to be used in promotional materials domestically and abroad. The inhabitants who render services for tourism used to pay more attention to the quality of the environment, which in turn, positively influenced the social support for the investment. According to the public authorities utilization of geothermal energy would influence positively the tourist movement. This indicated possible benefits for the population which was poor or durably unemployed. These profits could be gained through development of qualified tourism, sanatoria, sport *etc.* giving earning possibilities for the inhabitants.

The safety of geothermal heating was stressed, which was particularly important in the areas with wooden buildings and in buildings of public services. The necessity to employ service personnel for boiler houses and problems with removal of ashes are also reduced.

⁷ It seems that some public authorities had reported excessive expectations and investment opportunities in order to attract investors (?) There were big hopes in the construction of swimming pools and aqua parks. This possibility was mentioned so often that it seems that the public authorities (those with better prepared concepts and well located) competed among each other to find an investor. Big hopes were connected with the Geotermia as the possible strategic investor in the construction of such kind of infrastructure. Example of additional investment possibilities were glass houses to grow vegetables for the local market (vegetables are transported from other parts of the country) but here the interest was smaller.

Independence from international prices for fossil fuels was stressed several times as a possible benefit from geothermal district heating system. This aspect was considered as one of the main reasons to get connected to the district heating network. Only part of the representatives of the public authorities had doubts as the geothermal energy system also utilises large quantities of electricity and gas.

The accompanying renewal of the communal built environment was considered as an additional benefit for the public sector. In most situations this is the case, yet these benefits are not so obvious.

Customers: Four major groups were expected to benefit from the Project. More than 4,200 individual households are expected to convert to geothermal energy for home heating. Their choices were to reflect their desires for cleaner and more comfortable heat that requires less labor than handling coal. They were expected also to avoid any replacement investments for new boilers for the next twenty years. Finally, they would avoid the use of high-cost electricity for summer water heating when their coal or coke boilers are not operating. Similarly, larger loads were expected to switch to geothermal heating for similar reasons. Most of the thirty-four boiler houses that were previously operated by Tatry became a part of the merged Geotermia Podhalanska company. Nowy Targ was expected to convert three boiler houses to geothermal heat for both environmental and economic reasons. Savings in fuel costs to each of the four groups was supposed to reflect both the avoided purchase costs at the source and the avoided transport costs. The coal and coke for this area are generally transported to Podhale by train from sources about 200 km away, with local distribution by truck. The substitution of geothermal energy, distributed via district heating, for less benign fuels in households and commercial establishments was supposed to significantly improve the local air quality in winter. This major benefit was to accrue to the residents of the Podhale area as well as to visitors. The ski resort areas and surrounding tourist facilities were expected to gain from the project as well - in terms of increased revenues due to the improved environmental conditions in the Podhale area. Significant health benefits were envisioned to accrue to the communities where large quantities of coal and coke are currently used for space heating. The main target populations live in the municipalities of Zakopane, Nowy Targ, Koscielisko, Szaflary, Banska, Bialy Dunajec and Poronin.

The plant operator: The Company's mission is to use the renewable energy sources contained in geothermal waters for: central heating and preparation of utilised hot water, air-conditioning, tourism and recreation, balneology.

The Company's main aim is supplying the greatest number of consumers with ecologically pure heat for the needs of central heating and utilised hot water in a comfortable, unfailing and safe way. Scope of activities: production and distribution of heat power, mining services, output, purification and distribution of water, construction services, training and conference organisation, recreation and balneology services, cultivation of forest and agricultural plants, publishing activity, others.

The company runs a wide range of educational and information activities. It helps pupils and students with preparation of bachelors' or masters' thesis, with organisation of training courses for apprentices. It presents its achievements in using the renewable energy and the ecological and economical profits resulting from this fact to the domestic and foreign visitors of the PEC GP S.A. plants. The conference hall for 60 persons in the Educational and Information Centre allows organisation of conferences and educational meetings disseminating the knowledge on the geothermal project in the region of Podhale, as well as on the use of geothermal power in tourism, rest and health treatment both in Poland and in the world.

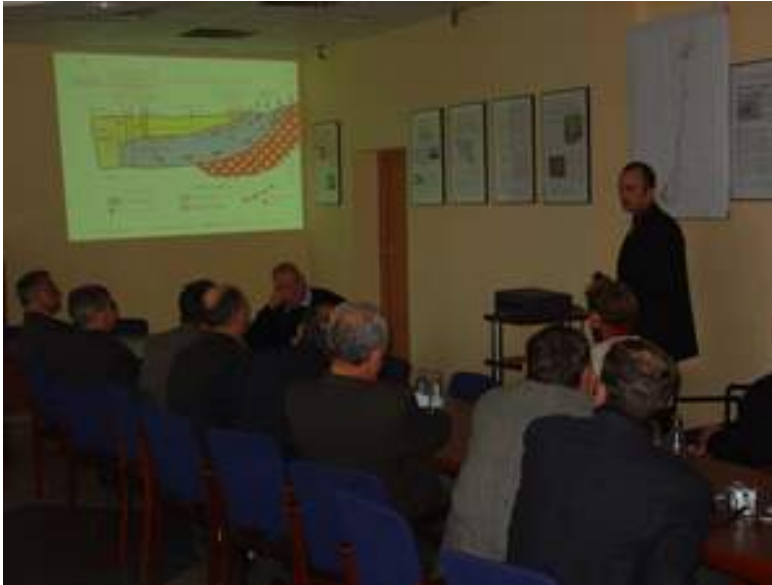


Figure 5.1 *Training of the study tour of representatives from other regions at Geotermia's headquarters*

6. STEP THREE: Understanding 'participatory' decision-making: negotiation expectations

The Table 6.1 describes the forms of participation (municipalities on the board, interviews with municipalities, interviews with customers, meetings with sales representatives, information campaigns). The main forms of participation were negotiations with public authorities, and interviews with key actors to determine their opinions and support of the project.

Table 6.1 *Forms of participation*

Type of involvement	Organizers	Involvement	Purpose
Interviews with municipalities	EC BREC IEO consultant	Open questions and discussion about the project development	Find out about obstacles and ways to overcome them, investigate the public attitude, find out to involve the local government more extensively in the process
Interviews with local stakeholders	Ec BREC IEO, PEC Geothermia	Co-ordinating filling in of the questionnaire for the potential consumers	Find out the characteristic of the customers reluctant customers and ways to adjust the commercial offer.
Information campaigns	Plant operator	Organization and running	PR for the services, increased number of customers and heat sales
Meetings with sales representatives	Plant operator	Convince institutional and private consumers to get connected to DH	Increase heat sales and company's profitability
Shareholders' meetings	Members of the board	Meeting with stakeholders, representatives of municipalities.	Ensure that the investment runs smoothly in terms of organization and finances.
Research and Development	Polish Academy of Sciences (PAN)	Investigating the geothermal water properties and building of an experimental plant	Start up of the geothermal energy heating projects throughout Poland
Financing of the project and its supervision	World Bank, national financing institutions and stakeholders	Crediting and subsidizing the investment capital, supervision of next steps of investment	Finance sustainable energy projects, demonstration project, example for other projects

The public authorities were a very essential participant in the implementation of the geothermal energy project. They had a role of a mediator of social anxieties, fears, therefore, the constant co-operation of the investor with the public authorities was necessary before, during and after the implementation of the project.

The Project managers and public authorities themselves had somewhat divergent perceptions of their role in the project. Representatives of public authorities saw their role as mainly supportive through work in the social sphere and facilitating paperwork. Project managers, in contrast, would have liked them to contribute in the form of tax exemptions and deductions, but opinions among public authorities were divided on this point. In some areas these financial support mechanisms were implemented. This financial incentives can support the demand for services from Geotermia and reflect the interest of public authorities in the development of the project. An important form of support to the project is the direct participation in the extension of the market of heat consumers. Readiness to connect public buildings belonging to public authorities was a common statement in the interviews, even in areas which are not yet supplied by Geotermia.

Representatives of Nowy Targ (another big city which was supposed to receive a large part of the heat produced) knew that without the participation of their town there was practically no chance for the quick payback for the geothermal investment. The town was a good partner for 'PEC Geotermia Podhalańska' - with 20 thousand inhabitants, its buildings close to each other and its modern heating network easily adaptable. The authorities of Nowy Targ were well aware

of the value of this potential market. Relations of the authorities of Nowy Targ with the company were described as difficult but based on partnership.

Public authorities stressed the importance of the active involvement of the representatives of the public sector in launching and implementing the project. At an earlier stage of project implementation, municipalities, which were founder members had their representatives in the board, this was however later on changed. Limiting the involvement of the public authorities in the Geotermia's supervisory board was translated into dissatisfaction and bitterness, which created an atmosphere of unfair exclusion and in this context reproaches were formulated that the company only realized investments suiting the interests of the present members of its supervisory board. The fundamental complaint was that in the initial phase the development of the project was concentrated mainly in Zakopane with nearly no activities in other municipalities. The comments were accompanied by presumptions that public money was spent ineffectively and even abused.

Exclusion from meetings of the company's supervisory board lowered the level of information about the investment decisions and understanding of their justification among public authorities. The lack of access not only made it impossible for the public authorities to express themselves in matters, which directly referred to them, but also made it difficult for them to impartially assess the operations undertaken by Geotermia and the overall acceptance. As a result it generated critical attitudes and in extreme cases suspicions of scheming and corruption. It is typical that actions of the company were assessed positively by those local self governments who maintained their seat at the board.

Interviews with clients showed that there were three different consumers groups, which need special attention, as they can deliver important information for the further development of the project:

- Current customers: consumers, which have already switched to geothermal energy.
- Consumers, who refused to connect: this group was the most important, as they were approached by the sales personnel of Geotermia, but refused to connect. The analysis of this particular group helped to find out, how the offer of Geotermia was perceived and which barriers were existing.
- Potential consumers: apart from Banska, Bialy Dunajec and the central areas of Zakopane, to 2003 there were little activities to increase the number of connections.

The majority of buildings in the sample, are buildings without central heating (C.H.) system, therefore, impossible to get connected to the geothermal heating system. In order to make them adjustable they must be equipped with a C.H. system beforehand. Such investment, although technically possible, due to the fact that such buildings are mainly old ones, among them majority constituted of wooden houses and being in a bad technical condition, which made such investments not feasible. Besides, demographic problems might have been the major obstacle. In many cases, these were rural buildings, which did not meet technical standards and were inhabited by the elderly people, not willing to introduce any innovative solutions. In such buildings very seldom thermal retrofits works were undertaken.

Yet, this problem did not affect all buildings. It turned out that part of owners of the buildings without C.H. system, undertook some energy efficiency measures in order to reduce energy expenditures, moreover, they consider geothermal heating system to be very attractive. Among those willing to change their current heating medium, geothermal heating was in the first place. Nevertheless, the costs of this installation as well as installing a C.H. system were an obstacle. Wooden buildings with no C.H. were probably not potential consumers of the geothermal heating system.

In the brick houses more technologically advanced solutions were applied *i.e.*: the possibility to program the boiler's operations, weather programming, automatic fuel loading. The thorough

analysis of data proved the next group hard to acquire for the geothermal heating were owners of the brick buildings with C.H. where highly advanced heating appliances were already installed. The use gas, fuel oil in modern boilers was considered to be efficient, ecological and comparably labor intensive, in comparison to geothermal heating. It turned out that the group already using modern heating appliances was the most skeptical towards the idea of switching to the geothermal heating. They considered technologies used by them as comfortable and economic and do not wish to change it. On the other hand it proved the demand of local population for a comfortable and economic heating system, what may be satisfied by the properly created trade offer by PEC Geotermia Podhalańska.

According to the analysis of the planned energy efficiency measures in the following 5 years, in the brick houses almost no replacement of obsolete boilers were expected, whilst in the wooden houses such investments were considered. It implies that the owners of brick houses decided earlier to install more technologically advanced appliances, but the climax point was already reached, so the rate of the boiler replacement in the brick houses was expected to drop, whilst in the wooden ones to increase.

A very promising group of potential customers were owners of houses of the medium standard, since the technical state of such building on one hand is acceptable for the geothermal connection and on the other hand such owners buildings did not have enough financial resources to switch to gas or fuel oil boilers which were main competitors to geothermal system.

In 50% of the buildings no energy efficiency measures were undertaken. However, when comparing this data with plans for the next five years, it turned out that in all cases where some elements were introduced, the energy efficiency process was continued and even more buildings would join it in the future. Slight number of houses where energy efficiency investments and the fact that they had been implemented on an irregular basis indicated that the main obstacle to implement energy efficiency measures was the lack of funds. When comparing this analysis with the qualitative interviews carried out among the representatives of self-governments, a general conclusion was drawn that for the majority of buildings switching to geothermal heating system was too expensive, since the energy consumption level was too high and those two factors made the connection to DH system unaffordable. So some households could not switch to the geothermal heating system due to their high energy consumption level, but they perceive geothermal heating as comfortable and attractive. So, it was recommended to relate the trade offer of PEC Geotermia Podhalańska to the support for the energy efficiency investments, which would make open way to connections of new group of customers.

The method of reaching the target group is the key element impacting the success of sales. Theoretically, every surveyed person was supposed to meet sales representative of PEC Geotermia Podhalańska who would made him/her acquainted with the offer. The results of the study on the knowledge of the PEC Geotermia Podhalańska trade offer are unsatisfactory. Even in the group of those who met the sales representatives the results weren't satisfactory. The survey proves that meetings with the sales representatives as well as their method of offer dissemination and other ways of promotion weren't effective enough. On the other hand, such results could have been caused by the reception quality *e.g.* careless treating of the oral or written information. Nevertheless, knowledge about this attitude made it possible to run more effective information campaign, refreshing contacts, using various forms of direct or indirect promotion.

For the promotion campaign purposes the target group has been divided into those willing to connect to the geothermal heating system and those totally rejecting such a possibility. Since first group was potentially less difficult to be convinced, getting the detailed data on the perception of geothermal heating by the second group was of crucial importance. For the purpose of elaboration of trade offer of PEC Geotermia Podhalańska following advantages of geothermal installations should be highlighted: maintenance-free boiler houses, fire safety, no fuel stocking as well as social benefits *e.g.* reducing of air pollution. In order to also encourage owners of the

houses without C.H. system, possibility to use hot tap water should be underlined, since the potential consumers perceived it as a an attractive option. The most often mentioned drawbacks of geothermal heating were monthly fees and costs of technical adaptations as well as the necessity to undergo troublesome construction works. Even though the modernization costs were pointed out more often by the owners of the houses without C.H. system, the disadvantages given above show the financial barriers of switching to the geothermal heating system.

All respondents were asked to choose a hypothetical type of heating which they would consider attractive to use on their infrastructure. The purpose of this was to investigate other sources competing with geothermal energy. Obtained results point that among persons who did not yet switch to other fuels an insignificant percentage wants to stay with the present heating mode. Interests mainly concentrate on the geothermal heating and small share of respondents is interested in gas or fuel oil heating. At the same time the group of "refusing definitely" (according to earlier results within this group) is lacking interest in any form of heating. It was revealed so that the part of these respondents possessed competitive to geothermal energy sources (gas, fuel oil) and did not wish to replace it. In general it can be stated that geothermal heating was not particularly threatened by the attractiveness of other market offers and but is not also much better according to subjective assessments of respondents.

The project area is a tourist attractive region. In order to estimate how presence of the incoming tenants influences energy consumption the owners of rented flats were asked to note the difference between their energy payments (or energy consumption) during months of the lowest and the highest concentration of tourists. This correlation between energy payments and tourist traffic intensity should be treated as a stated fact. In this case the structure of the current and earlier tourist traffic is essential as a factor influencing the total consumption in the region. The current decrease in the intensity of tourist traffic compared to the past years had an impact on the fall in the energy consumption in the region.

7. STEP FOUR: From visions to actualities

It was unexpectedly difficult to get some municipalities to promote the project through pricing policies. For example, it was the intention of PEC Geotermia to apply in Nowy Targ the same solution as in the case of Zakopane *i.e.* to take over the existing DH plant, belonging to the local municipality, a solution which the authorities of Nowy Targ refused to accept. The reason for such attitude was that the authorities did not want to lose control over the heating price policy of the town. It is important to stress that at the time Zakopane and Nowy Targ differed very much as far as policies towards shaping of the local heating prices was concerned. In Zakopane heating was not subsidized and the consumer-pays-principle was applied, while in Nowy Targ the price of heating was artificially kept low so that unforeseen price increases of fossil fuel did not have a disastrous effect on inhabitants. The Nowy Targ DH Plant operated within the Enterprise of Communal Services and had a possibility to subsidize different sections of its overall scope of activities.

The Project managers hoped that the municipalities could support the project through specific tax exemptions. The local authorities were approached several times as regards the possibility to withdraw from the 2% local tax on infrastructure on the investment (boiler houses and pipe system). The problem of this kind of tax should be looked at in a broader context of shortcomings of the system of financing of the activities of public authorities in Poland. The maximum tax level was specified by the law at 2% and theoretically the municipality had a possibility to lower it. However, in practice (as unanimously stated by representatives of the public authorities) it would be very difficult because the municipalities had been compelled by the legislator to charge it. Within the framework of cutting central expenditures the self-governments were „given” this new kind of tax - the tax on linear infrastructure - payable to public authorities; but at the same time higher budgetary amounts hitherto earmarked for education have been cut

down. In order to meet educational assignments (for which there was lack of money anyhow) the public authorities had to get means from the new tax. Therefore, it is not to be expected that municipality councils would limit the amount of the tax for enterprises possessing cables, pipelines, etc. or would meet special treatment in this respect to Geotermia because even with the highest rate of the tax (2%) they gather much less means for educational purposes than before this tax was introduced.

According to the representatives of self-governments there were the following major threats to the further development of the geothermal investment:

- High expenditures for the geothermal infrastructure and high energy costs.
- Unstable gas prices.
- Competition with other fossil fuels such as fuel oil and natural gas.
- Obstacles for the inhabitants during realization of construction works.

Providing insufficient information to the public sector has one more important negative dimension. It created distrust as to the credibility of the company as a partner and exaggerated the scale of its economic problems. Critical opinions were connected with the expected pro-social investment policy of the company to which the public authorities got used in the past⁸. In this context a part of the representatives of the public authorities were embittered with the investment policy of the company, which was realized without their participation in the decision making process and without their control on behalf of the local communities. The self-government people expected more partnership co-operation and had concrete suggestions as to how it should look like.

The public authorities indicated high costs of the geothermal infrastructure as the main barrier for the development of the technology. The awareness of the necessity to pay back for the property of „PEC Geotermia Podhalańska” raised fears about the price for the final consumer. In case the financial situation of consumers deteriorated they surely would resign from the geothermal heating and turn to cheaper fossil fuels. The reaction of the local population to the prices increase of fuel oil in the past would serve as a warning.

The inhabitants were looking for possibilities to cut their heating expenditures. Due to fluctuations of prices on the fuel market there are evident proofs that people would do anything to pay lower energy bills. There was a period when people invested in the construction of gas and fuel oil boiler houses. It is, however, obvious that costs forced them to give up comfort. It was difficult to assess the dimensions of the trend to go back to more uncomfortable but cheaper energy sources. The public authorities, unanimously stated that the key problem was not technology but the improvement of the personal situation of the inhabitants so that they could afford such kind of heating.

Another problem was the competition with other fuels present on the market. If gas prices were decreasing a strong competition would follow because of lower costs of implementing gas networks and their easier implementation. Moreover, gas and fuel oil also were perceived by public authorities and by inhabitants as ecological fuels (similar preferences are applied for gas, fuel oil and geothermal heating) and its use was perceived to be equally comfortable.

⁸ The question of reconstruction of roads another very delicate issue. On the one hand it is clear that Geotermia could not be forced to pay for the reconstruction of the entire road, when the district heating network was extended. On the other hand, reconstruction of only the part, which has been destroyed could lead to durable damage of the road construction. This is an important field of co-operation because the public authorities did not avoid financial and organizational participation in the costs of repairs. Moreover, this aspect very positively influenced the perception of the investment by the neighboring population creating an image of an investor participating in the so called social framework. It seems to be advisable for Geotermia to consequently support this image.

Co-operation with project designers from other regions in Poland (often from very far off places) created problems. They design networks without making proper study of the specifics of the area and submit imperfect technical solutions. It is suggested either to select project designers who know the area or to force a closer co-operation with the public authorities during the designing process.

The quality of the implementation of the investments turned out to be an essential issue in the Podhale area. The works on the extension of the network was burdensome for both public authorities and inhabitants, which created difficulties in the social perception of the project. Therefore, it was suggested to increase the efficiency of realization of construction work and to select sub-contractors who would take proper care to reduce the strain of the construction of the pipeline for the local inhabitants. In several cases great carelessness of the sub-contractors performing this work and lack of care to make it less difficult for the inhabitants and visitors was observed. The effects were very harmful for interests of all parties concerned. It was suggested to carefully select sub-contractors taking into account also these factors as the time of construction can become difficult for inhabitants deprived of their earnings for tourist services and for the public authorities indulged in constant interventions.

However, the attitude of „PEC Geotermia Podhalańska” itself in problematic situations was assessed positively and public authorities rather positively perceived operations of the company as an organization protecting their interests. They consider negotiations in such type of co-operation as a proper model of relations.

8. Lessons learned

Key lessons highlighted by this project relate to relations with local authorities, other contextual features of local renewable energy projects, as well as competition and synergies with other activities and technologies.

- *Importance of local authorities:* In the opinion of the public authorities Geotermia was supposed to be more active in marketing the investment and promoting their activities. In their opinion the activity of Geotermia in this field was visible but still needed more elaborated efforts. The public authorities couldn't replace the company in this activity but they could support this process due to their own interest in the positive development of the project.
- *Timing of marketing and information efforts:* The representatives of public authorities stressed that for the success of the investment it was necessary to convince the public. Without making this step the investor could neither start with the construction nor offer his services. Proper marketing among the inhabitants should start at least one or two years before the construction works start in a given area. There was a need to make contacts at the earliest possible stage with the public authorities in the areas where the investment was planned so that the public authorities would know details about the investment and could prepare both themselves and the local population (the necessity of earlier shaping of the awareness of the population is based on the experience of municipalities where the investment had already been implemented). The educational activities of the public authorities directed to the youth as well as seminars and conferences for adults brought very good results. The patronage of the company over some ecological initiatives for general public would be advisable.
- *Importance of the socio-economic context of the project:* The public authorities felt that inhabitants were anxious about the price - which they perceived as being too high. The public authorities tried to convince inhabitants that even if these costs are higher it is worth to get connected because of general social advantages. However, in the context of poor income situation of the inhabitants these arguments brought little effect. In the entire region under investigation it was unanimously stated that the price of heat was decisive for the success of the investment. Geothermal energy has number of advantages, which were appreciated and

considered as important. What was stressed was comfort, no need for service, and environmental protection. The latter one was often indirectly treated as a means to attract tourists. However, disregarding advantages, inhabitants perceived their possibilities from the point of view of their financial situation. Based on this income situation in the rural areas as well as of Zakopane and Nowy Targ, Geotermia was supposed to find a way to prepare attractive offers for the potential consumers. It was repeated continuously that consumers would look for the most economical source of heating and that many people - while changing the type of heating - kept their old furnaces as a backup in case of price increases.

- *Competition and synergies with other technologies:* Energy efficiency measures in buildings associated with a lower demand for heating should not be considered as a threat for the interests of Geotermia (lower heat sales), but rather it might prove that exactly thanks to this type of activities for some inhabitants switching to geothermal heating will be more profitable and comfortable and first of all affordable. There was a very clear trend observed towards thermal insulation of buildings. This trend was supposed to be maintained and become more common. There is no doubt that people were looking for savings and comfort. Paradoxically, energy efficiency was supposed an inevitable trend to gain new consumers. Therefore, this aspect was supposed to be more closely analyzed and it would make sense to consider additional (simpler credit procedures connected with the Law on Energy Efficiency In Buildings) financial encouragement to combine energy efficiency activities with the switch to geothermal heating offered by the Geotermia, which could increase the number of potential consumers eager to get connected and enabling the company to increase its participation in the energy market.

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Appendix A Shareholders of the PEC/GP

Shareholders	Shares	Percent
Bukowina Tatrzańska Municipality	496	0.2
Zakopane Municipality	38,068	12.7
Poronin Municipality	842	0.3
Koscielisko Municipality	619	0.2
Szaflary Municipality	993	0.3
Biały Dunajec	794	0.3
National Fund	237,308	78.9
Hydrotest, S.A	9,936	3.3
PKL-PKP (Private Ski Lift Company)	1,490	0.5
Nowy Targ Municipality	993	0.3
Other Shareholders	9,170	3.0
TOTAL	300,709	100.0