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FINAL REPORT

on the Project

Development of City-Wide Energy Efficiency Investment Plans for Partner Cities, Demonstrations, and Professional Strengthening of Local SMEs towards Offering Thermorenovation Services

(USAID Contract 181-G-00-97-00323)

for the period October 1997 - August 2000

prepared by

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LANDMARKS OF THE PROJECT

The project was implemented over the period October 1997 to August 2000 by The Foundation for Energy Efficiency (FEWE), Kraków Centre, and was supported, both organization- and content-wise, by The Association of Municipalities, Polish Network 'Energie Cites' (PNEC) and the University of Mining and Metallurgy in Kraków (AGH). The project covered six Polish towns: Krapkowice, Olsztynek, Nowy Sącz, Lubań, Trzcianka and Białystok.

The USAID grant for implementation of the project amounted to USD 546,000 and was supplemented with an additional grant amounting to USD 25,000 from the Global Environment Facility (GEF) Small Grants Program, UNDP-Warsaw for extension of the Project in Białystok. Another GEF grant (PDF-A) was triggered by the project in Krapkowice, where coal based heating was converted to biomass with additional 5000 USD contribution of the city. The total financial input on the part of the participating towns was planned to be USD 190,000. However, it considerably surpassed this amount, which emphasizes the success of the project.

The resources put into the project permitted the carrying out of demonstration thermal improvement work in twelve buildings, including five multi-family blocks of flats and seven public buildings (schools, medical clinic and kindergarten), achieving high thermal energy efficiency at low cost. A particular measure of the success is the annual award 'Modernization of the Year' for successful building restoration, which in 1999 was awarded for the work conducted in one of the buildings in Nowy Sącz thermally modernized in this Project. This prestigious award is granted by a consortium led by the State Office of Housing and City Development and the Association of Polish Architects, SARP.

IMPORTANT DATES

Contract and grant modifications

- **27 Sep 1997** Contract with USAID signed for the project to be executed in the period 1October 1997 – 31 December 2000
- **4 Jun 1999** Modification of the Grant, effective end date 31 July 2000
- **26 Apr 2000** Modification of the Grant , grant amount increased by 13 000USD (from 533 000 USD)
- **24 May 2000** Modification of the Grant , the ending of the Project changed to 31 Aug 2000

Signing agreements with the cities and conclusion of demonstration works

1.	**Krapkowice**	17 Feb 1998	03 Nov 1998
2.	**Olsztynek**	19 May 1998	04 Mar 1999
3.	**Nowy Sącz**	19 Feb 1999	02 Nov 1999
4.	**Lubań**	**01 Mar 1999**	**15 Oct 1999**
5.	**Trzcianka**	**01 Mar 1999**	**30 Mar 2000**
6.	**Białystok**	**13 May 1999**	**31 Aug 2000**

Other important dates

- 10 May 1999 GEF PDF-A grant of 25 000 USD for conversion on Krapkowice
- 27 Apr 2000 Additional grant of 25 000 USD received from GEF/SGP, UNDP Warsaw
- 18-19 Sep 2000 Closing Seminar in Nowy Sącz

1. INTRODUCTION

1.1 Project rationale

Experience teaches us than energy is mainly being wasted in those situations where there is no money to limit its consumption by investing in energy saving measures. Such is the typical situation in Poland and in most countries in economic transition, where cheap, heavily subsidized energy in the past decades has led to very inefficient use of energy, by the consumers.

The estimates show that about 30-40% of heat energy in residential, commercial and service or public buildings in Poland is wasted. Using only a fraction of this huge saving potential would lead to a major reduction of CO2 emissions and significant economic benefits to the occupants or users of the buildings and to the local communities as a whole. The biggest barrier to energy saving is lack of access to financial resources. However, possible heat saving improvements vary largely in costs, ranging from low cost measures, such as window carpentry repairs or attic insulation, through simple temperature controls or insulation of external walls - to the more expensive investments, such as window or boiler replacement.

The low-cost measures do not require big capital expenditures and are often affordable for most building owners or users within their financial resources.

If widely applied, such measures would help Poland reduce its CO2 emissions in a short time and bring significant environmental and economic benefits.

1.2 Barriers

During the period 1992-1994 USAID financed a heat saving demonstration project in the Kraków Low Emissions Project, the aim of which was to limit the emission of pollution from local combustion sources into the atmosphere. At that time experts from American companies, demonstrated the strategy implemented in the USA when the financial resources set aside for an investment designed to reduce energy consumption for heating are limited. The experiment has demonstrated that such simple, generally affordable measures can save as much as 7-10% of energy used for space heating in typical multifamily residential blocks of apartments that prevail in Poland, with a payback period of about 3 to 4 years. Similar savings can be achieved in other types of buildings, such as schools or offices. In buildings that are too cold simple improvements may often allow one to avoid or postpone costs of upgrading the heating system without trading the comfort. Alternatively they may lower the heating bills or fuel costs. However, despite the low costs and high benefits of such investments, and with the availability of the appropriate technologies and materials the volume of this kind of energy saving investment disproportionately small in Poland.

Observations made by FEWE-Kraków in co-operation with the American specialists following the conclusion of the Kraków project revealed a disturbing picture. Very often investments supposed to result in financial savings due to energy conservation are carried out the wrong way round. They begin with very costly investments with a long payback period or even - from the point of view of energy conservation - ones that will never give a return

Unfortunately, in Poland the drastic and omnipresent lack of money often goes hand in hand with the failure to acknowledge and take advantage of the opportunities for using the money much more effectively in limiting energy costs.

This situation results from, several barriers, the main ones being:

- Lack of awareness among representatives of the administration at various levels, concerning effective methods of achieving high energy efficiency, not demanding high expenditure and resulting in real savings and short payback periods;
- Conviction that simple measures are ineffective. This attitude results mainly from the fact that up till now such works were carried out at a domestic level, in a non-professional way, without the use of appropriate materials and tools. This led to some improvements being hard to notice and the consolidation of the above mentioned conviction;
- Lack of examples which demonstrate that the professional implementation of such works can produce the desired effect and that the costs are relatively low;

- Lack of local potential to carry out professional standard work in the small companies offering services in the field.
- Lack of city-wide studies that would give estimates how much energy can be saved with the low-cost measures, how many jobs such a city-wide activity may create, and what are the costs of such investments and the resulting financial savings.

A typical attitude, particularly among the residents of housing co-operatives and municipal housing stock, but also among the administrators of budget-maintained buildings (e.g. schools) is to complain and wait for someone to finally find the resources to solve the problem in accordance with their expectations, i.e. in a way usually demanding very high expenditure. Waiting for a costly solution takes a long time during which the losses accumulate. One would free the money that was being unnecessarily spent on wasted energy if only one carried out the repairs that could be afforded at a particular time instead of waiting. To break this widely observed practice, rooted in the first three barriers, demonstration of feasibility and profitability of the low cost approach was needed.

Overcoming of the fourth barrier will bring also significant social benefits. The market for such low cost energy-efficiency improvements in buildings in Poland is very large, which may lead to creation of many new jobs, particularly in the areas of high unemployment. Moreover, the jobs can be offered to people who are not highly-trained, and who constitute the majority of the unemployed in Poland. Additionally, there exists a great potential to create such SMEs by extending the scope of services of the existing companies or building maintenance teams at housing coops, which need only some re-training and appropriate equipment.

The Project proposed to USAID aimed at breaking those barriers by demonstration of the low-cost techniques and training of technicians to provide examples for further dissemination in Poland, and possibly in other countries in the Region.

It was specifically targeted to economic goals:

1) Demonstrating a fast return on a minimal investment (resulting quickly in a positive effect on the municipal budget) and
2) Creating jobs for local unemployed persons and strengthening the financial situation of local service companies.

We learned in the Krakow Low Emissions Project that it is necessary to have a local, visible demonstration of these techniques to convince the local government of their feasibility and to interest local entrepreneurs in pursuing these types of programs.

1.3 Project description

The Project's aim was to demonstrate that the development of the new business activity in implementing low-cost heat saving measures in buildings brings benefits to the local communities in several areas:

- **social** (improved housing conditions, creation of new jobs, new economic activity)
- **economic** (reduction of energy or fuel bills, or avoidance of supply-side investment costs)
- **environmental** (locally, by reduction of emissions from low pollution sources)

The project envisaged:

- Selection of **six cities** as project participants. It was assumed that they would represent different regions, population size and character (two below ca 20 000 inhabitants, three between 20 000 and 100 000 and one above 100 000). In the initial project proposal of May 1997, it was assumed that preference would be given to areas with high unemployment and retraining needs. However, after the flooding of summer 1997 it had decided that an additional factor should be the level of damage caused by the flooding.
- For the selected cities, city-wide inspection of the existing building stock and heat sources was planned to compile a list of possible main low cost investments that would be prioritized according to the Least Cost Planning principle and included in the final report for each city.

- Subsequently, **five** typical buildings were selected in each city for **complete heat-energy audits** performed by certified auditors as required by the new Act of Support for Thermorenovation Investments. Reports identifying possible measures and their cost-effectiveness were to be elaborated. The most cost-effective measures were specified to be demonstrated in real conditions as described in the next paragraph. The selection of buildings was to be done in close co-operation with the municipal governments, which were to provide necessary data in their possession.
- Subsequently, from among the five audited buildings, **two** were to be selected **in each city** for actual demonstration including:
  - actual implementation of the recommended measures
  - post-demonstration heat-consumption data collection and analysis

  It was assumed that the selected buildings would include:
  - a typical 4–5 story residential block of ca. 30 apartments,
  - a school of typical size ca. 3000 cubic meters or another building of a similar size owned or administered by the local government.

  Alternative choices were admitted, depending on the local government preference, the saving potential, replication potential and availability of funds. It turned out that that most of the building selected in the project exceeded the sizes specified in the project proposal.

  The building **selection criteria** included: technical feasibility, the saving potential, measurability of the results, replication potential and visibility, innovative features, the dissemination potential, commitment by the Polish Partner (co-financing) and a possibly wide spectrum of the low-cost improvements to be demonstrated.
- In order to develop the new business activity in heat-saving services, **on-the-job training** was planned for, typically, **8–14** local (usually unemployed) technicians in each city,.
- Apart of the training of technicians, training of the potential **local managers** or businessmen was to be offered to help them or re-orient their existing business.
- Finally, basing on the results of the city-wide studies were to be carried out that would give estimates of:
- the potential of heat energy savings achievable with the low-cost measures,
- costs of such investments and the resulting financial savings,
- number jobs such a city-wide activity may create.

All targets were achieved or exceeded by the end of the project in the end of August 2000.

2. PROJECT ACTIVITIES - SUMMARY OF THE RESULTS

Below the activities of the project are described as they were implemented in order of time in the whole project. More detailed account is given separately for each city in Section 3.

2.1 Call for proposal / questionnaire

The first assignment in the project after the contract signature was to prepare questionnaires and send them to cities that, by that time, had already signed the agreement with "Partner Cities", of another USAID project. It was decided that the questionnaire would be also distributed among member cities of PNEC. Consequently, in the beginning of December 1997, the questionnaire was sent to 55 municipalities. The questionnaires were used to detail the cities' building structures, numbers of inhabitants, types of heating, degrees of unemployment, and the existence of governmental employees responsible for energy management. An important question was to determine whether the city governments were interested in implementing the project and declaring financial support. Additionally, since in August 1997 several regions in Poland became flooded, USAID had requested that cities that suffered from the flooding should also be considered. In response, the questionnaire also addressed the size of losses and needs of the cities to repair damages. During a meeting at the USAID Office in Warsaw in February 1998, FEWE-Kraków presented the results of the questionnaire analysis, and it was decided which cities will be chosen for further inquiries.

2.2 Pre-selection of cities / preliminary visits

Using of the data from questionnaires and telephone interviews preliminary visits were paid in 16 cities by FEWE-Kraków staff in order to identify the best candidates.
Preliminary visits to such pre-selected candidate cities were made in Bielsko-Biała, Cieszyn, Krapkowice, Limanowa, Łęczyca, Miedźna, Morawica, Namysłów, Niepołomice, Nowy Sącz, Kłodzko, Laskowa, Ujanowice, Racibórz, and at a later stage in Gliwice and Białystok. The visits included inspection of a meaningful sample of buildings and local heat plants and heat distribution systems. The inspection focused on a preliminary inspection of the city housing stock based also on interviews with the local administration representatives.

In addition to this selection process, FEWE-Kraków representatives took part in two Trade Fairs devoted to flood relief in Racibórz in January 1998 and in Opole in the beginning of June 1998. The goal of this participation was to identify new candidates for the project from among the flooded cities.

2.3 Selection of participating cities / signing agreements

Based on the result of those visits, finally six cities were selected for the Project in the categories established earlier together with USAID. The selection was done in close co-operation with USAID. The following cities have been selected

- Category 1: Olsztynek (14 000) and Trzcianka (20 000)
- Category 2: Lubań (24 000) Krapkowice (25 000) and Nowy Sącz (84 000)
- Category 3: Bielsko Biała (180 000) (replaced finally by Białystok (280 000))

As mentioned above, the precondition of acceptance was the membership in "Partner Cities" of the LGPP Project of USAID. Additionally the cities of Trzcianka, Lubań, Nowy Sącz, and Bielsko-Biała were members of PNEC. The city worst affected by the flooding was Krapkowice.
After the selection had been completed, final negotiations of the agreements with the selected cities were begun. (preliminary talks were held in the pre-selection stage). The negotiation proved to be much more difficult than expected. The main reasons were the uncertainties related to municipal elections in the fall of 1998 and to the fundamental reform of the territorial division of the country and of the whole administration system which came into effect on January 1st 1999.

For five of the selected cities, the initial difficulties had been overcome and the agreements had been negotiated and signed, although with considerable delay in some cases. Unfortunately, in Bielsko-Biała the new city board represented a party that had previously been in opposition, and showed little interest in the project. In this situation another candidate city had to be considered.
The ideal candidate seemed to be Gliwice, a city above 100 000 and a Partner City with high unemployment rate, and huge needs for low cost energy saving investments. Additionally, the Górnośląski Zakład Energetyczny (Upper Silesia Power Utility) expressed interest in joining the project. A meeting with deputy mayor Mr. R. Trzebuniak was arranged in the end of February. The mayor expressed great interest in the project and promised to start processing the necessary formal arrangements. In March FEWE-Kraków staff met with Mrs. M. Żuromińska, head of environmental protection department of the city government. She also expressed great interest on part of the city, recognizing its great relevance to the needs of Gliwice. Unfortunately, FEWE-Kraków was soon notified that there were no funds in the city budget that could be used as contribution to the project, because the plans for 1999 have been already fixed and the City had already committed to a large capital investment program.. In this situation FEWE-Kraków suggested that it would cover all costs from its own resources in 1999, provided that there will be a clause in the agreement that the contribution to the project would be included in the 2000 budget. Unfortunately, the city could not decide so far whether this option is acceptable.
Finally, the city of Białystok (280 000 inhabitants) was chosen. The delay caused by withdrawal of Bielsko-Biała from the list of candidates delayed the whole project by several months. This has produced some tension in the schedule, which finally has been overcome.

Finally the agreement with Białystok has been signed on 23 May 2000. The agreements with the particular cities followed one basic template. An example is given in the Annex. In particular each city agreed to assign a Local Project Co-ordinator (LPC) who would represent the city in the project and assist the FEWE-Kraków project team in realization of the project locally.

2.4 Training of local managers

In each city, several prospective managers of the future SMEs or facilitators on part of the local administration were selected in co-operation with the LPC. The selected candidates were trained in the principles of IRP and DSM, understanding of energy audits, financing energy efficiency (TPF, ESCo, grant and soft-loan sources, etc.) The participants were also instructed how to prepare the input data for an energy audit and how to co-operate with a professional expert-auditor. More data about the training sessions are given in the next Section.

2.5 Energy audits

The local assistants helped collect the necessary input data (building-design and heat system documentation, previous consumption data, etc.). FEWE-Kraków experts worked together with the local representatives on the selection of five buildings per city for detailed energy audits.
The audits themselves were performed by experts from **FEWE-Kraków**. Reports containing recommendations based on a Least-Cost evaluation of the proposed measures were prepared and discussed with the involved local managers.
Two out of the five audited buildings: a residential block of apartments and a municipality-owned public building (school, kindergarten or health center), were subsequently selected for the actual demonstration of the thermal improvements.

The identified thermal improvement measures included primarily:

- window and door-carpentry improvements, weather-stripping, caulking,
- attic-space insulation of ventilated attics,
- installation of radiator shields,
- external insulation of selected external wall as indicated by the audit,
- removing over-glazed areas (usually the glass brick walls) and filling the space by a Styrofoam wall.

When complementary funding was available other measures could be applied, such as insulation of the whole building envelope.

The list of the audited buildings is given below; more detailed information about the audits is given in the next Section. The full audits were one of the deliverables and have been delivered to the USAID Warsaw Office at the end of the Project.
As can be seen the total audited volume of buildings exceeds the value that would follow from the original contract. Also the number of buildings audited in Białystok was larger. This was made available by additional funding obtained from the Small Grants Program of the Global Environment Facility, UNDP, Warsaw.

2.6 Selection and initial training of local technicians

In order that the operations described above bring the results expected (savings with low investment costs), several conditions must be fulfilled:

- professional definition of potential energy savings and their relation to the costs, and definition of the hierarchy of works and the order of their implementation;
- a professional standard of work, requiring technicians to be trained in the works carried out and to be provided with appropriate experience;
- organizing operations in such a way that the costs are affected by the economies of scale, i.e. organization of the operations by large units (housing co-operatives, local government authorities, education authorities, etc.);
- providing work teams with professional equipment of adequately high standard;
- professional choice of adequate materials and their wholesale purchase to allow the lowest possible unit prices;

Therefore, parallel with the selection and audits of buildings a group of **8-14** people per city were interviewed and selected by **FEWE-Kraków**. The qualified technicians underwent 2-3-days long "theoretical" training in the respective technologies and work-safety regulations, as required by Polish law. More details about the training and are given in Section 3.

Selecting trainees through the Unemployment Offices proved to be less efficient than expected. The first problem that was encountered was the quality of the candidates. Unfortunately, some of those who came for the interviews turned out to be people who could not provide any references and were evidently seeking only temporary work in order - literally - to buy alcohol. Some others had problems with alcohol that could not be noticed immediately; after an initial good start, they began to come to work drunk or began drinking during working hours. Such people had to be fired on a short notice, or (in most cases) immediately when the abuse of discipline was noticed.

The other problem was that the FEWE-Kraków team did not know the people before, and there was a risk of theft, both of the materials and of property of residents in whose apartments the work was done. This required particular attention of the FEWE-Kraków staff. The adopted practice was that the trainees were never let alone in the customers' apartments and a FEWE-Kraków technician was always present with them while in the apartment. Of course, this had an impact on the efficiency of work, however this was a price that had to be paid to achieve the project objectives. Fortunately, not a single case of theft was reported during the whole project, which should be largely attributed to the tight discipline requirements and diligent control of the trainees by FEWE-Kraków supervising staff. Typically after one week of work the situation was becoming "normalized", i.e. only those trainees were left who met the criteria and complied with the regime established by FEWE-Kraków.

Fortunately, only four trainees had to be dismissed for breaching discipline after they were integrated into the teams. Most dismissals occurred within the first week, as the problems were noticed during the initial training.

This notwithstanding, it should be stressed that the overwhelming majority of the trainees proved to be very good, orderly and honest workers.

Table 1. List of the buildings audited in the six cities in the Project.

Building	City	Address	no	volume [m3]	estimated savings [%]
residential building	Krapkowice	os. 1000 Lecia	9	6952	11
residential building	Krapkowice	Księdza Duszy	16	3470	76
Primary School #4	Krapkowice	Żeromskiego	34	7725	18
residential building	Krapkowice	Kilińskiego	15	3725	68
Primary School #3	Krapkowice	Mickiewicza	3	3973	67
subtotal 1				**25845**	**5762 GJ**
residential building	Olsztynek	Kolejowa	17	6453	21
residential building	Olsztynek	Pionierów	9	1817	32
residential building	Olsztynek	Mickiewicza	3	3977	37
Primary School #2	Olsztynek	Ostródzka	4	16405	25
Secondary School	Olsztynek	Klikowicza	4	6370	34
subtotal 2				**35022**	**3366 GJ**
residential building	Nowy Sącz	Broniewskiego	2	3806	14
residential building	Nowy Sącz	Zamenhoffa	4	6199	49
residential building	Nowy Sącz	Barska	6	10963	66
residential building	Nowy Sącz	Żółkiewskiego	23	2807	28
Medical centre	Nowy Sącz	Broniewskiego	1	2933	54
subtotal 3				**26708**	**4252 GJ**
Primary School #4	Lubań	Skalnicza	3	4332	48
residential building	Lubań	Kazimierza Wielkiego	5a-5e	10582	28
residential building	Lubań	Kazimierza Wielkiego	9a-9e	10582	42
residential building	Lubań	Kolejowa	36	5516	48
Public Kindergarten #44	Lubań	Różana		2678	38
subtotal 4				**33690**	**5191 GJ**
residential building	Trzcianka	Sikorskiego	42	2261	91
residential building	Trzcianka	Sikorskiego	25/27	5455	34
residential building	Trzcianka	Grottgera	5	1253	95
Primary School	Trzcianka	Rychlik		3186	65
Primary School	Trzcianka	Przyłęki		1863	30
subtotal 5				**14018**	**3924 GJ**
residential building	Białystok	Zamenhoffa	1	4525	30
Public Kindergarten #21	Białystok	Staszica	18	3000	27
residential building	Białystok	Skłodowskiej	11	6552	47
Grammar School	Białystok	Antoniukowska	9	2478	54
residential building	Białystok	Żabia	14	6176	50
residential building	Białystok	Broniewskiego	8a	7432	59
Primary School #9	Białystok	Sucha		15000	16
subtotal 6				**45163**	**8919 GJ**
TOTAL				**180446**	**31414 GJ**

2.7 Demonstration and on-the-job training

The identified low-cost thermal improvements were first demonstrated by **FEWE-Kraków** technicians. The FEWE-Kraków team then trained the local technicians on the job, for about two weeks. After that period the trainees were able to continue the work themselves.
Upon completion, the work was commissioned by a team of experts including the representatives of the building owner/user, local government and FEWE-Kraków. The commissioning protocols were submitted to USAID.
Details of the applied measures and the estimated heat savings are given in Section 3. A summary is given in the table below which gives the volumes of the buildings, type of heat source and the measured heat savings.

Table 2. List of buildings were demonstration of low-cost heat saving measures were applied

No	Building	City	Address	Volume [m^3]	Heating source	Measured heat savings GJ/year
1	Residential	Krapkowice	1000 Lecia 9	6952	Municipal network	203
2	Primary School	Krapkowice	Żeromskiego	7725	Boiler house (wood waste)	508
3	Residential	Olsztynek	Pionierów 9	1817	Boiler house (gas)	291
4	Secondary School	Olsztynek	Klikowicza	6370	Boiler house (gas)	405
5	Residential	Nowy Sącz	Broniewskiego 2	3806	Municipal network	225
6	Health Clinic	Nowy Sącz	Broniewskiego 1	2933	Municipal network	67
7	Residential	Lubań	Kolejowa 36	5516	Boiler house (gas)	192
8	Primary School	Lubań	Skalnicza	4332	Boiler house (gas)	638
9	Residential	Trzcianka	Grottgera 5	1253	Home coal stoves	122
10	Primary School	Trzcianka	Rychlik	3186	Boiler hose (coal)	166
11	Kindergarten	Białystok	Staszica 18	3000	Boiler house (gas)	*)
12	Primary School	Białystok	Sucha 2	15000	Municipal network	*)
	TOTAL			61890		2817

(*) Energy savings will be estimated after the heating season 2000/2001

One of the main goals of the project was to train the local technicians on the job, while doing the demonstration works in the two selected buildings.

During the project **altogether 91** technicians were trained in the low cost measures. Among them:

- 73 from the cities participating in the project.
- 12 from other Polish cities which sent their technicians for training using their own resources (Miedźna, Bieruń, Brzozów, and Słomniki).
- Six from Lviv, Ukraine who were also trained in Krapkowice, due to the initiative of the US Alliance to Save Energy. The costs of this training were fully covered by USAID-Kiev.

The list of the trained technicians from cities which were not formal participants in the Project is given below, together with the list of new SMEs which were registered as a result of the Project, directly, or by inspiration. The lists and contact addresses of the technicians trained in the Project cities are given in the Section 3 for each city separately.

Table 3a. List of trained technicians from cities other than project participants

No	Name	City
1	Oleh Bichuk	**Lwów- Ukraina**
2	Artur Cichy	**Słomniki**
3	Jerzy Czarnynoga	**Bieruń**
4	Bohdan Kamyanka	**Lwów- Ukraina**
5	Yuriy Khatsko	**Lwów- Ukraina**
6	Dmytro Krawczyna	**Lwów- Ukraina**
7	Łukasz Kurpas	**Bieruń**
8	Roman Lutsyk	**Lwów- Ukraina**
9	Grzegorz Mryk	**Bieruń**
10	Bogdan Nowak	**Brzozów**
11	Andriy Severyn	**Lwów- Ukraina**
12	Janusz Szczepek	**Brzozów**
13	Henryk Szymonek	**Bieruń**
14	Sławomir Waliczek	**Bieruń**
15	Krzysztof Klekot	**Miedźna**
16	Mariusz Opołka	**Miedźna**
17	Mirosław Oślak	**Miedźna**
18	Petro Voytsikhovskyy	**Lwów- Ukraina**

Table 3b. List of companies created as a result of the project or those which extended their services

No	Name	City	Status	Registration Date
1	„SIK-POL"	Krapkowice	created	20.05.1999
2	„Usługi remontowe", R. Adamowski	Olsztynek	created	24.05.1999
3	„Usługi remontowo-budowlane" G. Klimek	Olsztynek	created	24.05.1999
4	„EKOTECH", W. Pimpicki	Olsztynek	created	26.01. 1999
5	„PNRW" -Bogdan Wójcik"	Nowy Sącz	extended	1993
6	„Usługi remontowo-budowlane Jerzy Małecki"	Trzcianka	created	4.05.2000
7	„TOM-BUD"	Białystok	created	16.08.2000
8	Firma Krzysztof, Szałaj	Białystok	created	16.08.2000
9	Firma STANDARD	Majstry	extended	1995
10	Magrem	Kraków	extended	1998
11	Negawatt, Ltd.	Kraków	created	22 .07.1999
12	Energored, Ltd.	Kraków	created	16.06.1999

2.8 Data analysis and measurements

Upon completion of the demonstration project in each city, the data were collected over the following heating season, analyzed and the results of the improvements were calculated and included in the reports for the cities. The results for Białystok will become available only after the heating season 2000/2001, as the work has been completed only last Summer.

A method for testing the results of carpentry improvements has been proposed and tested together with the researches from the University of Mining and Metallurgy AGH) in Kraków. The method is based on gas chromatography. Measurements were made in the residential block in Krapkowice. Chromatographic sampling was being carried out for twenty five rooms in the residential block taking measurements before and after renovation and weather-proofing the windows. The efficiency of the low cost repairs and weather-proofing of windows has been additionally tested using the "blower door" method in ten selected apartments in the same block of apartments. The measurements confirmed that the results are very satisfactory. The results of these measurements are described below.

It should be noted that in the project, the method of estimating savings was dependent on the technical and organizational conditions, as well as on the season when the demonstration works were conducted in a given town or building. The estimation process consisted of an estimate of energy consumption before and after thermal modernization and after reference to the number of degree-days in particular seasons. Simultaneously, the analysis of heat comfort was performed before and after thermal modernization.

Measurement of heat consumption before thermal modernization, which - dependent on technical feasibility - covered the following:

- Actual physical measurements of temperatures inside the selected rooms and outside the building,
- Actual physical measurements of consumption of heat from the district heating or fuel (gas or oil),
- Analysis of historical data on the basis of book documents and interviews with users, concerning the level of heat in the room
- Comparison of neighboring buildings with the structure allowing for re-scaling the data,

Measurement of heat consumption after thermal modernization, which - dependent on technical feasibility - covered the following:

- Actual physical measurements of temperatures inside the selected rooms and outside the building,
- Actual physical measurements of consumption of heat from the district heating or fuel (gas or oil),
- Comparison of neighboring buildings with the structure allowing for re-scaling the data
- Temporary application of the audit forecasts corrected on the basis of the observation of results of demonstration works (this case concerns buildings executed after the end of the 1999/2000 heating season, for which the collection of actual measurement data will be possible only in 2000/2001 heating season).

Measurements of heat loss by infiltration

In order to obtain information that would allow us estimate the energy saving potentials city-wide, an experimental determination of heat losses through excessive penetration of air through poorly fitting window frames and the efficiency of weather proofing and repair of window frames with the methods used in the Project. For this purpose, measurement was conducted before and after weatherproofing, using the gas chromatography method. Additionally the 'blower door' method was used to test the effectiveness of weather-proofing of windows. This was necessary to scale the most important data concerning the effectiveness of window retrofits. The measurement was performed by scientists of the University of Mining and Metallurgy in Kraków and the Warsaw Technical University. The measurement was performed at the very beginning of the project in Krapkowice.

It must be stressed that such measurements are rather expensive, and their application to every room would greatly exceed the financial resources of the project. For that reason, a statistical method was applied: 25 rooms were measured with the chromatography method and 10 apartments with the 'blower door' method. The measurement of air exchange in the rooms/apartments tested performed before the weather proofing, showed a range from a lower than standard, 0.28/h (standard exchange: one exchange per hour) to nearly 3 exchanges per hour in some cases. Low values of air exchange occurred in rooms where the users had weather proofed the windows with traditional weather strips, which - obviously - last one year, or are disposable after opening of the window. Because of that, inhabitants of all these apartments willingly agreed to have the windows weather proofed professionally with cut-in weather strips offered via the project.

The measurement after weatherproofing indicated that the repairs of window frames performed within the project gave good results, to the extent that the trained technicians had to be instructed about the necessity of leaving certain parts of the window frame girth without the weather strip. This is a crucial measurement confirmation of the fact that, as far as the reduced infiltration of air is concerned, the professional repair and weather proofing of window frames brings **the same** results as the replacement of windows with new ones.

Simultaneously, interviews were held with the inhabitants to obtain their subjective assessment of the condition of window frames, they assessed their experience of the cooling effect of poorly fitting window frames. The inhabitants' assessments were divided into five groups on a scale of values from '0' to '4', where:

'0' indicated:	„no draughts", „rather little draught" or „ don't know"
'1' indicated:	„sometimes draughts wind"
'2' indicated:	"visible draughts"
'3' indicated:	„visible draughts and it is cold"
'4' indicated:	„terrible draughts, hardly bearable"

These assessments could be well approximated to the following grids of measurement results, expressed in the multiplication factor of air changes per hour:

below	1.25	(group '0'),
between	1.25-1.75	(group '1'),
between	1.75-2.25	(group '2'),
between	2.25-2.75	(group '3'),
above	2.75	(group '4').

The above results were a valuable guideline when estimating the infiltration factor on the basis of site visits and examination and interviews with users of other buildings.

It must be stressed that the assessment of savings is, of course, **subject to errors** of estimation. In our case, the error refers mainly to the assessment of savings on weather proofing the window frames. For that reason, our audits and this report present careful estimations assuming rather conservative levels of energy saving, usually referring to an infiltration factor between about 1,5 to about 2,5. In this sense, the quoted estimates show rather low levels of possible savings that can safely be trusted. Probably this is one of the reasons why the actual savings achieved on weather proofing are higher than estimated in the audits.

Simultaneously, the estimates quoted in the audits should also be corrected due to savings resulting from the higher heating comfort achieved in a situation where the rooms had not been heated enough before the thermal modernization. Also here, we have adopted careful estimates, based on interviews with users, assuming that the average increase in interior temperature totaled 1 to 1,5°C while we were often informed that the temperature in the rooms used to fall to 14-15°C comparable to the 19-20°C achieved in comparable weather conditions. At the same time, the improvement of heating comfort by 1°C equals an energy saving of 5-7%.

2.9 Elaboration of the City-Wide Plans for Energy Efficiency Investments

Upon selection of the final project participants, the team of FEWE-Kraków experts began work on collecting the data needed for obtaining estimates of the potential of heat energy savings achievable with the low-cost measures, costs of such investments and the resulting financial savings. For this purpose the team collected information on heat sources, distribution systems and a number of selected buildings (sufficient to obtain a representative sample of the city's building stock). The whole process was pursued in close co-operation with the local administration representatives.

At the same time the demonstration project in the two selected buildings enabled FEWE-Kraków engineers to assess how labor intensive were the low cost investments, and relate it with the local cost of labor. These two pieces of information combined allowed us to make estimates also of number jobs such activities may create city-wide.

Questionnaires and statistical survey

Another team, working under guidance of a sociologist, prepared a questionnaire for a statistical survey of the households, to investigate the potential for demand side measures. The questions concerned the levels of thermal comfort perceived that could be correlated with the chromatographic measurements described above, the thermal conditions of the building, and the residents' willingness to invest in energy savings. The sampling was done separately for blocks of apartments, traditional street-lined houses and detached, single family houses.

Due to the type and character of the data required it was decided that a poll be conducted, i.e. primary research. Since an interview is a costly and time-consuming method, the questionnaire option was selected. The most effective questionnaire method is a direct questionnaire, since it yields twice as many answers as any other polling method.

A single household was taken as the sampling unit. The questionnaire suggested that it should be completed by the person who is the most responsible for budget and investment decisions in the household. Since data had to be collected on different types of buildings, the research involved a certain degree of stratification.

Due to the different features of single and multi-family houses (including blocks of flats, town houses) separate research tools had to be developed for each of these types of buildings.

The town was divided into three areas, one with single-family houses, the second with town houses and the third with blocks of flats. Before the research started, it was necessary to obtain relevant data from the local administration units and during on-site visits.

Due to the costs involved in the preparation of a report including stratified sample units, random samples were not used. Hence the target sample was selected. Selection of units for the target sample is very much based on the qualifications and experience of the research team with respect to the nature of the problem and type of data required. This kind of sample has often been used in marketing research, even though, compared with random selection, it limits the possibilities of prediction. Among non-random selection methods widely used is the method of selecting typical units. That was the most appropriate method for research at Krapkowice. From each group of buildings the most typical ones were selected for a particular type of construction and period of construction in which uniform building materials and techniques were applied.

The data obtained from the analysis of the questionnaires, supplemented with the data describing the structure of the housing stock obtained from the City Hall and engineering information, enabled us to make extrapolations giving the estimates of the *city wide* heat energy saving potentials that can be realized by implementing *city wide* projects using the most cost effective measures identified in the Project falling into the category of low-cost investments.

The surveys provided valuable data, which were used to prepare policy recommendations for the city. Ample materials (over 100 pages plus annexes) were prepared for each city separately. The copies were distributed to the representatives of the cities during the closing seminar in Nowy Sącz. After completion of the project, one additional copy for each city was also given to USAID in Warsaw as one of the project deliverables.

A shorter version (ca. 30 pages) was also prepared for distribution among city councilors and other interested persons.

The content of the city-wide plans is given below

CONTENT :

I. Introduction

II. General project description
- 2.1. Project background
- 2.2. Project objectives and tasks

III. Project implementation in city
- 3.1. Training of local project staff
- 3.2. Elaboration of recommendations for local authorities of the city
- 3.3. Energy audits
- 3.4. Low-cost demonstration works
- 3.5. Measurements and monitoring

IV. Low-cost approach to the heat saving
- 4.1. Background
- 4.2. Definitions of terms
- 4.3. Definitions of parameters and variables

V. Classification of DSM measures
- 5.1. DSM versus SSM measures
- 5.2. DSM activities
- 5.3. Criterion of Cost
- 5.4. Criterion of Pay-Back Time

VI. Prioritization of DSM measures
- 6.1. Planning and action
- 6.2. Choice of the optimal DSM path
- 6.3. Prioritization according to cost

VII. Determination of the city-wide DSM potential
- 7.1. Methodology
- 7.2. Single-family houses
- 7.3. Residential blocks
- 7.4. Street-lined buildings
- 7.5. Comparative analysis
- 7.6. Results of the survey of attitudes

VIII. Final recommendations for the city

IX. Annexes

2.10 Information brochure

A short brochure about the final project results and the approach developed has been prepared. The brochure is being distributed in c.a. 2500 copies and distributed among Polish municipalities. A large part of the brochure has been published in October 2000 in "Przegląd Komunalny" a popular monthly magazine for municipal governments (edition size ca. 8 500). The whole brochure is also been published in parts in the monthly bulletin of PNEC.

The content of the brochure covers the main results of the Project to give a concrete example of what can be achieved in real field conditions in Poland. It consists of seven chapters:

1. Can one save energy with little money?
2. Heat savings achievable at low cost
3. An important example: Heat losses through leaky windows
4. Retrofit or exchange - this is a question !
5. Schools a special example
6. Quickly, well and at low cost - practical guidance
7. Job creation

The target group of the brochure are the municipal and housing estate administrations. However it is written in a manner that can be easily absorbed by a person who is not necessarily interested in the problem at the moment. The goal is to catch the attention of a wide group of people that can be potentially interested., and make them start thinking.

Below some examples of the results of the studies are presented for illustration

Table 4. Job creation potentials of city-wide window repairs

City	Heat saved [GJ/y]	Money saved [1000PLN/y]	Jobs created, men-years	Unemployment [%]	Population [thousand].
Krapkowice	240 265	6 007	**151**	5,0	25
Olsztynek	63 705	1 593	**45**	18,0	14
Lubań	71 847	1 796	**73**	6,4	24
Trzcianka	107 603	2 690	**99**	13,0	18
Nowy Sącz	579 706	14 493	**469**	5,2	84
Białystok	1 953 622	48 841	**1 164**	4,3	284

Table 4 above shows the potentials of energy and cost savings and the job creation potential for the project cities, which can be ascribed to repairs and weatherproofing of windows only.

In particular, the huge job creation potential should be noted. For instance, in Białystok, the repair of window frames alone would guarantee jobs to 100 unemployed people for almost 12 years or to 200 unemployed for about 6 years, and would bring with it a long-term saving of about PLN 50 million a year. The figures quoted in the table are conservative - close to the lower limits of the estimates. It is therefore obvious that the possibilities are very significant.

Tables 5 - 10 below show examples of aggregated data for other low-cost measures. Other examples of findings are presented in the next Section.

Tables 5 - 10. City-Wide Heat Savings and CO_2 Reduction Potentials of the Low Cost Measures

No	Investment type	Hierarchy	Area [10^4 m^2]	Savings potential [GJ/y]	CO_2 reduction [t/y]
	Białystok				
1	Window improvements	1	437	1 953 600	**290 830**
2	Ventilated attic insulation	3	27	68 300	**10 160**
3	Radiator shields	2	52	260 160	**37 720**
	Trzcianka				
1	Window improvements	1	39,4	107 600	**16 000**
2	Ventilated attic insulation	3	3,2	7 900	**1 200**
3	Radiator shields	2	0,4	1 770	**260**
	Lubań				
1	Window improvements	1	26	71 900	**10 700**
2	Ventilated attic insulation	3	10	26 900	**4 000**
3	Radiator shields	2	1,6	8 100	**1 200**
	Nowy Sącz				
1	Window improvements	1	230	579 700	**86 300**
2	Ventilated attic insulation	3	16	62 620	**9 330**
3	Radiator shields	2	6	30 750	**4 580**
	Olsztynek				
1	Window improvements	1	22,5	63 700	**9 240**
2	Ventilated attic insulation	3	2,5	6 200	**900**
3	Radiator shields	2	0,7	3 330	**480**
	Krapkowice				
1	Window improvements	1	75,0	240 270	**34 840**
2	Ventilated attic insulation	3	26,0	64 130	**9 300**
3	Radiator shields	2	4,5	22 500	**3 260**

2.11 Contribution of the Cities

The table below presents summary of the contribution

Table 11 Contribution of the cities

City	Contribution declared	cash to FEWE	cash to other	in-kind personal	total city	total city	rate
					PLN	USD	
Krapkowice	100 000,00	57 941,40	243 329,17	15 440,00	316 710,57	90 488,73	3,50
Olsztynek	100 000,00	27 478,16	33 582,63	32 900,00	93 960,79	25 394,81	3,70
Nowy Sącz	200 000,00	29 272,82	389 049,75	57 425,00	475 747,57	121 986,56	3,90
Lubań	100 000,00	34 031,69	0,00	38 785,00	72 816,69	18 204,17	4,00
Trzcianka	30 000,00	18 425,09	0,00	10 124,00	28 549,09	6 879,30	4,15
Białystok	300 000,00	56 856,56	0,00	10 000,00	66 856,56	15 369,32	4,35
total	830 000,00	224 005,72	665 961,55	164 674,00	1 054 641,27	278 322,89	
					target	140 179,00	198,5%

3. PROJECT IMPLEMENTATION IN THE CITIES

Below the Project activities are described in more detail for each city separately. Some of the results of the survey vary little from town to town, particularly the estimated costs of the low-cost investments. The reason is that, practically the only variable parameter is the cost of labor and average workers' efficiency. The latter was carefully monitored during the demonstration works and turned out to be on average the same within the uncertainties of the estimates. The costs of labor were estimated on basis of interviews with the local officials and assessment of wage expectations of the trainees based on talks with them concerning, how much would they want to earn after the training has terminated. Those expectations differed depending on the level of unemployment in the area and competitive job opportunities and salaries offered there. The highest expectations were in Krapkowice where, despite of significant unemployment, many people have relatives in Germany and frequently work seasonally in Germany. The expectations for Lubań (where the situation is to some extent similar due to proximity of the German border) and Nowy Sącz, ranged between 0.8 - 0.9 of the average expectation for Krapkowice. In Białystok, Olsztynek and Trzcianka the corresponding estimates ranged correspondingly between 0,7 and 0.75. Still, those differences boiled down to ca 10% in the total costs, due to the contribution of the costs of materials, transportation etc. Therefore, the cost data are presented below only for Krapkowice, to give an guiding estimate. The values are given in Polish złoty (PLN), which is related to USD (exchange rate) on the date of this report 1 USD = 4.5 PLN.

3.1 Krapkowice

A factor which helped determine the selection of Krapkowice, apart from its being a participant in the USAID Local Government Partnership Program, was the fact that Krapkowice was one of the towns which was significantly affected by the flood in the summer of 1997. It required aid, part of which –as it was assessed – should be aid needed to support reconstruction of the flooded area. This would at the same time result in improved energy efficiency for heating purposes in households and public buildings.

Krapkowice was the first town where the work was begun. An agreement was signed between FEWE-Krakow and the Krapkowice Municipality on February 17, 1998. This defined the mutual undertakings for the implementation of the project. The agreement was signed by: Mayor Piotr Soloch and Vice-Mayor Jan Nadbrzeżny, on behalf of Krapkowice Municipality and by Adam Guła Director of FEWE's Krakow Center on behalf of FEWE. The Municipality assigned Andrzej Klaka as a local co-ordinator of the project, and Henryk Steinhof and Krystian Muszelik as his assistants. General supervision of the works in relation to the contacts with FEWE was carried out by Vice-Mayor Jan Nadbrzeżny, and after elections of 1998, Vice-Mayor Romuald Haraf on behalf of the Municipality.

The Municipality committed up to 100 000 Polish Złoty according to the requirements of the project as their input to the project. By the day when this report was being completed, the input of the Municipality has greatly exceeded this sum, and amounted to 316 710 PLN

The input covered:

• The cost of external cladding of buildings paid directly to contractors outside FEWE	243 329 PLN,
• Input of their own time	16 440 PLN,
Repayment of the cost of insulation materials installed by FEWE	57 941 PLN
Total	**316 710 PLN.**

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID.

Additionally, the Municipality had an input of 20 000 PLN in the form of co-financing of the wood-waste-burning boiler in Primary School No 4 within another project implemented in Krapkowice on FEWE's initiative. This was financed by the GEF (Global Environment Facility) to the amount of USD 25 000, and entitled an 'Integrated Approach to Waste-Wood Application for Heat Generation in Poland'.

According to the Project scope of work, five buildings were selected for the energy audits

- Municipal building 1000-lecia 9,
- Municipal building Kilińskiego 15,
- Municipal building Ks. Duszy 16,
- Primary School no 3 Mickiewicza
- Primary School no 4 Żeromskiego 34

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

3.1.1 Summaries of the audits

What follows, is a brief description of the full energy audit reports (containing proposed work as well as the estimated savings resulting therefrom) have been prepared. The data provided below is limited to the range of potential gains in energy savings – both, for the low-cost as well as the medium-cost variants.

The apartment building situated at 16 Księdza Duszy St.
The volume of space requiring heating amounts to: 3 470 m^3, the number of apartments – 22, the number of inhabitants – 90. This building was constructed in 1958 of brick. This building is currently heated with individual old-fashioned coal-burning stoves. The thermal power requirements have been calculated at 146 kW, and the seasonal thermal energy requirements at 1,196 GJ/year (not including efficiency of the heating system). The seasonal thermal energy requirements, including efficiency of the heating system, have been calculated at 4,884 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Replacement of the currently used sources of thermal energy with separate gas heating systems serving one floor each
- Weather-proofing and refitting of the existing window frames as well as installing manually operated window ventilators
- Insulating the ceilings above the top floor with the use of foamed polystyrene (thickness – 10 cm)

The total cost of the entire project has been estimated at PLN 173,000, and the payback period at 5 years. The total estimated savings, depending on the variant chosen for implementation, range from 72% to 87%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 59% (assuming replacement of the individual coal-burning stoves with the individual gas systems on each floor), the range due to the above works is 13% – 28%.

The apartment building situated at 15 Kilińskiego St.
The volume of the space requiring heating amounts to: 3,725 m^3, the number of apartments – 18, the number of inhabitants – 52. This building was constructed in 1953 of brick. This building is currently heated with old-fashioned individual coal-burning stoves. The thermal power requirements amount to 103 kW. The seasonal thermal energy requirements amount to 886 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Replacement of the currently used sources of thermal energy with a new gas-powered central heating system
- Weather-proofing and refitting of the existing window frames
- Insulating the ceiling above the top floor with blown glass wool (thickness – 13 cm)

The total cost of the entire project has been estimated at PLN 108,000, and the payback period at 7 years. The total estimated savings, depending on the variant chosen for implementation, range from 63% to 80%, Since this includes an assumed increase of the efficiency of the thermal system amounting to 58%(assuming replacement of the coal-burning stoves with a gas central heating system), the range due to the above works is 5% – 22%.

The apartment building situated at 8 1000-lecia St.
The volume of the space requiring heating amounts to: 7,336 m^3, the number of apartments – 60, the number of inhabitants – 220. This building was constructed in 1965 using prefabricated building panels of the „Żerań" type. It receives thermal energy from the municipal district heating network through a thermal centre situated in the neighboring building. The thermal power requirements amount to 339 kW. The seasonal thermal energy requirements amount to 2,257 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Installation of thermal radiator screens
- Weather-proofing and refitting of the existing window frames
- Insulating the ceiling above the top floor with blown glass wool (thickness – 10 cm)
- Insulating the external walls with applied foamed polystyrene (thickness – 10 cm) – light type application and a coat of rendering.

The total cost of the entire project has been estimated at PLN 220,000, and the payback period at 6,7 years. Implementation of all the proposals listed above would result in a 43% saving in energy (without any modifications to the existing heating system), and a 36% saving in heating costs.

The apartment building situated at 9 1000-lecia St.
The volume of the space requiring heating amounts to: 6,952 m^3, the number of apartments – 45, the number of inhabitants – 165. This building was constructed in 1965 using prefabricated building panels of the „Żerań" type. It receives thermal energy from the municipal district heating network through a thermal center situated in the neighboring building. The thermal power requirements amount to 225 kW. The seasonal thermal energy requirements amount to 1,695 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Weather-proofing and refitting of the existing window frames
- Insulating the ceiling above the top floor with blown glass wool (thickness – 10 cm)

The total cost of the entire project has been estimated at PLN 26,000, and the payback period at 6,4 years. The total estimated savings, depending on the variant chosen for implementation, range from 3% to 10% (without the change of the efficiency of the thermal system).

The grammar school complex situated at 34 Żeromskiego St.
The volume of the space requiring heating amounts to: 7,725 m^3, the number of users, i.e. pupils and employees – 310. This building was constructed in 1964 of brick. The building is currently heated with its own coal-burning boiler situated in the basement.
The thermal power requirements amount to 289 kW. The seasonal thermal energy requirements amount to 1,709 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Renovation of the windows that includes replacement of some of the windows in the gym hall with polycarbonate panels as well as insulation and refitting of the other windows of the gym hall
- Blocking the upper windows of a gym hall
- Installation of thermal radiator screens
- Insulating the ceiling with a 10 cm thick layer of glass wool blown with an air jet into the ventilated space
- Weather-proofing and renovation of the window frames in the main building
- Insulation of the external wall adjacent to the dressing room with an applied layer of 10 cm thick foamed polystyrene– light type application and a coat of rendering.

The total cost of the entire project has been estimated at PLN 72,000, and the payback period at approximately 7 years. Implementation of all the proposals listed above would result in an energy saving of 19% (without any modifications to the existing heating system).

The Grammar School No. 4 situated at 3 Mickiewicza St.
The volume of the space requiring heating amounts to: 3,973 m^3, the number of users, i.e. pupils and employees – 480 (in two shifts). This building was constructed in 1933 of brick. The building is currently heated with its own coal-burning boiler situated in the basement.
The thermal power requirements amount to 160 kW. The seasonal thermal energy requirements amount to 1,388 GJ/year.

The project, in its most extensive form, is comprised of the following elements:

- Installation of thermal radiator screens
- The thermal system amounting to 44%. Weather-proofing and renovation of the window frames in the building
- Insulating the ceiling with a 6 cm thick layer of the glass wool blown with an air jet into the ventilated space

The total cost of the entire project has been estimated at PLN 211,000, and the payback period at 6.7 years. The total estimated savings, depending on the variant chosen for implementation, range from 50% to 70%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 44%, the range due to the above works is 6% - 26%.

3.1.2 Demonstration works

Subsequently, the City and FEWE had selected two buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

- Municipal building 1000-lecia 9,
- Primary School no 4 Żeromskiego 34

After the selection, auditing and training the demonstration works in Krapkowice lasted between 15 July and 3 November 1998.

The tables below give the obtained estimates of the unit costs of the particular low-cost investments referred to unit floor area (PU) of the building, [1 sq. meter], assuming that the average area of windows constitute 12% of floor area.

Table 3.1.1 requires several comments:

(i) The above unit prices do not cover painting of the frames. Painting adds 20-25 PLN/m^2 to the above prices, depending on the window condition, whereas the last estimate is based on the KNR indices and may differ for particular regions and towns depending on the local cost of labor. It must be stressed here that modern primer-absorbent varnish, the when properly used, lasts for at least 10 years. Obviously, plastic or metal frames do not require painting.

(ii) In practice, windows classified to 0 class, are windows with good, tight frames; at the same time those not producing any complaints are equipped with weather strips of metal plate sheets (usually in 'Swedish' windows), or with glued-on weather strips made of various materials and with various profiles. Without these weather strips, windows of similar technical condition are classified as class 1 or 2. In thermal modernization practice, the problem of glued weather strips, already installed and still in good condition, comes up quite often. Even though the condition of the strips is satisfactory, their longevity lasts between 1 season to 3 years, compared to cut-in weather strips, the longevity of which – it may be assumed – exceeds 10 years.

Table 3.1.1 Unit costs of window repairs, in the particular groups of damage defined in Section 2.

Window type	Investment type	Tightness class „before" thermal modernization				
		0	1	2	3	4
French windows	Weather proofing of inner frames	0	7,5	12,5	18,8	25,0
	Weather proofing of both frames	0	15,0	25,0	37,6	50,0
Swedish windows	Weather proofing of frames	0	7,5	12,5	18,8	25,0
	Weather proofing and air-tight sealing	0	9,0	14,0	20,3	26,5
New windows	replacement	69	69	69	69	69

Table 3.1.2 shows the corresponding numbers for the insulation of the attic of different type.

Table 3.1.2. Financial input for thermal insulation of attics calculated per 1 m^2 PU for the city of Krapkowice

Ceiling/Attic type	Number of floors			
	1	2	5	11
traditional attic	54–72	24-36	10,8-14,4	-
ventilated	27–36	13,5-18	5,4-7,2	2,5-3,3
full(solid)	90-126	45-63	18-12,6	8,2-11,5
full (with roofing repaired)	46–64	23-32	9,2-12,8	4,2-5,8

Comments on the table.

(i) The cost in the case of insulation of attic ceilings also involves the average cost of attic clearing, laying wooden walkways so as not to damage the insulation while walking, as well as the cost of laying the vapor-permeable foil.

(ii) Cost of ventilation insulation involve the cost of piercing the wall, allowing the workmen to crawl into the inter-roof area.

(iii) Investment on the surface insulation of full (solid) ceilings is especially to be recommended on the occasion of the renovation of roofing. Then the cost of insulation becomes a marginal cost, which greatly increases the profitability of the investment

The corresponding rough estimates for external wall insulation are given in Table 3.1.3 below.

Table 3.1.3 Approximate investment costs of wall insulation depending on insulation method and the number of staircases in the building taking into account local labor costs

	Number of staircases			
	1	2	4	8
Light wet	90–117	72–90	54–72	49–68
Siding	90–135	68–104	54–86	49–77
Rockwool	72–117	54–90	45–72	41–68
Heavy wet	99–126	77–95	63–81	54–72

As shown, the investment input on wall insulation falls into the category of a high-level input, if we only consider the benefits to energy efficiency. However, if the facade renovation is done for other purposes, such as the elimination of technical faults, leaking walls, etc., wall insulation is only a marginal cost, and usually falls within the medium-level input investments.

3.1.3 Technicians trained

Altogether 18 technicians were trained in Krapkowice, their names an previous status are listed below.

List of persons trained in Krapkowice

No.	Name and surname	Status
1	Jan Baron	Unemployed
2	Marek Kołakowski	Pension suspended
3	Mariusz Kupacki	Unemployed
4	Bernard Kurzaj	Unemployed
5	Stanisław Łabędowicz	Retrained
6	Grzegorz Natkański	Retrained
7	Mirosław Natkański	Retrained
8	Waldemar Naruk	Retrained
9	Henryk Nieużyła	Unemployed
10	Maciej Nowak	Retrained
11	Michał Olbrich	Unemployed
12	Jacek Opiłka	Unemployed
13	Anatoli Pawłowski	Unemployed
14	Gotfryd Poliwka	Unemployed
15	Marek Raczyński	Retrained
16	Jan Skórka	Unemployed
17	Piotr Sykut	High school graduate
18	Marek Zarankiewicz	Unemployed

3.1.4. City wide estimates

The data obtained from the analysis of the questionnaires, supplemented with the data describing the structure of the housing stock obtained from the City Hall and engineering information, enabled us to make extrapolations giving the estimates of the *city wide* heat energy saving potentials, that can be realized by implementing *city wide* projects using the most cost effective measures identified in the Project falling into the category of low-cost investments.

The results of those extrapolations are summarized in Tables 3.1.4 -7 below

Table 3.1.4. "PRE" carpentry condition fraction determined by the poll survey for detached and multifamily houses in Krapkowice.

„PRE" carpentry condition	**Type of the buildings**	
	detached houses	**multifamily housing**
0	23%	9%
1	34%	20%
2	27%	22%
3	12%	29%
4	4%	20%
Total	100,0%	100,0%

Table 3.1.5. Energy savings due to weatherproofing of window carpentry in different "PRE" condition groups in Krapkowice.

GROUP of window damage	**Detached houses**		**Multifamily housing**	
	Area [m^2]	**Savings** [GJ/y]	**Area** [m^2]	**Savings** [GJ/y]
0	74 175	0	38 475	0
1	109 650	25 220	85 500	19 665
2	87 075	33 959	94 050	33 345
3	38 700	20 898	123 975	46 170
4	12 900	7 998	85 550	53 010
Total:	**322 500**	**88 075**	**427500**	**152 190**

Table 3.1.6. Investment costs and pay-back times for weatherproofing vs. replacement of window carpentry in Krapkowice.

Area [m^2]	**Savings** [GJ]	**Savings** [PLN]	**investment costs**		**SPBT**	
			weather proofing	**replacement**	**weather proofing**	**replacement**
750 000	**240 265**	**6 006 619**	**10 202 003**	**51 750 000**	**1,7**	**8,6**

Table. 3.1.7. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Krapkowice.

Investment	**Area** [m^2]	**Savings** [GJ]	**Savings** [PLN]	**Inputs** [PLN]	**SPBT** [years]
insulation of ventilated attics	256 500	64 125	1 603 125	8 079 750	**5,04**
insulation of traditional attics	193 500	38 700	1 967 500	12 190 500	**12,60**
installation of radiator shields	45 000	22 500	562 500	945 000	**1,68**

3.2 Olsztynek

Olsztynek was the second town where the work was begun. An agreement was signed between FEWE-Krakow and the Olsztynek Municipality on 19 May 1998. This defined the mutual undertakings for the implementation of the project. The agreement was signed by: Mayor Jerzy Tytz and Vice-Mirosław Stegienko on behalf of Olsztynek Municipality and by Professor Adam Guła Director of FEWE's Cracow Centre on behalf of FEWE. The Municipality assigned Mr. Wojciech Pimpicki as a local co-ordinator of the project, and Halinę Dąbrowską and Andrzeja Ponieważ as his assistants.

The Municipality allocated 100 000 PLN as their input to the project. By the day when this report was being completed, the input of the Municipality has amounted to 93 960,79 PLN

The input covered:

• The cost of external cladding of buildings paid directly to contractors outside FEWE	33 582,63 PLN,
• Input of their own time	32 900,00 PLN,
• Repayment of the cost of insulation materials installed by FEWE	27 478,16 PLN.
Total	**93 960,79 PLN.**

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID.

3.2.1 Energy audits

According to the Project scope of work, five buildings were selected for the energy audits

- Municipal building Pionierów 9,
- Municipal building Mickiewicza 3,
- Municipal building. Kolejowej 17,
- Secondary School Ostródzkiej,
- Primary School Ostródzkiej.

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

The Order of the Ministry of Internal Affairs and Administration (MSWiA) of April 30th, 1999 refers to the scope and form of energy audits and the algorithm for profitability assessments of thermal modernization projects and imposes certain heating system efficiency levels. If heat energy production affects the environment (since rooms are heated with ceramic and tile stoves) and it is proposed to replace the heating system with a more environmentally-friendly (and more expensive) one, theoretical savings might be overestimated. In reality, savings will not be that significant for, let us say, technical reasons. In particular, if a building has tile stoves, not all the rooms are usually heated (in calculations it is assumed in the entire building is heated). Moreover, in those rooms which are heated the temperature is not usually maintained at the same required level, and the rooms are sometimes underheated for economic reasons. However, regardless of the above mentioned uncertainties, the proposed projects will definitely have a beneficial effect on the environment, since the reduction of heat losses will always curb the emissions of air pollution produced by individual coal stoves..

The audits at Olsztynek were conducted in blocks of flats located at ul Mickiewicza 3, Kolejowa 17 and Pionierów 9, primary school No 2at ul Ostródzka 4 and a secondary school at ul. Klikowicza. All of the audits were conducted in compliance with the existing requirements. Each of the audits evaluates the scope as well as the technical and economic parameters of the thermal modernization project, presents the optimal solution in terms of costs of implementation and energy savings generated, and at the same time serves as the basis for an engineering design.

When the Orders adopted by the Ministry of Internal Affairs and Administration with respect to "The Support of Thermal Modernization Projects Act" became effective in April, 1999, a decision was taken to update an audit for one of the buildings where works had not been carried out. This is because according to the new regulations it is not possible to apply for a loan from the thermal modernization fund using audits conducted according to the previous standards. Therefore, the audit for the secondary school at ul. Ostródzka was updated.

The current state of each of the buildings is briefly presented below, together with the works recommended in the audits as well as the projected savings resulting from the proposed thermo-renovation works.

The amounts of potential saving of heat energy are only given here for the cost-effective and medium capital-intensive options. The capital intensive projects are included in the schedule (which mainly involved replacement of wooden fixtures and fittings).

Block of flats at ul. Mickiewicza 3

Volume heated - 3 978 m^3, number of flats - 18, number of residents - 72.
The building was constructed in 1958 from brick, heated with coal tile stoves.
The thermal power demand of the building has been estimated at 101 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 841 GJ/year.

The optimal option included the following measures:

- Replacement of the current heating system with a central gas boiler and a central heating system,
- Insulation of the external walls with a 12-cm layer of foamed polystyrene using the light/wet method,
- Insulation of the ceiling above the top storey with a 7-cm layer of glass wool,
- Insulation of the ceiling above the basements which are not heated with a 10-cm layer of foamed polystyrene using a method similar to the light/wet one,
- Installation of heat reflective panels behind the radiators,
- Weatherstripping/sealing of the windows and their adjustment, installation of separate manual intake ventilators.

The total cost of the project has been estimated at PLN 157,000 and the investment payback time at 6.0 years.

The calculated total savings depend on the option and vary between 32% and 48 %, assuming an increase in the heating system efficiency of 30%.

Block of flats at ul. Kolejowa 17

Volume heated - 6 453 m^3, number of flats - 40, number of residents - 145.
The building was constructed in 1985 from prefabricated units of the "Wk-70" type. Heat is supplied from the municipal district heating network by means of a heat distribution centre.

The thermal power demand of the building has been estimated at 161 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 2 506 GJ/year.

The optimal option included the following measures:

- Installation of heat reflective panels behind the radiators,
- Modernization of the present heating system by installation of weather regulating devices, individual air locks and cost calculators,
- Weatherstripping/sealing of the windows and their adjustment, installation of separate manual intake ventilators,
- Insulation of the ceiling above the top storey with a 12-cm layer of glass wool using the blowing method,
- Insulation of the ceiling above the basements which are not heated with a 11-cm layer of foamed polystyrene,
- Insulation of the external load-bearing walls (N and S directions) with a 16 cm layer of foamed polystyrene using the light/wet method.

The total cost of the project has been estimated at PLN 123,000 and the investment payback time at 6.7 years.

The calculated total savings depend on the option and vary between 32% and 48 %, assuming an increase in the heating system efficiency of 30%.

Block of flats at ul. Pionierów 9

Volume heated - 1 817 m^3, number of flats -12, number of residents - 52.
The building was constructed in 1981 from prefabricated units of the "OWT" type, heat is supplied from a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 78 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 1066 GJ/year.

The optimal option included the following projects:

- Installation of heat reflective panels behind the radiators,
- Weatherstripping/sealing of the windows and their adjustment,
- Modernization of the present heating system by installation of weather regulating devices, thermostatic valves, automatic air locks and cost calculators,
- Insulation of the ceiling-roof with a 10 cm layer of foamed polystyrene.
- Insulation of the ceiling above the top storey with glass wool, using the blowing method.

The total cost of the project has been estimated at PLN 43,000 and the investment return time at 6.2 years.

The calculated total savings depend on the option and vary between 6% and 37 %.

Primary school no. 2 at ul. Ostródzka 4

Volume heated - 16 406 m^3, number of pupils and employees - 871.
The building was constructed in 1973 from prefabricated units of the "Żerań" type, heat is supplied from a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 571 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 4436 GJ/year.

The optimal option included the following measures:

- Weather-stripping/sealing and renovation of the wooden window frames,
- Installation of heat reflective panels behind the radiators,
- Replacement of single glazed windows with double glazed ones and to some extent with a PC panel,
- Insulation of the ceiling above the storey in the ventilated space with a 10-cm layer of foamed polystyrene using the forced-blowing method,
- Weather-stripping/sealing and renovation of the wooden windows in the main building,
- Insulation of the external wall flanking the cloakroom with a 10-cm layer of foamed polystyrene using the light/wet method.

The total cost of the project has been estimated at PLN 488,000 and the investment payback time at 7 years.

The calculated total savings depend on the option and vary between 7% and 29 % (excluding the modernization of the heating system)

Secondary school at ul. Ostródzka

Volume heated is 6 370 m^3. The building was constructed in 1953 from brick. Heat is supplied from a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 169 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 1 447 GJ/year.

The optimal option included the following projects:

- Installation of heat reflective panels behind the radiators,
- Weather-stripping/sealing and renovation of wooden window frames in the building,
- Modernization of the heating system including installation of automatic weather regulating devices, thermostatic valves, automatic air locks,
- Insulation of the ceiling above the storey in the ventilated space with glass wool using the forced-blowing method.
- Insulation of the external walls using the light/wet method.

The total cost of this project has been estimated at PLN 134,000 and the investment payback time at 4.3 years. The calculated total savings for this option are about 34%

3.2.2 Demonstration works and training of technicians

Subsequently, the City and FEWE had selected two buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

- Municipal residential building at Pionierów 9,
- Secondary School at Ostródzka str

After the selection, audits, and trainings have been completed, the woks lasted between 6 January 1999 and 4 March 1999.

List of trained technicians and their previous status

No.	Name and surname	Address
1	Roman Adamowski	Unemployed
2	Mariusz Filipiak	Unemployed
3	Radek Gostkiewicz	Unemployed
4	Marcin Grochowski	Unemployed
5	Ryszard Grzywiński	Unemployed
6	Marcin Jankowski	Unemployed
7	Grzegorz Klimek	Unemployed
8	Paweł Kuciński	Unemployed
9	Franciszek Piłat	Unemployed
10	Wojciech Pimpicki	Retrained
11	Andrzej Ponieważ	Retrained
12	Andrzej Popielarski	Retrained
13	Robert Sieński	Unemployed
14	Leszek Wiśniewski	Unemployed
15	Krzysztof Zakrzewski	Unemployed
16	Zdzisław Zmysłowski	Retrained

3.2.3 City-Wide extrapolations.

The extrapolations were done following the same method as in Krapkowice
The results of those extrapolations are summarized in Tables 3.2.1 - 3.2.4

Table 3.2.1. "PRE" carpentry condition fraction determined by the poll survey for detached and multifamily houses in Olsztynek.

„PRE" carpentry condition	Type of the buildings	
	Detached houses	multifamily housing
0	36%	12%
1	26%	18%
2	28%	17%
3	10%	26%
4	0%	27%
Total:	100,0%	100,0%

Table 3.2.2. Energy savings due to weather proofing of window carpentry in different "PRE" condition groups in Olsztynek.

„PRE" carpentry condition	Type of the buildings			
	detached houses		multifamily housing	
	Area [m^2]	Savings [GJ]	Area [m^2]	Savings [GJ]
0	27 672	0	17 850	0
1	19 986	4 597	26 775	6 158
2	21 523	8 179	25 287	10 174
3	7 687	4 074	38 675	14 191
4	0	0	40 162	16 333
Total:	76 868	16 849	148 749	46 856

Table 3.2.3. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Olsztynek.

Investment	Area [m^2]	Savings [GJ]	Savings [PLN]	Inputs [PLN]	SPBT [years]
insulation of ventilated attics	24 791	6 198	154 947	780 932	*5,0*
insulation of traditional attics	21 157	4 232	105 784	12 190 500	*12,60*
installation of radiator shields	6 669	3 334	83 362	140 048	*1,68*

3.3 NOWY SĄCZ

Nowy Sącz was the third town where the work was begun. The main implementation stages were carried out in the period between April 15 and July 30, 1999. An agreement was signed between FEWE-Krakow and the Nowy Sącz Municipality on February 19, 1999 according to the requirements of the project. This defined the mutual undertakings for the implementation of the project. The agreement was signed by: Mayor Andrzej Czerwiński and Vice-Mayor Ludomir Krawiński, on behalf of Nowy Sącz Municipality and by Professor Adam Guła Director of FEWE's Cracow Centre on behalf of FEWE. The Municipality assigned Józef Hojnor as a local co-ordinator of the project, and Janusz Obtułowicz and Beata Susuł as his assistants. General supervision of the works in relation to the contacts with FEWE was carried out by Janusz Obtułowicz.

The Municipality allocated PLN 200 000 as their input to the project. By the day when this report was being completed, the input of the Municipality has greatly exceeded this sum, and amounted to PLN 475 747,57.

The input covered:
The cost of external cladding of buildings paid

• directly to contractors outside FEWE	PLN 389 049,75
• Input of their own time.	PLN 57 425,00
Repayment of the cost of insulation materials	
• installed by FEWE	PLN 29 272,82
Total	**PLN 475 747,57**

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID. Additionally, the Municipality had an input of 8 additional building where weatherization was done.

3.3.1 Energy audits

According to the Project scope of work, five buildings were selected for the energy audits

- Municipal Block of flats building at Broniewskiego 2
- Municipal Block of flats building at Barska 6
- Municipal Block of flats at ul. Zamenhoffa 4
- Municipal Block of flats building at Żółkiewskiego 23
- Medical Center at Broniewskiego Street

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

The state before thermal renovation of each of the buildings is briefly presented below, together with the works recommended in the audits as well as the projected savings resulting from the proposed thermo-renovation works.
The amounts of potential saving of heat energy are only given here for the cost-effective and medium capital-intensive options. The capital intensive projects are included in the schedule (which mainly involved replacement of wooden fixtures and fittings).

Block of flats at ul. Broniewskiego 2
Volume heated - 2 398 m^3, number of flats 25, number of residents - 70.
The building was constructed in 1965 from prefabricated units of the "Żerań" type.
The thermal power demand of the building has been estimated at 89 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 1032 GJ/year.

The optimal option included the following projects:

- Weatherstripping/sealing of the windows and their adjustment,
- Insulation of the ceiling above the top storey with a 12-cm layer of glass wool using the forced-blowing method,

- Installation of heat reflective panels behind the radiators.

The total cost of the project has been estimated at PLN 27,000, and the investment payback time 5.0 years. Approximately 14% of energy savings will be generated without modernisation of the heating system and about 11 % of heating-related expenses will be saved.

Block of flats at ul. Zamenhoffa 4
Volume heated - 6 200 m^3, number of flats - 48, number of residents - 168.
The building was constructed in 1978 using mixed types of technology – i.e. walls built from brick while the ceilings from DMS.
Heat is supplied from the municipal district heating network by means of a hydro-elevator heat distribution centre.
The thermal power demand of the building has been estimated at 293 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 2468 GJ/year.

The optimal option included the following projects:

- Installation of heat reflective panels behind the radiators,
- Insulation of the ceiling above the top storey with a 7-cm layer of glass wool using the blowing method,
- Weatherstripping/sealing of the windows and their adjustment,
- Modernisation of the heat distribution centre,
- Replacement of single glazed windows with double glazed ones.

The total cost of the project has been estimated at PLN 214,000 and the investment payback time at 6.7 years.

The calculated energy savings depend on the option and vary between 20% and 60 %, assuming an increase in the heating system efficiency of 16%.

Block of flats at ul. Barska 6
Volume heated - 10 964 m^3, number of flats - 95, number of residents - 168.
The building was constructed in 1964 with prefabricated units of the "BSK-Żerań" type. Heat is supplied from the municipal district heating network by means of a heat distribution centre.
The thermal power demand of the building has been estimated at 309 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 3 223 GJ/year (4811 GJ/year considering the heating system's efficiency levels)

The optimal option included the following projects:

- Weatherstripping/sealing of the windows and their adjustment,
- Installation of heat reflective panels behind the radiators,
- Modernisation of the present heating system involving replacement of the hydro-elevator with an exchanger centre, installation of weather regulating devices, automatic air locks and cost calculators,
- Insulation of the NW and SE wall with a 16-cm layer of foamed polystyrene using the light/wet method and insulation of the SW and NE gable wall with a 15-cm insulation layer,
- Insulation of the roof-ceiling with a 12-cm thermal layer – using the forced-blowing method.

The total cost of the project has been estimated at PLN 411,000 and the investment payback time at 6.7 years.

The calculated energy savings depend on the option and vary between 40% and 71 %, assuming an increase in the heating system efficiency of 12%.

Block of flats at ul. Żółkiewskiego 23
Volume heated - 2 807 m^3, number of flats - 59, number of residents -186.
The building was constructed in 1958 from brick. Heat is supplied by a thermal network with a modernised internal central heating system which calculates utilisation costs on an individual basis.
The thermal power demand of the building has been estimated at 278 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 3118 GJ/year.

The optimal option included the following projects:

- Weatherstripping/sealing and renovation of the window wooden frames and their adjustment, installation of separate manual intake ventilators,
- Insulation of the roof-ceiling in the inhabited section of the attic with a 6-cm layer of glass wool,
- Installation of heat meters for individual flats.

The total cost of the project has been estimated at PLN 210,000 and the investment payback time at 6.6 years.

The calculated energy savings depend on the option and vary between 15% and 60 %, assuming an increase in the heating system efficiency of 10%.

Medical centre at ul. Broniewskiego
Volume heated - 2 096 m^3. The building was constructed in 1953 from brick, heat is supplied by a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 91 kW, while the average heat energy demand in winter (not considering the heating system's efficiency levels) is 881 GJ/year.

The optimal option included the following projects:

- Installation of heat-reflective panels behind the radiators,
- Insulation of the west and east external walls with a 17-cm layer of foamed polystyrene using the light/wet method,
- Modernisation of the heating system involving modernisation of the heating distribution centre (replacement of the hydro-elevator distribution centre with an exchanger one) and modernisation of the central heating installation (flushing of the system, installation of thermostatic valves, automatic air locks etc.)
- Insulation of the north and south external walls with a 15-cm layer of foamed polystyrene using the light/wet method,
- Weatherstripping/sealing of the windows and their adjustment, installation of separate manual intake ventilators, one window of the set of four being covered,
- Redesign of a wall constructed with luxfer tiles; part of the wall covered with a lightweight construction, made of water-proof plaster board on the inside, and of a layer of foamed polystyrene covered with plaster in the same manner as in the light-wet method on the outside. Part of the wall will be replaced with a PC panel.

The total cost of the project has been estimated at PLN 96 000 and the investment payback time at 5.5 years.
The calculated energy savings depend on the option and vary between 25% and 59 %, assuming an increase in the heating system efficiency of 16%.

3.3.2 Demonstration works and training of technicians

Subsequently, the City and FEWE had selected two buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

1. Medical Centre at Broniewskiego Street
2. Municipal residential building at Broniewskiego 2

The works have been executed, in the following periods of time correspondingly:
from April 15 to May 30 from May 4 to July 30 (December 30-insulation of the attic)

As it was mentioned before the building at Broniewskiego 2 was awarded the title "Modernization of the Year 1999"

List of technicians trained in Nowy Sącz

No.	Name and surname	Status
1	Andrzej Białk	Skills extended
2	Janusz Kowalczyk	Skills extended
3	Mariusz Kowalczyk	Skills extended
4	Michał Kowalczyk	Skills extended
5	Jan Kotas	Skills extended
6	Jan Nowak	Skills extended
7	Leszek Siedlarz	Skills extended
8	Marek Siedlarz	Skills extended
9	Wojciech Siedlarz	Skills extended
10	Zenon Szkaradek	Skills extended

3.3.3 City-Wide extrapolation

The data obtained from the analysis of the questionnaires, supplemented with the data describing the structure of the housing stock obtained from the City Hall and engineering information, enabled us to make extrapolations giving the estimates of the *city wide* heat energy saving potentials, that can be realized by implementing *city wide* projects using the
most cost effective measures identified in the Project falling into the category of low-cost investments.

The results of those extrapolations are summarized in Tables 3.3.1 - 3.3.4. below

Table 3.3.1. Energy savings due to weatherproofing of window carpentry in different "PRE" condition groups in Nowy Sącz.

„PRE" carpentry condition	type of the buildings					
	detached houses		multifamily housing		Street-line houses	
	Area [m^2]	Savings [GJ]	Area [m^2]	Savings [GJ]	Area [m^2]	Savings [GJ]
0	362 732	0	19 643	0	31500	0
1	380 161	87 437	130 357	29 982	55 929	12 864
2	194 982	76 043	140 179	50 839	76 821	21 812
3	115 464	62 351	358 929	70 393	73 286	30 201
4	35 946	22 287	243 750	80 821	83 893	34 676
Total:	1 089 286	248 118	892 857	232 036	321429	99 553

Table 3.3.2 Investment costs and pay-back times for weatherproofing vs. replacement of window carpentry in Nowy Sącz.

Area [m^2]	Savings [GJ]	Savings [PLN]	investment costs		SPBT [years]	
			weather proofing	replacement	weather proofing	replacement
2 303 571	579 706	14 492 652	28 491 493	158 946 429	*2,0*	*11,0*

Table 3.3.3. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Nowy Sącz.

Investment	Area [m^2]	Savings [GJ]	Savings [PLN]	SPBT [years]
insulation of ventilated attics	164 017	1 565 618	5 166 540	3,3
installation of radiator shields	61 506	1 195 958	1 291 635	1,1

3.4 Lubań

Lubań was the fourth town of the Project where the work was begun. The main implementation stages were carried out in the period between July 1 and October 15, 1999. An agreement was signed between FEWE-Krakow and the Lubań Municipality on January 3, 1999 according to the requirements of the project. This defined the mutual undertakings for the implementation of the project. The agreement was signed by: Mayor Konrad Rowiński and Vice-Mayor Wiesław Wydra, on behalf of Lubań Municipality and by Adam Guła Director of FEWE's Krakow Center on behalf of FEWE. The Municipality assigned Piotr Browarczyk as a local co-ordinator of the project. General supervision of the works in relation to the contacts with FEWE was carried out by Vice-Mayor Wiesław Wydra.

According to the agreement the Municipality declared to cover all material purchases and contribute in-in kind the necessary amount of time as their input to the project. By the day when this report was being completed, the input of the Municipality amounted to PLN 72 816,69.

The input covered:

- The cost of external cladding of buildings paid directly to contractors outside FEWE — PLN 34 031,69
- Input of their own time. — PLN 38 785,00

  and
- Repayment of the cost of insulation materials installed by FEWE — PLN 34 031,69

Total PLN **73 476,69**

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID.

3.4.1 Energy Audits

According to the Project scope of work, five buildings were selected for the energy audits

- Residential building at Kolojowa #36
- Residential building at Kazimierza Wielkiego #5a-5e
- Residential building at Kazimierza Wielkiego #9a-9e
- Primary School #4 at Skalnicza Street
- Kindergarten #44 at Różana Street

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

The amounts of potential saving of heat energy are only given here for the cost-effective and medium capital-intensive options. The capital intensive projects are included in the schedule (which mainly involved replacement of wooden fixtures and fittings).

Block of flats at ul. Kolejowa 36
Volume heated - 5 516 m^3, number of flats - 45, number of residents - 117. The building was constructed in 1970 from pre-fabricated units of the "WBL-16" type. The heating system was under modernisation during the audit. At present, heat is supplied by a new gas boiler. The thermal power demand of the building has been estimated at 188 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 1 761 GJ/year.

The optimal option included the following projects:
- Installation of heat-reflective panels behind the radiators,
- Insulation of the ceiling above the top storey with a 7-cm thick layer of glass wool using the blowing method,
- Weatherstripping/sealing of the windows and their adjustment.

The total cost of this project has been estimated at PLN 186,000 and the investment payback time at 5.7 years. The calculated energy savings depend on the option and vary between 34% and 51 %, assuming an increase in the heating system efficiency of 26%.

Block of flats at ul. Kazimierza Wielkiego 5a-5e
Volume heated - 10 582 m^3, number of flats - 80, number of residents - 210. The building was constructed in 1972 from prefabricated units of the "WBL-14" type. Heat is supplied from the municipal district heating network by means of a hydro-elevator heat distribution centre .
The thermal power demand of the building has been estimated at 320 kW, while the average heat energy demand in winter (considering the system's efficiency levels) is 3 400 GJ/year.

The optimal option included the following projects:
- Installation of heat-reflective panels behind the radiators,
- Weatherstripping/sealing of the windows and their adjustment,
- Insulation of the ceiling above the top storey with a 13-cm thick layer of glass wool using the blowing method,
- Modernisation of the heating system involving modernisation of the heating distribution centre (replacement of the hydro-elevator distribution centre with an exchanger one) and modernisation of the central heating installation (flushing of the system, installation of thermostatic valves, automatic air locks etc.)

The total cost of the project has been estimated at PLN 259,000 and the investment payback time at 6.5 years. The calculated energy savings depend on the option and vary between 20% and 60%,assuming an increase in the efficiency of the heating system of about 16%.

Block of flats at ul. Kazimierza Wielkiego 9a-9e
Volume heated - 10 582 m^3, number of flats - 80, number of residents - 210. The building was constructed in 1972 from prefabricated units of the "WBL-14" type. Heat is supplied from the municipal district heating network by means of a hydro-elevator heat distribution centre.
The thermal power demand of the building has been estimated at 320 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 3 400 GJ/year.

The optimal option included the following projects:

- Installation of heat-reflective panels behind the radiators,
- Weatherstripping/sealing of the windows and their adjustment,
- Insulation of the ceiling above the top storey with a 13-cm thick layer of glass wool using the blowing method,
- Modernisation of the heating system involving modernisation of the heating distribution centre (replacement of the hydro-elevator distribution centre with an exchanger one) and modernisation of the heating installation (flushing of the system, installation of thermostatic valves, automatic air locks etc.)

The total cost of the project has been estimated at PLN 259,000 and the investment payback time at 6.5 years. The calculated energy savings depend on the option and vary between 37% and 60%, assuming an increase in the efficiency of the heating system of about 10%.

Primary School no. 2, at ul. Skalnicza 3
Volume heated - 4 332 m^3, number of pupils – 188, teachers - 28 plus 8 other employees. The building was constructed in 1965 from prefabricated units of the "Żerań" type. Heat is supplied from a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 265 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 2 100 GJ/year.

The optimal option included the following projects:

- Renovation and weatherstripping/sealing of the wooden window frames and installation of manual intake ventilators,
- Insulation of the external wall flanking the gymnasium with a 10-cm thick layer of foamed polystyrene using the light-wet method.
- Insulation of the ceiling-roof with a 6-cm layer of glass wool.
- Insulation of all walls (except for the one mentioned above) with a 14 cm layer of foamed polystyrene using the light- wet method.
- Redesign of a wall constructed with luxfer tiles; part of the wall covered with a lightweight construction, made of water-proof plaster board on the inside, and of a layer of foamed polystyrene covered with plaster in the same manner as in the light-wet method on the outside. Part of the wall will be replaced with a PC board.
- Installation of reflective film on the weatherstripped/sealed windows.

The total cost of the project has been estimated at PLN 214,000 and the investment payback time at 3.8 years. The calculated energy savings depend on the option and vary between 20% and 40%, excluding modernisation of the heating system (the boiler and central heating system currently under modernisation)

Nursery school at ul. Różana
Volume heated - 2 678 m^3. The building was constructed in 1958 from brick. Heat is supplied by a gas boiler installed in the basement.
The thermal power demand of the building has been estimated at 143 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 862 GJ/year.

The optimal option included:

Insulation of the ceiling above the staircase with a 8-cm insulation layer.
- Weatherstripping/sealing of the wooden window frames and installation of manual intake ventilators,
- Insulation of the roof above the pram-room with a 11-cm insulation layer,
- Insulation of the ceiling above the basements which are not heated with a 12-cm insulation layer,
- Insulation of the ceiling above the ground floor with a 12-cm insulation layer,
- Insulation of the walls of the pram-room with a 12-cm layer of foamed polystyrene.

The total cost of this project has been estimated at PLN 82,000 and the investment payback time is 5.5 years. As a result, 62 % of the energy and 56 % of the heating-related expenses will be saved.

3.4.2 Demonstration works and training of technicians

Subsequently, the City and FEWE had selected two buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

1. Residential building, at Kolejowa #36
2. Primary School #4, at Skalnicza Street

The works have been executed, in the following period of time: July 1 and October 15, 1999

List of trained technicians

No.	Name and surname	status
1	Michał Abramczyk	Unemployed
2	Tadeusz Burczyński	Unemployed
3	Daniel Podgórny	Unemployed
4	Grzegorz Ptasiński	Unemployed
5	Jerzy Szepietowski	Retrained
6	Arkadiusz Szulc	Unemployed
7	Marcin Tyrański	Unemployed
8	Artur Waniewski	Unemployed

3.4.3 City-Wide Extrapolation

As ion the other cities, the data obtained from the analysis of the questionnaires, supplemented with the data describing the structure of the housing stock obtained from the City Hall and engineering information, enabled us to make extrapolations giving the estimates of the *city wide* heat energy saving potentials, that can be realized by implementing *city wide* projects using the most cost effective measures identified in the Project falling into the category of low-cost investments.

The results of those extrapolations are summarized in Tables 3.4.1 – 3.4.4. below

Table 3.4.1. "PRE" carpentry condition fraction determined by the poll survey for multifamily houses in Lubań.

„PRE" carpentry condition	multifamily housing
0	3,5%
1	15,0%
2	20,3%
3	35,2%
4	26,0%
Total:	100,0%

Table 3.4.2. Energy savings due to weatherproofing of window carpentry in different "PRE" condition groups in Lubań.

„PRE" carpentry condition	multifamily housing	
	Area [m^2]	Savings [GJ]
0	9 418	0
1	40 364	9 284
2	54 625	15 742
3	94 720	21 796
4	69 964	25 025
Total:	269 091	71 847

Table 3.4.3. Investment costs and pay-back times for weatherproofing vs. replacement of window carpentry in Lubań.

Area [m^2]	Savings [GJ]	Savings [PLN]	investment costs [PLN]		SPBT [years]	
			weather proofing	replacement	*weather proofing*	replacement
269 091	71 847	1 796 182	4 173 682	18 567 279	*2,3*	*10,3*

Table 3.4.4. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Lubań.

Investment	Area [m^2]	Savings [GJ]	Savings [PLN]	Inputs [PLN]	SPBT [years]
insulation of ventilated attics	107 636	26 909	672 728,0	3 390 547	*5,04*
insulation of traditional attics	161 455	48 436	1 210 910,0	17 437 097	*14,4*
installation of radiator shields	16 145	8 073	201 818,3	339 055	*1,7*

3.5 Trzcianka

Trzcianka was the 5th town where the work was begun. The main implementation stages were carried out in the period between January 15 and March 30, 1999. An agreement was signed between FEWE-Krakow and the Trzcianka Municipality on January 3, 1999 according to the requirements of the project. This defined the mutual undertakings for the implementation of the project. The agreement was signed by: Mayor Paweł Kolendowicz, on behalf of Trzcianka Municipality and by Professor Adam Guła Director of FEWE's Krakow Centre on behalf of FEWE. The Municipality assigned Wojciech Roman as a local co-ordinator of the project, and Danuta Wojtków and Florian Gielnik as his assistants. General supervision of the works in relation to the contacts with FEWE was carried out by Mayor Paweł Kolendowicz.
Considering the budget constraints the Municipality allocated PLN 30 000 as their input to the project. The factor that decided about choosing Trzcianka (as it was the case with Lubań) was its membership in LGPP and PNEC which made meant co-operation prospects By the day when this report was being completed, the input of the Municipality amounted to PLN 28 549,09.

The input covered:

- Input of their own time. PLN 10 124,00
  and
- Repayment of the cost of insulation materials
  Installed by FEWE PLN 18 425,09

Total PLN **28 549,09**

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID.

3.5.1 Energy Audits

According to the Project scope of work, five buildings were selected for the energy audit

- Municipal residential building at Grottgera 5

- Municipal residential building at Sikorskiego 42
- Municipal residential building at Sikorskiego 25/27
- Primary School in Przyłęki
- Primary School in Rychlik

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

Block of flats at ul. Grottgera 5

Volume heated - 1 253 m^3, number of flats - 12, number of residents – 42. The building was constructed in 1961 from brick, heated with coal ceramic stoves.
The thermal power demand of the building has been estimated at 70 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 2 960 GJ/year.

The optimal option included the following projects:

- Weatherstripping/sealing of the windows and their adjustment, installation of separate manual intake ventilators,
- Insulation of the ceiling-roof with a 5-cm layer of glass wool,
- Insulation of the internal walls in the staircase with a 12-cm layer of foamed polystyrene,
- Insulation of the ceiling above the basements which are not heated with a 10-cm layer of foamed polystyrene,
- Insulation of the external walls with a 14-cm layer of foamed polystyrene using the light/wet method,
- Modernisation of the present heating system involving replacement coal stoves with individual heaters - using two-functional gas heaters (option to heat water for consumption).

The total cost of the project has been estimated at PLN 175,000 and the investment payback time at 4.3 years. The calculated total savings depend on the option and vary between 76% and 95%, assuming an increase in the efficiency of the heating system of about 53% (tiles stoves replaced with gas ones), and an increase in hot water production for consumption of 50%; i.e. with respect to the partitions between 23 and 42%.

Block of flats at ul. Sikorskiego 42

Volume heated - 2 261 m^3, number of flats - 14, number or residents - 35. The building was constructed in 1961 from brick and gas-concrete bricks, Akerman ceilings. The building is heated with coal ceramic stoves.
The thermal power demand of the building has been estimated at 95 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 4159 GJ/year.

The optimal option included the following projects:

- Weatherstripping/sealing of the windows and their adjustment, installation of separate manual intake ventilators,
- Insulation of the ceiling above the basements which are not heated with a 10-cm layer of foamed polystyrene,
- Insulation of the external walls with a 14-cm layer of foamed polystyrene, using the light/wet method,
- Insulation of the „balcony" walls with a 16-cm layer of foamed polystyrene using the light/wet method,
- Insulation of the internal walls in the staircase,
- Installation of reflective film on the weatherstripped/sealed windows,
- Insulation of the ceiling-roof with glass wool,
- Modernisation of the present heating system involving replacement coal stoves with individual heaters - using gas heaters (option to heat water for consumption).

The total cost of the project has been estimated at PLN 240,000 and the investment payback time at 4.0 years. The calculated total savings depend on the option and vary between 80% and 90%, assuming an increase in the efficiency of the heating system of about 53% (coal tiles stoves replaced with gas ones), and an increase in hot water production for consumption of 50%; i.e. with respect to the partitions between 27 and 37%.

Block of flats at ul. Sikorskiego 25-27

Volume heated - 5 455 m^3, number of flats - 47, number of residents - 181. The building was constructed in 1967 from brick. Heat supplied by a local boiler by means of a heat distribution centre.

The thermal power demand of the building has been estimated at 269 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 2 424 GJ/year.

The optimal option included the following projects:

- Installation of cost calculators,
- Installation of heat-reflective panels behind the radiators,
- Weatherstripping/sealing of the windows and their adjustment,
- Insulation of the ceiling-roof,
- Insulation of the ceiling above the basements which are not heated,
- Insulation of the external walls.

The total cost of the project has been estimated at PLN 105,000 and the investment payback time at 3.5 years. Approximately 34% of energy savings will be generated and about 32 % of heating-related expenses will be saved.

Primary school in Przyłęki

Volume heated - 1 863 m^3, number of pupils - 101 (9 teachers and 3 employees). The building was constructed in 1965 from brick. Heat is supplied by a coal boiler installed in a nearby building.
The thermal power demand of the building has been estimated at 72 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 707 GJ/year.

The optimal option included:

- Installation of heat reflective panels behind the radiators,
- Weatherstripping/sealing and renovation of wooden windows,
- Replacement of a luxfer wall with a PC panel,
- Insulation of the external walls (North and West directions) with a 20-cm layer of foamed polystyrene, using the light/wet method,
- Modernisation of the heating system involving replacement of the present thermal network with pre-insulated pipes including the heat distribution centre installed in the school.

The total cost of the project has been estimated at PLN 54,000 and the investment payback time at 5.4 years. The calculated total savings depend on the option and vary between 25% and 45%, assuming an increase in the efficiency of the heating system of about 8% (replacement of the thermal network), i.e. with respect to the partitions between 17 and 37 %.

Primary school in Rychlik

Volume heated - 186 m^3. The building was constructed in 1972 from brick and gas-concrete bricks, ceilings constructed from prefabricated units of the "DZ-3" type. Heat supplied by a coal boiler installed in the basement.
The thermal power demand of the building has been estimated at 97 kW, while the average heat energy demand in winter (considering the heating system's efficiency levels) is 2 157 GJ/year.

The optimal option included:

- Installation of heat reflective panels behind the radiators,
- Weatherstripping/sealing and renovation of wooden windows, and installation of manual intake ventilators,
- Modernisation of the boiler-room (replacement coal boilers with oil ones) and a central heating system (flushing of radiators, installation of thermostat valves, pressure control valves and automatic air-locks, installation of weather regulating devices, etc.)
- Connection of the consumption hot water system to the heat exchanger and installation of water-saving devices.

The total cost of the project has been estimated at PLN 86,000 and the investment payback time at 6.6 years. The calculated total savings depend on the option and vary between 55% and 70%, assuming an increase in the efficiency of the heating system of about 37%, i.e. with respect to the partitions between 17 – 37 %.

3.5.2 Demonstration works and training of technicians

Subsequently, the City and FEWE had selected two buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

1. Primary School at Rychlik
2. Municipal building at Grottgera 5

The works have been executed, in the following periods of time, correspondingly:

1. from January 5 to March 11, 2000
2. from February 20 to March 18, 2000

List of technicians trained in Trzcianka

No.	Name and surname	status
1	Henryk Bagrowski	Retrained
2	Jacek Brzychczy	Unemployed
3	Piotr Brzychczy	Unemployed
4	Hieronim Dolata	Unemployed
5	Adam Helwich	Unemployed
6	Stanisław Kuszyński	Unemployed
7	Jerzy Małecki	Retrained
8	Andrzej Sztejkowski	Skills extended
9	Ireneusz Szymczak	Unemployed

3.5.3 City-Wide Extrapolations

Examples of the results of City-Wide extrapolations based on the data collected from th analysis of the questionnaires and information provided by the City are summarized in Tables 3.5.1. - 3.5.4. below

Table 3.5.1 "PRE" carpentry condition fraction determined by the poll survey for detached and multifamily houses in Trzcianka.

„PRE" carpentry condition	type of the buildings	
	detached houses	multifamily housing
0	18,8%	5,0%
1	29,2%	14,8%
2	29,2%	19,4%
3	12,5%	32,0%
4	10,4%	28,8%
Total:	100,0%	100,0%

Table 3.5.2. Energy savings due to weatherproofing of window carpentry in different "PRE" condition groups in Trzcianka.

„PRE" carpentry condition	type of the buildings			
	detached houses		multifamily housing	
	Area [m^2]	Savings [GJ]	Area [m^2]	Savings [GJ]
0	14 805	0	15 750	0
1	22 995	5 289	46 620	10 723
2	22 916	8 937	61 110	18 182
3	9 844	5 316	100 800	25 175
4	8 190	5 078	90 720	28 904
Total:	78 750	24 620	315 000	82 984

Table3.5.3. Investment costs and pay-back times for weatherproofing vs. replacement of window carpentry in Trzcianka.

Area [m^2]	Savings [GJ]	Savings [PLN]	investment costs		SPBT [years]	
			weather proofing	replacement	*weather proofing*	replacement
393 750	107 603	2 690 080	4 672 899	27 168 750	*1,7*	*10,1*

Table3.5.4. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Trzcianka.

Investment	Area [m^2]	Savings [GJ]	Savings [PLN]	Inputs [PLN]	SPBT [years]
insulation of ventilated attics	31 500	7 875	196 875	992 250	*5,04*
insulation of traditional attics	283 500	56 700	1 417 500	17 860 500	*12,60*
installation of radiator shields	3 544	1 772	44 297	74 419	*1,68*

3.5 Białystok

Białystok was the last town where the work was carried out. An agreement was signed between FEWE-Krakow and the Białystok Municipality on 13 May 1999. However, the details which led to the final contract between FEWE-Krakow and the City of Białystok was signed only on 23 May 2000. The latter finally defined the mutual undertakings for the implementation of the project. The agreement was signed by: Vice-Mayor Marek Kozłowski and Member of the City Board Krzysztof Sawicki, on behalf of Białystok Municipality and by Adam Guła Director of FEWE's Krakow Center on behalf of FEWE. The Municipality assigned Ms Danuta Żędzian as a local co-ordinator of the project and Ms Elżbieta Garbacik and Ms Lucyna Mroczko as her assistants.

The Municipality agreed to spend up to 300 000 PLN on the needed materials (apart from their in-kind contribution) as their input to the project.

After the audits of the five buildings had been completed and the buildings for demonstration works selected the City asked FEWE to change the latter ones for other buildings which had not been audited previously and extend the project to a large Primary School no 9 which was grossly exceeding the assumed size of ca. 3 000 cubic meters. Since the new objects were very interesting form the point of view of achieving the project goals, FEWE applied to GEF/SGP at UNDP Warsaw for a grant that would make it possible to extend the scope of work that was previously planned. The grant of 25 000 USD was obtained in April 2000.

It has been decided that the GEF will be used to cover the works in the adjacent parts of the core building, which required - apart from additional funding - also more time than was available before the Project were to terminate in the end of August 2000. The end of the works under the GEF is scheduled for the end of April 2001.

By the day when this report was being completed, the input of the Municipality has contributed in committed reimbursements for the materials used and in-kind the amount of 101 171,56 PLN.

This input covers:

• Repayment of the cost of insulation materials installed by FEWE	61 671,56 PLN .
• Input of their own time	39 500,00 PLN
Total	**101 171,56** PLN.

All other costs of training, performance, technical and engineering supervision, energy audits, project organization, and measurements as well as data collection and analysis were covered by USAID.

3.6.1 Energy Audits

According to the Project scope of work, five buildings were selected for the energy audits

- Municipal residential building, Skłodowskiej 11,
- Municipal residential building Żabiej 14,
- Municipal residential building Broniewskiego 8a,
- Municipal residential building ul. Zamenhoffa 1,
- Kindergarten no 44 ul. Antoniukowska 9,

The relevant audits are have been executed and submitted to the City. Full audit reports in Polish have been also submitted to USAID with the corresponding executive summaries.

Subsequently, the City had selected two additional buildings for the actual implementation of the low-cost thermal renovation works indicated by the audits. These were:

- Primary School no 9 Sucha 2,
- Kindergarten no 41 Stasica 18.

For those two **additional** objects only preliminary audits have been made by the end of the project, the reaming part of the work will be the *follow-up* of the Project and will be covered by the GEF grant and the additional funding by the City.

The apartment building situated at 11 Skłodowskiej St.

The volume of space requiring heating amounts to: 6,552 m^3, the number of apartments – 55, the number of inhabitants –114. This building was constructed in 1964 of brick and aerated concrete blocks. It receives thermal energy from the municipal district heating network through a thermal centre. The thermal power requirements amount to 280 kW. The seasonal thermal energy requirement amounts to 3,216 GJ/year (including efficiency of the heating system).

The project, in its most extensive form, is comprised of the following components:

- Renovation of the existing heating system (i.e. flushing of the entire system, installing thermostatic valves, differential pressure valves, and cost allocators)
- Installation of thermal radiator screens
- Weather-proofing and renovation of existing window frames
- Insulating ceilings on the top floor
- Insulating ceilings in the cellars that are not being heated

The total cost of the entire project has been estimated at PLN 124,000, and the payback period at 4.4 years. The total estimated savings, depending on the variant chosen for implementation, range from 37% to 77%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 22%, the range due to the abovementioned works is 15% – 55%.

The apartment building situated at 8a Broniewskiego St.

The volume of space requiring heating amounts to: 7,432 m^3, the number of apartments – 75, the number of inhabitants – 275. This building was constructed in 1965 of brick and aerated concrete blocks. It receives thermal energy from the municipal heat distribution network through a thermal centre. The thermal power requirements amount to 343 kW. The standard seasonal thermal energy requirement amounts to 4,603 GJ/year (including efficiency of the heating system).

The project, in its most extensive form, is comprised of the following components:

- Renovation of the existing heating system (i.e. flushing of the entire system, installing thermostatic valves, differential pressure valves, cost allocators, heat exchanger, creation of a design, installing weather control)
- Installation of thermal screens
- Weather-proofing and renovation of existing window frames
- Insulating ceilings on the top floor
- Insulating ceilings in the cellars that are not being heated

The total cost of the entire project has been estimated at PLN 226,000, and the payback period at 5.3 years. The total estimated savings, depending on the variant chosen for the implementation, range from 37% to 77%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 22%, the range due to the above mentioned works is 15% – 55%.

The apartment building situated at 1 Zamenhoffa St.

The volume of space requiring heating amounts to: 4,525 m^3, the number of apartments – 23, the number of inhabitants – 86. This building was constructed in 1957 of brick. It receives thermal energy from the municipal district heating network through a thermal centre. Thermal power requirements amount to 200 kW. The standard seasonal thermal energy requirement amounts to 3,151 GJ/year (including efficiency of the heating system).

The project, in its most extensive form, is comprised of the following components:

- Renovation of the existing heating system (i.e. flushing of the entire system, installing thermostatic valves, differential pressure valves, and cost allocators)
- Installation of thermal radiator screens
- Weather-proofing and renovation of existing window frames
- Insulating of ceilings on the top floor
- Insulating of ceilings in the cellars that are not being heated

The total cost of the entire project has been estimated at PLN 57,000, and the payback period at 3.3 years. The total estimated savings, depending on the variant chosen for implementation, range from 17% to 55%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 6%, the range due to the abovementioned works is 11% – 49%.

The apartment building situated at 14 Żabia St.

The volume of space requiring heating amounts to: 6,176 m^3, the number of apartments – 60, the number of inhabitants – 180. This building was constructed in 1973 of brick and aerated concrete blocks. It receives thermal energy from the municipal district heating network through the thermal centre. The thermal power requirements amount to 212 kW. The standard seasonal thermal energy requirement amounts to 3,849 GJ/year (including efficiency of the heating system).

The project, in its most extensive form, is comprised of the following components:

- Renovation of the existing heating system (i.e. flushing of the entire system, installing thermostatic and differential pressure valves, cost allocators)
- Installation of thermal radiator screens
- Weather-proofing and renovation of existing window frames
- Insulating ceilings on the top floor
- Insulating ceilings in the cellars that are not being heated

The total cost of the entire project has been estimated at PLN 139,000, and the payback period at 4.7 years. The total estimated savings, depending on the variant chosen for implementation, range from 14% to 71%. Since this includes an assumed increase of the efficiency of the thermal system amounting to 6%, the range due to the above mentioned works is 8% – 65%.

3.6.2 Demonstration work and training of technicians

As mentioned above the City has replaced the two initially chosen building by

- Primary School no 9 Sucha 2,
- Kindergarten no 41 Stasica 18.

By the end of the Project the Kindergarten has been fully completed and the core building of School no 9, as the USAID funding and project time limit allowed. The GEF project will terminate in the end of April 2001.

lp.	Imię i Nazwisko	Adres
1	Leszek Kosior	Unemployed
2	Andrzej Kościelecki	Unemployed
3	Artur Królik	Unemployed
4	Bogusław Mańkowski	Unemployed
5	Marek Omeljanowicz	Unemployed
6	Wojciech Speichler	Retrained
7	Romuald Strzymiński	Unemployed
8	Krzysztof Szałaj	Skills extended
9	Tomasz Tołcz	Unemployed
10	Zdzisław Tołcz	Retrained
11	Jarosław Wagenheim	Retrained
12	Tadeusz Wagenheim	Retrained

3.6.3 City-Wide Extrapolation

The results of the extrapolations for Białystok are summarized in Tables 3.6.1.- 3.6.4. below.

Table 3.6.1. "PRE" carpentry condition fraction determined by the poll survey for multifamily houses in Białystok.

„PRE" carpentry condition	multifamily housing
0	6,1%
1	15,3%
2	20,2%
3	27,3%
4	31,1%
Total:	100,0%

Table 3.6.2. Energy savings due to weatherproofing of window carpentry in different "PRE" condition groups in Białystok.

„PRE" carpentry condition	Multifamily housing	
	Area [m^2]	Savings [PLN]
0	262 613	0
1	669 663	3 850 563
2	884 130	8 399 239
3	1 194 889	15 832 281
4	1 361 211	20 758 463
Total:	4 372 506	48 840 546

Table 3.6.3. Investment costs and pay-back times for weatherproofing vs. replacement of window carpentry in Białystok.

Area [m^2]	Savings [PLN]	investment costs [PLN]		SPBT [years]	
		weather proofing	replacement	weather proofing	replacement
4 372 506	48 840 546	59 087 486	301 702 937	1,2	6,2

Table 3.6.4. Investment costs, energy savings and pay-back times for attic insulation and installation of radiator shields in Białystok.

Investment	Area [m^2]	Savings [GJ]	Savings [PLN]	Inputs [PLN]	SPBT [years]
insulation of ventilated attics	273 097	68 274	1 706 853	8 602 540	5,0
insulation of traditional attics	598 898	179 669	4 491 736	64 680 999	14,4
installation of radiator shields	52 320	26 160	653 996	1 098 713	1,68

4. DISSEMINATION ACTIVITIES

The USAID Project was presented during many seminars, conferences, meetings, special events in Poland and in abroad. The engagement of all partners involved in project has been described in many publications in nationwide and in local newspapers and bulletins, broadcasts and 20 minutes video film. Here is the list presenting the different ways of the dissemination of development and results of the Project.

1. Seminars and conferences

- "*What roles are there for municipalities in the city of the future*", annual seminar of Energie Cites, Barcelona, 12.03-13.03.1998, **A.Guła**
- In March 1999, Poznan, during the seminar concerning the modernization of house buildings, **M.Surówka**
- The seminar organized by USAID, NAPE and FEWE in Warsaw for the local governments, on 24.06.1999, **A.Guła, J. Markiewicz**
- *"How to reduce energy consumption in school buildings"*, Ustroń, 16.11-19.11.1999, **A.Guła**
- **J. Markiewicz**
- "*The Communal Energy Projects and Environment Protection*", Pólish - American Seminar, Kraków-Łopuszna, 6.12.-8.12.1999, **A.Guła, J. Markiewicz, M. Stankiewicz**
- *"Less Energy - More Money"*, Wilkasy, 28.02.-29.02.2000, **M. Stankiewicz**
- *"Tychy - Energia - Oszczędność"*, Tychy, 6.03.-7.03.2000, **A.Guła**
- *"The Local Economy and Energy Policy. Polish Obligation Following the Kioto Protocol"*, Starbienino, 25.04.-30.04.2000, **Ł.Pytliński**
- The final seminar titled „*The Gaining and Using of Foreign Grants for Environemental Protection - Examples*" organized by Polish Network "Energie Cities", Nowy Sącz City Council and FEWE on 18-19 September 2000, during which the results were presented **A.Guła, J.Markiewicz, M.Surówka**
- The Plans of Energy Saving Investments, elaborated in frame of USAID Project, were handed to those local community representatives who participated in the Project :
  - Mr. Andrzej Czerwiński from Nowy Sącz,
  - Mr. Wiesław Wydra from Luban,
  - Mr. Jan Kogut from Olsztynek,
  - Mr. Roman Zozula from Trzcianka, and
  - Mr. Bogusław Tylek from Krapkowice.
- „*Course on sustainable energy for local administrators*", Tempus Project, 27.09-9.10.2000, **A.Gula, J.Markiewicz**

2. The most important meetings

- Presentation of USAID Project by **Adam Guła** during the meeting with inhabitants and authorities of the city of Nowy Sącz (April 10, 1999) - **Mr.Czerwiński**, Mayor of the City was present.
- In May 2000 **J.Markiewicz** and **J.Zawada** performed presentation of City Wide Plan for city of Luban and gave the evaluation of works done in the chosen buildings.
- In June 2000 **Ł.Pytliński** and **M.Surówka** performed presentation of City Wide Plan for city of Krapkowice and gave the evaluation of works done in the chosen buildings.
- In June 2000, during the celebration of Nowy Sącz City Council meeting, **A.Guła**, **Ł.Pytliński** and **M.Surówka** performed presentation of City Wide Plan for city of Nowy Sącz and gave the evaluation of works done in the chosen buildings.
- In July 2000, during the Olsztynek City Council meeting, **A.Guła**, performed presentation of City Wide Plan for city of Olsztynek and gave the evaluation of works done in the chosen buildings.

- In July 2000, during the Białystok City Council meeting, **A.Guła**, **Ł.Pytliński** and **M.Surówka** performed presentation of City Wide Plan for city of Olsztynek and gave the evaluation of works done in the chosen buildings.

3. Special events

- In January 2000 in the USAID Office in Kiev during her visit on the occasion to undersign the EkoLinks project **M. Stankiewicz**
- The general assembly of Polish Network „Energie Cites" on March 29, 2000 in Warsaw, **M.Stankiewicz**
- The Earth Day Celebration in Krakow in April 2000 the presentation of USAID Project and the presentation of low-cost methods of energy saving were performed.

4. Publications

- "Development of city-wide energy efficiency investment plans for cities, demonstrations of low-cost energy saving measures and professional strengthening of local SMEs towards offering thermal modernization services" by **Adam Guła** in TEXTE No.27/00, Seminar Proceedings, Ostritz, Germany, December 6-10, 1999.
- There were edited and published two monthly bulletins of Polish Network „Energie Cites" containing the description of gained Project results: No.17/2000 (regarding Olsztynek, Trzcianka, Białystok) and No.18/2000 (regarding Krapkowice, Lubań, Nowy Sącz) **M.Stankiewicz**
- Article "Heat-Saving Jobs and Companies" by **Adam Guła** in Sustainable Energy News No.30, August 2000 - newsletter of International Network for Sustainable Energy
- Brochure "How to save heat energy having little money?", September 2000, **A.Guła**

5. Articles in Newspapers

- "Dziennik Polski", No.43, 20-21.02.1999
- "Gazeta Wyborcza", No. 43, 20-21.02.1999
- "Ziemia Lubanska", No.6, 24.03-7.04.1999
- "Gazeta Olsztyńska", No. 81, 27.04.1999
- "Gazeta Samorzadowa", No.21/22, 19.07-1.08.1999
- "Gazeta Wspolczesna","Monitor Bialostocki", No 108, 2.08.1999
- "Gosc Niedzielny", No.13, 26.03.2000
- "Dziennik Polski", No.101, 29.04-1.05.2000-11-29
- "Kurier Poranny", 11.07.2000
- "Gazeta Wspolczesna", 11.07.2000

5. CONCLUDING REMARKS

The project had a pioneered character in Poland and presented many challenges to the project team. It was a difficult project in several respects:

- Breaking psychological barriers that low cost means ineffective
- Lack of good practice examples in this areas in Poland
- Budget constrains in the Cities - participating in the Project
- Opposition of some administration officials or city counselors driven by the aforementioned psychological barrier and possible pressure from the companies that make money on the high cost investments
- Political changes which took place in the beginning of 1999 in connection with the local elections and change of the administrative structure of the country
- Nature of the work with the unemployed people which in some cases led to problem with drinking alcohol or absence at work
- Lack of sufficient interest of the local unemployment offices, and neutral attitude of local governments to the unemployment (the unemployment costs were covered by the central budget)
- Time pressure of the shortening of the project duration by 4 mouths

This notwithstanding the project has ended with considerable success.

- All targets of the Project have been achieved and in most cases exceeded.
- The Project has triggered two GEF grants: in Krapkowice and Białystok. A third mayor GEF grant to integrate. low cost heat saving measures with conversion from coal to biomass in being processed.
- The message of the Project has spread to other cities in Poland and also in Ukraine and Slovakia.

Final remark is that the Project will have significant impact on Poland's fulfillment of the Kyoto targets.
However one should not expect that the large scale results will come immediately. This is confirmed in particular by the experience of the previous USAID Low Emissions Project in Kraków or the GEF Polish Efficient Lighting Project (PELP).

ACKNOWLEDGEMENTS

The successful completion of the project would not be possible without dedicated work of many people and support given to the project team by many institutions and individuals.

Special recognition and expressions of gratitude are due to:

USAID

Ms **Maryla Jakubowicz** was extremely helpful in giving the project team professional advice, which in some cases turned out to be critical for the success of the project. She has not limited her role to supervision of the project; she was creative and active in co-and profound knowledge of Polish realities, especially in the field of energy and environmental protection, combined with the understanding of the objectives set forth by American sponsors helped us to achieve the project goals. Ms **Alicja Piątkowska** and Ms **Ewa Stanisławska** assisted the project team in resolving the financial and formal questions. Finally, the interest in the project shown by **William M. Frej** constituted important moral support and encouragement for us which is greatly appreciated.

US Consulate in Kraków

The continued interest of the staff of United State Consulate in Kraków had a significant impact on our work. We are particularly grateful to Mr **Francis Scanlan**, US Consul General, Ms **Paula Thiede**, Mr **Marek Guzik** and Mr **Brett Pomainville** for helping us publicise the project and its achievements on several occasions, notably during the celebrations of Earth Day in April 1999 and April 2000.

GEF / SGP UNDP Warsaw

We greatly appreciate the contribution of 25 000 USD from the Global Environment Facility – Small Grants Program, UNDP Warsaw, which made possible extension of the project in Białystok. Apart from this institutional support we greatly acknowledge the continued and inspiring interest and involvement of Mr **Przemysław Czajkowski,** National GEF Project Co-ordinator.

American experts

The inspiration for FEWE team to propose the project to USAID in 1997 came from the success of the previous USAID/DoE project in Kraków in 1992–1994. Since then, the FEWE Kraków team continued to co-operate with the American experts and technicians who were transferring their knowledge, experience and skills to our staff. We are particularly grateful to Mr **Lawrence Markel** and Mr **George Reeves** who, while not formal partners in the project, where always ready to give us their advice and suggestions. Special gratitude is due to Mr Markel for his help in trouble shooting, which was rather frequent in our difficult and challenging project, and for his voluntary contribution to teach our trainees. We should emphasise that his lectures, especially on customers relations had a lasting impact on the trained technicians and managers.

Polish Network "Energic Cites"

Co-operation with the Association of Municipalities, PNEC (Polish Network "Energie Cites") in all phases of the project was a crucial factor in the successful implementation of the project and meeting its goals. PNEC has helped select the candidate cities and maintain working contacts with their local authorities. We should emphasise the creative support of the PNEC board with its chairman Mr **Zbigniew Lerarczyk**, MP, and with Mrs **Ryta Stożyńska**, deputy chair, Mr **Zdzisław Fadrowski**, Mayor of Ełk, in particular. We especially acknowledge PNEC contribution to publicising and disseminating the results of the project among other cities regular reporting on the progress of the project in their monthly bulletin, informing the media in Poland and abroad. It should be attributed to PNEC that cities which were formally not participating in the project: Miedźna, Bieruń, Słomniki and Brzozów have sent their technicians to be trained by the project team, using their own resources.

Alliance to Save Energy (ASE)

Due to the initiative of ASE and funding granted by USAID–Kiev, six technicians from Lviv could take part in the training, which helped transfer the American and Polish experience in thermal renovation to Western Ukraine. As a result, a similar project has been designed in the city of Truskavets, Ukraine and several Ukrainian municipalities have established a cooperative municipal network modelled on PNEC.
The initiative of Mr **Tom Lemley** in establishing the contacts and dedication in the work that had followed, is greatly acknowledged. The organisational assistance of Mr **Anatoliy Kopets** was particularly helpful.

University of Mining and Metallurgy in Kraków (AGH)

Two faculties of **AGH** made important contributions to the project: the Faculty of Fuels and Energy (FFE) and Faculty of Nuclear Physics and Techniques. In particular, the measurements of the result of thermal renovation of window carpentry performed using the gas chromatography, enabled us to make quantitative estimates of energy savings and draw conclusions that will help design future projects. The contributions of Prof. **Jan Lasa** and dr **Ireneusz Śliwka** should be mentioned, in particular. We should acknowledge also valuable assistance of more than ten postgraduate students of both faculties in collecting the data needed for the energy audits and the recommendations for the city governments which concluded the whole project.

Warsaw Technical University

The team of the WTU performed measurements of air infiltration after thermal renovation using the blower door technique. We especially acknowledge the contribution of dr **Jerzy Sowa**.

National Energy Conservation Agency (NAPE)

NAPE with Drs **Aleksander Panek** and **Maciej Robakiewicz** have verified the energy audits performed in the project and provided valuable comments and suggestions.

The participating cities

The project could not be completed without dedicated involvement and support of the city administration units, and the local project managers appointed by the city governments. Work of many individual people deserves acknowledgement. We would like especially thank the following people:

Krapkowice:

Mr **Bogumił Tylek**, director of Primary School No 4, the first object renovated in the project, for wonderful co-operation and help in dissemination of the project outcomes. Mr **Piotr Solloch**, mayor, Mr **Romuald Haraf** and Mr **Jan Nadbrzeżny** deputy mayors, and Mr **Andrzej Klaka**, local project co-ordinator.

Olsztynek

Mr **Jerzy Tytz,** former mayor, for his initiative to include Olsztynek in the project and Mr **Jan Kogut** for his dedicated efforts to make the project succeed. We also thank Ms **Elżbieta Linkiewicz**, director of the Gymnasium for co-operation in project implementation in her school.

Nowy Sącz

Mr **Andrzej Czerwiński,** mayor, and Mr **Józef Hojnor,** local project co-ordinator for their genuinely creative support which resulted-in, one of the most outstanding achievements of the project: nomination of one of the buildings of the project as "Thermal Renovation of the Year 2000" in the annual national competitions under auspices of the ministerial Office of Housing and City Development. We also greatly acknowledge the outstanding effort of organising the closing seminar of the project in Nowy Sącz; special thanks are due here to Ms **Alicja Marek.** We also express our gratitude to Ms **Beata Susuł -Klimek** for her help during the whole project duration in Nowy Sącz.

Lubań

Mr **Wiesław Wydra**, deputy mayor, for his initiative and support and Mr **Piotr Borowczyk**, local project co-ordinator for his assistance. We also thank Ms **Janina Zawodna** director of Primary School No 4 for co-operation.

Trzcianka

Mr **Paweł Kolendowicz**, mayor for his involvement, Mr **Wojciech Roman,** local project co-ordinator, and Mr **Roman Zozula** for his constant readiness to serve as a contact person. Ms director of the Primary School in Rychlik Ms **Elżbieta Sowa** for her valuable help and co-operation.

Białystok

Mr **Ryszard Tur**, mayor, for his support, especially in critical moments, Mr **Krzysztof Sawicki**, City Board member, Ms **Danuta Żędzian,** local project co-ordinator and Ms **Joanna Łempicka** for their involvement. We are particularly grateful and obliged to the former director of the kindergarten No 21 Ms. **Małgorzata Proskin** or splendid co-operation and assistance during the work in Białystok. We extend those expression of gratitude to Ms **Barbara Rzemieniecka**, the present director, the work with her an equally great pleasure. We should not

omit Mr **Leszek Koleśnik** the press secretary of the City Hall in Białystok for his very professional coverage of the project in the media.

Finally, sincere thanks to the staff of FEWE – Kraków and our cooperating Companies, Negawatt and Energored, whose dedicated work, persistence and professional skills contributed to the successful completion of the project, notably to: **Maria Stankiewicz, Jacek Markiewicz, Małgorzata Osewska, Maciej Surówka, Łukasz Pytliński, Łukasz Balon, Andrzej Kromka and Jerzy Zawada**. We should also acknowledge the dedication of our support staff: **Ania Jakiel-Miśtal Monika Krowicka-Ziembowicz, Małgosia Kabzińska, Arkadiusz Figórski, and Roma Cieśla.**

Adam Guła

Director

FEWE-Kraków

ANNEX

AGREEMENT WITH THE CITY OF NOWY SĄCZ - AN EXAMPLE

AGREEMENT

contracted on January 25, 1999 in Nowy Sącz

between

the Polish Foundation for Energy Efficiency (FEWE), headquarters in Warsaw - Center in Krakow, ul. Floriańska 55. 31-019 Krakow,
hereafter referred to as FEWE,
represented by
Prof. dr hab. Adam Guła – Director of FEWE, Center in Krakow, acting on the grounds as power of attorney, a copy of which is enclosed with the present Agreement,

and with the city of Nowy Sącz. hereafter referred to as the Participating City

represented by Andrzej Czerwiński – City Mayor

in the matter of the joint implementation of the project sponsored by USAID entitled. "Development of Small and Medium Enterprises Offering Services in Low-Cost Heat Saving Improvements of Buildings."

I. General Resolutions

§ 1.
Agreement Goals

1. The Parties in the Agreement have reached the goals of the joint implementation of the project, "Development of Small and Medium Enterprises Offering Services in Low-Cost Heat Saving Improvements of Buildings."

2. The aim of the above-mentioned project is to prepare a plan of energy saving investments for the receiving party in the Participating City and for FEWE to show the Participating City the plan's basis for low-cost investments initiated in residential buildings owned by the city and public places useful for publicizing improvements in their energy management.

3. The mutual intention of the Parties in this Agreement is to develop firms offering low-price energy saving services or to extend the range of activities of already existing firms within the indicated provision of services.

§ 2.
Time of Agreement Implementation

1. The Project referred to in this Agreement will be implemented in a period of twelve months from the date of signature on the enclosed Contract.
2. The Parties establish the project deadline to be January 31, 2000.

II. Basis of Implementation of the Agreement – Law and Obligations of the Parties

§ 3.
Obligations of the Participating City

1. The Participating City commits itself to cooperation with and giving all information required by FEWE necessary to implement the project, including information from providers of heat energy.
2. The Participating City commits itself to helping legally and organizationally the creation of or modification of firms, as mentioned in paragraph 3 § 1.
3. Under the goal of fulfilling the assignments specified in paragraphs 1 and 2 of the present clause, the Participating City will appoint a Project Coordinator and two assistants for the duration of the project, providing them with power of attorney.

4. The Local Coordinator of the project will be responsible for the following details:
a/ giving FEWE all necessary information to initiate the project,
b/ preparing reports about the project implementation,
c/ assurance of assets and supervision of the Participating City's financial obligations to the project,
d/ contacts with FEWE,
e/ participation in each stage of the project implementation,
f/ participation in the organized training for potential owners of firms implementing the project,
g/ preparation of a list of candidates for the training
h/ participation in the creation or modification of activity profiles of firms implementing the project,
i/ participation in the creation of the energy saving investment plan for the Participating City.
5. The Participating City appoints the following people as Local Project Coordinators:

Józef Hojnor, and his assistants:

1/ Janusz Obtułowicz

2/ Beata Klimek Susuł

§ 4.
FEWE Obligations

4. 1. Energy Saving Investment Plan

a. Within the framework of the project implementation, FEWE will perform the energy savings investment plan for the receiving party in the Participating City, and under that goal will inspect and use information collected from questionnaires predating the project's commencement.
b. In the specified plans, the investments and indicated priorities will be necessary and possible, consistent with principles of lowest cost planning.

4. 2. Building Selection for Energy Inspection
a. Under the agreement with the Participating City, a detailed energy review will be performed by FEWE workers and if necessary, FEWE specialists, in five buildings selected by FEWE.
b. The list of buildings, as referred to in paragraph 1 of the present clause, will be in an enclosure attached to this Agreement and will be signed by the Parties immediately after the building selection.

4. 3. Initiating Solutions Provided for in the Energy Savings Investment Plan
a. After performing the activities described in §4, paragraphs 4.1 and 4.2, FEWE will choose, in agreement with the Participating City, two buildings in town from among the building selected in paragraph 2, for which the following will be performed:
- initiating the proposed undertakings,
- analysis of gathered data and description of energy efficiency accomplishments after the project's completion.
b. The remaining three energy audits described in §4 paragraph 4.3 will be used for the goal of creating a preliminary packet of assignments for the specified subjects in paragraphs 1and 2 of the present clause.
c. The selected buildings should fulfill the following conditions:
- residential buildings: up to 5 stories with around thirty apartments,
- public buildings, especially schools: capacity up to around 3000 cubic meters.
d. According to the Participating City preferences, the supplier of energy, the possibility of replicating activities in buildings of similar structure and accessibility of funds from the Party can modify the conditions specified in paragraph 4.3.c.
e. The undertakings indicated in paragraph 4.3.a will have the following low-cost investment characteristics:
- repairs and waterproofing of the carpentry around the doors and windows,
- insulation of ceilings.
f. In the possibility that supplementary funds can be obtained, additional undertakings can be performed, in particular:
- installation of thermostatic valves,
- installation of weather controls
- insulation of external walls, especially those subject to winds - exclusively in buildings not higher than two stories.

g. The implementation of activities described in paragraph 4.3.f. of the present clause will be performed according to recommendations made from previous energy audits.

4.4. Training School for the Implementation of Project Goals
a. The Participating City will present the candidates, and the Parties will jointly choose local managers and local businessmen (2-5 persons) with respect to restructuring existing small firms in order to broaden the range of their activities or establishing new ones for the provision of services which would enable heat savings in buildings.
b. With the selected persons addressing the conditions described in paragraph 4.4.a of the present clause, FEWE will prepare and execute a suitable instruction program.
c. The Participating City will present and the Parties will choose the most suitable candidates (6-12 persons) from among local thermo-renovation technicians, who will be trained by FEWE without charge in the range of low-cost thermo-renovation techniques.
d. Energy efficiency investments in the two selected buildings will be performed by engineers and technicians from FEWE with the participation of persons indicated in paragraph 4.4.a on the basis of the energy audits.
e. FEWE does not cover insurance costs or possible payments to the trained technicians or businessmen.

III. Basis of Financing Agreements

§ 5
FEWE Services

1. In the framework of implementing the Agreements FEWE commits itself to performing the specified activities in §4 independent of costs according to the detailed list of buildings and works, which is an enclosure to the present Agreements.

2. Depending on needs the finances can consist of the provision of services or providing assets in-kind.

§ 6
Participating City Services

1. In the framework of implementing the Agreement the Participating City commits itself to:
a) assuring proper local conditions for the training execution;
b) purchasing materials for thermo-insulation in the form of seals, caulking, glass wools, etc. According to the lists enclosed with the present contract, the total will not exceed 200 000 zloty.
c) organizing and covering training costs of persons specified in paragraph 4.4.c in the range of safety principles and work hygiene as required by Polish law.
d) assuring rooms free of charge for storing materials, sufficiently guarded places to keep the trailers with the thermo-insulation machine, and places to work.

e) covering costs of the:
-training organization for local project coordinators and local technicians assigned to work on the project
-purchase of insulating materials and seals in coordination with FEWE in accordance with point b
-seminar organization concluding the project results in the city during which the city will present the experiences gained throughout the project to the Nowy Sącz administration.
2. On order of the Participating City FEWE can purchase assets to which financing is not obliged, and the Participating City commits itself to returning financial resources spent under this goal within 14 days of presenting proper documents of the purchase.

§ 7
Inspecting the Execution of the Agreement

1. FEWE reserves its right to inspect all financial documents connected with the project implementation once a month.

2. Documents connected with financial obligations are signed by people authorized to contract obligations.

3. Work performed within the framework of the Agreement will be reclaimed after the project completion by the indicated proxy of FEWE, who will confirm their correct performance with a protocol signed by the proxy of the received works.

§ 8
Change of Range of Agreement

1. FEWE reserves its right to one-Party changes in the range of matters in this Agreement, in the event of a loss of financial sources or decreases in its scale, with FEWE immediately informing the Participating City about the necessities of changes.

2. Changes described in paragraph 1 of the present clause will not result in any obligations of compensation by FEWE.

IV. Ownership and Use of Nonmaterial or Legal Properties.

§ 9
Using Nonmaterial or Legal Properties

FEWE will decide each time about the range of use by the Participating City of nonmaterial or legal properties necessary to implement this Agreement.

§ 10
Unsuitable Use Nonmaterial or Legal Properties

1. In the event of the use of nonmaterial or legal property in a manner contradictory to the goals of the Agreement under circumstances which the Participating City could have prevented, it will be obliged to pay for uses contrary to the Agreement, and also to stop their use in whatever manner.

2. Obligations described in paragraph 1 of the present clause will be implemented by the Participating City upon written motion by FEWE.

IV. Suspension of Implementation and Withdrawal of the Agreement

§ 11
Suspension of Agreement Implementation

1. FEWE can suspend one-sidedly the Agreement implementation under the following events:

1/ the Participating City does not perform any of the duties resulting from the Agreement,
2/ an extraordinary situation arises, making impossible the success of the project goal of the Agreement or its implementation as well as a loss of financial resources.

2. Suspension can refer to parts or whole of the Agreement.

3. FEWE will inform the Participating City about the suspension in writing, sending notification by registered mail, informing about the range of suspension and acts which the Participating City must fulfill, so that implementation of the agreement can be resumed and a suitable time-frame for this goal can be appointed.

4. Suspension is effective after 14 days from the date of notification by registered mail.

§ 12
Withdrawal of the Agreement

1. The Agreement can be withdrawn by writing by all Parties, with a 30-day period of notification.

2. The withdrawal becomes effective on the date when FEWE provides written receipts accounting for mutual financial obligations.

3. The Agreement can be withdrawn one-sidedly by FEWE in the event of missing the deadline for removal of the causes of the Agreement's suspension, and paragraph 1 of the present clause complies adequately.

4. In the case specified in paragraph 3, principles specified in § 11 adequately comply.

V. Final Rulings

§ 13
Agreement Changes

Changes in this Agreement must be in writing in the form of an appendix on penalty of invalidity.

§ 14
Violation of the Laws of Third Parties

1. FEWE does not hold responsibility in the case of third parties, in which the law is violated in connection with the implementation of this Agreement.

§ 15

1. In cases not described in this agreement, regulations fall under the civil code.
2. The Parties in the Agreement will select a suitable general court to settle litigation of civil law resulting during the implementation of this Agreements.

§ 16

The Agreement is prepared for the Parties in two identical copies.

§ 17
Date of Entry

The Agreement comes into force on the date of the signatures.

for the Polish Foundation for Energy Efficiency	**for the Participating City**
	_____
	_____
Prof. dr hab Adam Guła **Director of FEWE, Center in Krakow**	**Andrzej Czerwiński** **Mayor**
	Ludomir Krawiński **Deputy Mayor**