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Task 2 Final Report

Introducing Energy Efficiency and Training Programs in the Czech Republic

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1 INTRODUCTION

SEVEn was a member of an international team of experts for the purpose of performing energy audits in hospitals and schools The project's tasks were to

- Select 3 to 5 suitable hospitals/schools for performing energy audits
- Conduct a preliminary evaluation of the energy efficiency potential in the hospitals/school
- Conduct a detailed energy audit of the hospitals/school and subsequently give the hospitals advice on how to arrange implementation of the energy efficiency measures identified
- Formulate and document the methodology for identification, assessment, and implementation of energy efficiency projects to help other hospitals in the Czech Republic replicate this project's activities
- Propose and document demonstration projects in the selected hospitals
- Prepare and organize regional seminars presenting the results and recommendations of the conducted energy audits

The individual tasks were completed during 1997 Despite the complex conditions prevailing in the Czech health care sector at that time, all the specified tasks were accomplished with a high degree of success The response and interest of other hospitals in the issue of energy savings are the best evidence of this

2. HOSPITAL/SCHOOL SELECTION

At the start of the program, two meetings with US AID representative Jan Pisko were organized in Prague Initial proposals for five hospitals and one school were reviewed SEVEn proposed a procedure for selecting the first three hospitals/school In accordance with the approved procedure, SEVEn prepared a five-page questionnaire Open negotiations with the candidates were begun, and the purpose of the US AID project was explained After preliminary agreement among the respective managements was reached, SEVEn sent the questionnaire to all proposed candidates Only two questionnaires were returned in time, however This necessitated an extension of the evaluation stage to the end of November 1996, and final negotiations with the US AID representative were postponed to the beginning of December During negotiations with Jan Pisko (US AID Prague), two hospitals (Ostrava Fifejdy and Frydlant) and one school (in Mimon) were approved as initial candidates for energy audits

Two other hospitals, Litomerice hospital (northern Bohemia) and Ivancice hospital (southern Moravia), were proposed to the US AID office in Prague later and approved by Jan Pisko in January

A preliminary program for energy audits was designed, and visits to the sites were arranged

3 PRELIMINARY ENERGY AUDITS

From December 4 - 7, 1996 the energy audit team conducted a study of the Ostrava-Fifejdy hospital The team was lead by J Marousek (SEVEn) and consisted of three Czech specialists and two US specialists Thanks to very close cooperation among team members, all basic data were collected in two and a half days The hospital employees were helpful and receptive to the team's needs From December 8 - 10 the same team performed energy audits in the Frydlant hospital and in the school in Mimon

The Frydlant hospital expressed a strong desire to participate in the project

The school in the town of Mimon also represented a good candidate for the project The key energy-saving potential was found in separating the heating system of a large gymnasium, in use during weekends, from other rooms which do not need to be heated at that time It was also found that energy-efficient lights as well as some other measures could be installed to good effect

The audit team visited Litomerice hospital in January, 1997 The team visited the director, Mr Jiranek, and he required a written agreement which would ensure confidentiality in dealing with data The team collected basic technical information and economic data After interviews with several employees the team confirmed that some energy efficiency measures might be justified

The last preliminary audit was done at Ivancice hospital during January It looked promising that the hospital would quickly implement the measures proposed by the team, and this proved to be the case The current district heating energy source is to be shut down after next winter There were two possibilities to build a new energy source or to connect the hospital to another heating source (owned by the city of Ivancice)

Data from the energy audits were analyzed and energy-saving proposals elaborated in greater detail Each member of the team took over responsibility for one group of measures in all facilities All data, information and personal experiences from the visits to the hospitals and school served as the basis for the preliminary audit reports The proposed energy saving measures were developed and designed in more detail These reports were discussed within the team as well as with the hospital and school management

4. FINAL ENERGY AUDITS

SEVEn, in cooperation with Andrew Popelka of Tysak Engineering, finalized all project proposals, and the team members prepared the final energy audits Below are the summaries of the five energy audits Each report summarizes key data and information on the energy situation in the hospitals and on the consumption of individual types of energy, it includes a breakdown of total energy consumption according to specific purposes These reports are mainly focused on identifying possible energy savings in the hospitals and school and on evaluating the impact of

energy consumption The basic economic appraisal of these proposals is an indispensable part of this evaluation

The selection and calculations of individual measures were done on the basis of the following considerations and assumptions

- The measures considered were not to reduce the level of comfort in the hospital, nor were they to restrict the operation of the hospital in the course of being implemented
- The measures proposed were to be tried and tested measures that had been successfully carried out at a number of other facilities
- The measures selected were to be directed at key areas of energy consumption
- All estimates made by the specialists were to be conservative
- The basic economic evaluation was to be done on the basis of current energy prices without regard to their future movement

The results of these reports were discussed with the hospital management and served as initial information for further decisions in the process of making energy consumption by the hospital more efficient On the basis of each report, a proposal for acceptable measures coupled with a financial analysis of the proposed solution was prepared in detail

4 1 Ostrava Fifejdy Municipal Hospital Nemocnicni 20, 728 80 Ostrava 1

Summary of Results

The information obtained on the current condition of the hospital and on its future plans made it possible to identify ways to increase the energy efficiency of existing equipment and to reduce the energy-service costs of the hospital If all proposed measures were implemented, which clearly depends on an array of additional technical and economic factors, it would be possible to reduce the annual electricity consumption of the hospital for lighting by 45 MWh and heat consumption by 10 - 11 5 thousand GJ, which means a savings of 2 0 - 2 2 million CZK /year at current price levels This savings represents long-term cost reductions for the lifetime of the installed technology and equipment of around 8% of the annual energy costs of the hospital All these measures together will require an investment of 5 3 - 6 8 million CZK, yet it is essential to keep in mind the possible - in some cases obligatory - incremental implementation of these measures

The simple payback period of these measures is about 4 years, while the average lifetime of the installed measures is about 10 years

With the implementation of all of the proposed measures **in the heating system**, an annual savings of 1 million CZK could be expected, with a payback period on investments of less than 2 years There are other important energy-saving measures in **ventilation technology**, where there would be an annual savings of 300 - 500 thousand CZK with a payback period of 7-10 years Another measure is the installation of a **cogeneration unit**, which would annually save 8 million CZK of

heat and electricity costs with annual fuel costs of 4 million CZK The payback period of this investment would be expected to be less than 3 years

All of the proposed measures have been evaluated using conservative estimates of potential savings, and in selecting them no consideration was given to the generally expected increase in energy prices, which will probably increase potential energy cost savings and thereby decrease the payback period of investments even more

Conclusion and Recommendations

The specialists in charge are devoting the necessary—and in comparison to the situation at other similar facilities, an above average level of—attention to the hospital's energy management The specialists in management (the technical deputy and the energy manager) are aware of the problems that must be solved in the near future Energy management is a process that can be influenced from above (operation, implementation of measures, investment measures, etc) and from below (behavior of individual energy consumers) A comprehensive approach to energy management must deal with both of these aspects Plans and work procedures leading to increased energy efficiency in the hospital were divided into two timelines

The **first stage** of activities includes short-term goals and procedures

- Evaluate the suitability, consistency, and feasibility of the proposed measures in view of the specific operating or other conditions or limitations related to them and then, based on this, select the most suitable measures for initial implementation
- Determine a general implementation plan for these measures, prioritizing them and outlining their individual investment requirements in relation to the extent of each measure This is particularly necessary in the event that not all the measures are implemented at the same time

It would be best to carry out these activities in cooperation with the specialists in charge at the hospital and with the authors of this study, which would make the process of selecting specific measures more efficient for both sides (those proposing the measures and those operating the facility)

The **second stage** of activities involves the long-term goals and plans for energy management of the hospital, and takes more of a conceptual and organizational approach to the issue

- Create a conceptual plan for the entire hospital which includes proposed measures It would be best to prepare the conceptual plan in any event, regardless of whether or not the proposed measures are to be implemented
- Expand the practice of energy metering by individual departments
- Strive to make energy-related issues a regular part of work meetings, at the managerial level and below
- Set up a working group comprised of those responsible for the operation of the hospital and representatives of the finance department capable of providing information on costs and revenues arising in conjunction with the implementation of different project alternatives

- Introduce a program based on metering to monitor specific energy consumption Within this framework, the part of the hospital consuming the energy would have direct responsibility for costs In such a program it is indispensable to set goals for reducing energy consumption, to determine functional direction mechanisms, to clarify motivation and define needed stimuli, and to ensure wide-ranging communication on energy-related issues

4.2 Frydlant Hospital
V uvoze 860, 464 15 Frydlant

Summary of Results

The current heat supply side (new decentralized gas boilers) is well controlled Given this, the team concentrated its efforts on the demand side of the hospital energy system, mainly on the pipe balancing and heat demand control as well as interior temperature control and monitoring

Special attention was given to the existing stand-by engine, which is broken and has to be reconstructed in any case A cogeneration unit seems to be one possible cost-effective solution to this urgent problem facing the Frydlant Hospital

The installation of an additional gas cooling unit as well as steam for sterilization has to be investigated in detail because of its potential for both cost and energy savings

Some measures to conserve electricity as well as hot domestic and drinking water have also been analyzed and evaluated as cost-effective options

The information obtained on the current conditions of the hospital and on its future plans made it possible to identify ways to increase the energy efficiency of existing equipment and to reduce the energy costs of the hospital Assuming that all proposed measures are implemented, which clearly depends on an array of additional technical and economic factors, it is possible to reduce the electricity consumption of the hospital for lighting by 19 MWh and heat consumption by 1000-1400 GJ, which means a savings of 200,000-270,000 CZK/year at current price levels This figure reflects the long-term cost reductions for the lifetime of the installed technology and equipment and equals around 12% of the annual energy costs of the hospital All these measures together will require an investment of 300,000 CZK, yet it is essential to keep in mind that these measures can be—and in some cases must be—implemented gradually

The simple payback period of these measures is about 1 5 years, with an average lifetime of about 10 years For measures involving annual maintenance costs, the payback is 3 5 - 10 months

Another measure is the installation of a cogeneration unit, which would annually save 840,000 CZK in heat and electricity costs and involve annual fuel costs of 690,000 CZK The payback period of this investment is expected to be less than 3 years

All of the proposed measures are evaluated using conservative estimates of potential savings, and in selecting them no consideration was given to the generally expected increase in energy prices,

which will probably increase potential energy cost savings and thereby decrease the payback period of investments even more

Conclusion and Recommendations

The specialists in charge are devoting the necessary attention to the hospital's energy management The specialists in management (the technical deputy and the energy manager) are aware of the problems that must be solved in the near future Energy management is a process that can be influenced from above (operation, implementation of measures, investment in measures, etc) and from below (behavior of individual energy consumers) A comprehensive approach to energy management must deal with both of these aspects, therefore plans and work procedures leading to increasing energy efficiency in the hospital should be divided into two timelines

The **first stage** of activities includes short-term goals and procedures On the basis of the information obtained on the hospital, we recommend the hospital do the following

- Evaluate the suitability, consistency, and feasibility of the proposed measures in view of the specific operating or other conditions or limitations related to them and then, based on this, select the most suitable measures
- Determine a general implementation plan for these measures, prioritizing them and outlining their individual investment requirements in relation to the extent of each measure This is particularly necessary in the event that not all the measures are implemented at the same time

The **second stage** of activities focuses on addressing the long-term goals and plans in regard to the energy management of the hospital, and has more of a conceptual and organizational approach to the issue

- Create a conceptual plan for the entire hospital which includes proposed measures It would be best to prepare the conceptual plan in any event, regardless of whether or not the proposed measures are to be implemented
- Strive to make energy-related issues a regular part of work meetings, at the managerial level and below

4 3 Ivancice Hospital
Siroka 16, 664 95 Ivancice

Annual turnover is about 150 million CZK Energy costs amount to about 5 2 million CZK for heat and 1 3 million CZK for electricity, which comes to around 5% of the annual budget The hospital does not pay the Value Added Tax

Summary of Results

- With the aid of the proposed rationalization measures the present heat consumption of 21,500 GJ/year could be reduced by 5,950 GJ/year, i e , by 28%

- We also recommend that measures be put in place to reduce electricity consumption A control system could make it possible to disconnect the highest-use equipment for short periods during peak demand and thus keep electricity demand to the target maximum
- We propose to use gas-operated steam generators They will be placed in the surgery and gynecology buildings They do not require servicing and work at high efficiency We recommend converting the kitchen to gas and installing corresponding cooking equipment
- Heat used for heating buildings and hot domestic water should be produced either in the hospital's own boiler house or purchased externally The study presents alternatives for a boiler house fueled by natural gas, coal or wood chips Purchase from an external source would require a connection to the steam distribution system of the Oslavany Incinerator and to the city heat distribution system of the residential heating plant TEPLO Ivancice The piping systems throughout the complex will be only reconstructed for the transport of heating water A modern method of pre-insulated piping will be used which does not need costly heating corridors
- We recommend that hot domestic water be prepared in individual buildings, where small transfer stations and exchangers will be installed This will ensure the warming of water and heating The latter will be regulated according to the operational requirements of each building

4.4 Litomerice City Hospital
Zitenicka 18, 412 01 Litomerice

The Litomerice Hospital is a city-operated health facility with an annual turnover of about 250 million CZK Energy costs amount to about 5 8 million CZK for heat and gas and 4 2 million CZK for electricity

Summary of Results

The hospital has a definite savings potential By implementing the proposed rationalization measures energy costs could be reduced by 1 3 million CZK annually with an investment of 2 3 million CZK

- Primary attention should be given to the central heating system and the warming of air for the air conditioning
- The production and consumption of refrigeration affects the electricity consumption Production of cooling with the existing equipment is ineffective
- Heat losses in the warming of hot domestic water and in transporting it throughout the complex amount to approximately one-fourth of heat used for that purpose An appropriate solution would be to warm hot domestic water directly in the buildings and thus reduce heat losses by 1,650 GJ/year
- The installation of secondary meters in individual buildings and on major equipment would aid in the tracking of all types of consumption and energy flows This data would then allow measures to be implemented in optimal places and with maximum effect The expected savings would amount to 300,000-500,000 CZK/year with an investment of 1 2 million CZK

Following completion of work on the initial audit and discussion of the submitted report, we recommend that the hospital consider making the present consumption analysis more accurate by taking further measurements and studying the relevant data which was not available for the project

4.5 Ralsko Elementary School
Okruzni Street, 471 24 Mimon

The City of Mimon is located in the North Bohemia region It is the commercial and administrative center of an area adjacent to a former military zone It has a population of 6500

Summary of Results

Measures in the central heating and air regulation systems

- The central heating distribution system under the floor does not permit division into individual zones
- In order to introduce a heating regime it is necessary to install regulators on individual radiators
- Conduct a control calculation of the heat production needed in the atrium corridors Based on the results, dismantle superfluous heating radiators
- Install some kind of system to regulate radiator valves in the facility (TRASCO, ETATHERM, or the like) The system will make it possible to manage both the time and temperature of heating in each room At the same time install additional regulating equipment for the circulation pumps
- After installation, balance the heating system A service group should determine water flows with a non-destructive ultrasound measurement and regulate the system
- Create guidelines for service and maintenance

Monitoring and regulation measures

- Installation of a control system for radiator valves
- Putting a time and temperature regime in place

Hot domestic water measures (Measures to conserve heat and electricity in the area of hot domestic water will not in the present situation be apparent in the school's financial accounts, but they will be of benefit to the operator of the residential exchange station We therefore recommend that implementation of the measures wait until the exchange station is set up for the school building)

- Installation of switching clocks to prevent the circulation of hot domestic water outside of work hours
- Separate the hot domestic water distribution system of the school from that of the gymnasium, either by laying a new piping system from the exchange station or by installing a solenoid valve

on the branch for the school, regulated by switching clocks This measure will reduce heating losses during circulation

Electricity saving measures

- An immediate change to an alternate electricity tariff
- Adjustment of the lighting in the classrooms (for the specific case of the physics laboratory in building U2, see energy audit appendix)

Building envelope measures

- New weather-stripping around the windows on the side facing the wind (silicon in the grooves)

Measures with an indirect effect on energy efficiency

- Revision of rental agreements with users of the gymnasium
- Introduction of tracking, recording and evaluating data from the energy gauges
- Including energy costs in rental agreements

Implementation Recommendations

Carry out the specific energy efficiency measures in the following order

- Weather-stripping the windows of classrooms facing the wind
- Refitting the lighting fixtures in the physics laboratory
- Installation of a programmable regulation system of non-concurrent heating in individual rooms (TRASCO, ETATHERM, etc)

5 METHODOLOGY MANUAL

A methodology manual has been prepared for the use of hospital management which explains how hospital energy efficiency projects should be prepared The need to create this manual arose out of experience and information which gradually came to light through cooperation on projects in this area Hospitals often lacked an overall idea about how to go about solving energy issues, some of them had inadequately prepared investment plans, and very often they lacked the financial resources to carry out these plans

As part of USAID project, *Introducing energy efficiency and training programs in the Czech Republic*, a team of experts (from SEVEn and Tysak) prepared a methodology manual which provides a comprehensive overview of project preparation procedure and of the basic contents of individual documents needed in the course of preparation The manual's appendix presents specific technical measures for energy efficiency in hospitals under the conditions of the Czech Republic

Work on the manual took place over the course of the entire project, and the individual chapters were gradually compiled on the basis of the new experience being gained In particular the

catalogue of efficiency measures contains information backed up by the specific experience of Czech and American hospitals with such projects

Contents of the Manual

The manual explains the basics of a proper approach to preparing energy audits in hospitals It clarifies why, when, and what information is necessary to prepare for assessing an intended investment and for making decisions on its implementation It provides information about the purpose and method of preparing an energy audit or feasibility study and business plan and what they should contain It presents possible methods of financing projects and the procedures to follow in obtaining the financial resources to carry them out

Goal of the Manual

The authors wanted to give readers sufficient information and understandable instructions so they could quickly and easily orient to the issue of preparing projects, drafting feasibility studies and business plans, and applying knowledge gained to prepare a project in their hospitals The manual does not intend to cover this extensive area in an exhaustive way, however, and so it includes a list of specialized literature for those wishing to have a deeper understanding of the area

6. DEMONSTRATION PROJECTS

In all Czech hospitals, potential energy savings exist which would pay for themselves and are technically feasible (taking into account how hospitals are run) but which are nevertheless not realized One of the goals of *Introducing energy efficiency and training programs in the Czech Republic* was to demonstrate in practice a method of project preparation and realization under current conditions Each hospital has its own specific conditions, despite this, a number of common problems and their common possible solutions can be found in many hospitals, and oftentimes they can be realized with minimal modifications

The work plan called for assistance to the audited hospitals/schools to implement recommended measures identified in the audits, if the time and budget of the USAID contract permitted The Ostrava hospital was already undergoing a major renovation, the audit's recommendations were considered, and some were implemented within the scope of the existing reconstruction For the other 3 hospitals and the school, demonstration projects based on the audits were designed by the project team and implemented In all cases, the USAID funding was 50% or less of the total project cost (i e , substantial co-funding from the hospital or school), selected measures had a quick payback, and all projects were judged to be relevant to conditions in hospitals/schools throughout the Czech Republic

In addition, Andrew Popelka of Tysak Engineering identified an energy efficiency demonstration opportunity in Uherske Hradiste, to help dry out buildings damaged during the floods of the summer of 1997 A small project was implemented, with high efficiency technology applied to schools, hospitals, and historical buildings

Each demonstration project is described below

6 1 Litomerice City Hospital - Energy Management Control System

In the hospital in Litomerice (North Bohemia) where the recording of the energy flow and energy costs will improve significantly with the installation of a building energy management system, it will be possible to set up a high-quality control of energy flow and consumption in the facility and the operation of the hospital's entire energy system will be greatly simplified This is a solution which many other hospitals will copy

In the course of project preparation it was necessary to negotiate with the hospital management on the use of obtained data, the way in which it would be presented, and the overall cooperation with the hospital management It was necessary to train the hospital's technical staff in the use of modern computer technology, which required extra effort on the part of SEVEn's experts

Project Schedule

May	Application for US AID financial assistance to implement the project
June	Invitation and evaluation of tenders
July	Signing of contracts and performance of the work
August	Projections, installation of cables, installation of some devices
September	Completion of installation of devices, fine-tuning of the software
October	Trial operation

The company Omega Controls s r o of Usti nad Labem performed the work according to the specifications of the agreement between SEVEn and the hospital for an amount of 1,200,000 CZK The company respected the requirements of the hospital for use of existing cable lines At the same time, supply and distribution company devices were used and supplemented with pulse readers (electricity meter, gas meter), and full use was made of the uniform outlet of the main heat meter (Combimeter brand) The main electricity meter is being used as the basic reader for evaluating the quarter-hourly maximum At present the procedure of disconnecting individual energy consumption equipment has yet to be established because their structure and operation is not known Hospital staff is now preparing this structure Expected savings (a change in the contract with the electricity distributor) will be realized after a thorough evaluation

A similar situation applies to heating, a change in the contract can be made after the 1997/98 heating season Other gauges and sensors are to establish the overall energy balance in the hospital complex and to identify a breakdown primarily in the heating and in the hot domestic water preparation and distribution systems The measurement of the complex's main water intake intended initially was not carried out due to large construction costs Instead partial measurement is being done inside the complex

The technical staff of the hospital is gradually learning to use the entire system, and they are beginning to carry out partial tracking of the individual gauges This will gradually lead to a more accurate consumption balance and adjustments to the contracts with the supplier

6 2 Ralsko Elementary School in Mimon - programmable regulation system (IRC) using controls of radiator valves

For the demonstration project in the Mimon school (North Bohemia), an energy control system was proposed for the school complex to permit the tracking, controlling and invoicing of the individual parts according to their actual consumption, which can then be reflected in the rent charged the various users of the facilities Given the conditions under which the separate parts of a multi-building school complex are operated, this method of measurement and control of heat consumption is very effective, and the project is expected to bring considerable energy and financial benefit In such school complexes built since 1970 in particular, the potential of installing similar technology is substantial

Project Schedule

May	Application for US AID financial assistance to implement the project
June	Invitation and evaluation of tenders
July	Signing of contracts and performance of the work
August	Projections, adjustment of the heating system (change in the number of heaters), valve replacement
September	Installation of cables and radiator heads, and system modules, fine-tuning the software
October	Trial operation

The company Elektroservis of Usti nad Labem performed the work according to the specifications of the agreement between SEVEn and the City of Mimon for an amount of 501,795 CZK, excluding VAT Within the framework of the project, a conversion of the heating system was carried out Superfluous radiators were removed Valves and control heads were installed on all heaters On the school grounds, four control panels were installed and connected to the individual valves and to a control computer provided by the City of Mimon At the end of the month of September, software was installed and the entire system was tested

The technical staff of the school is gradually adjusting the fine-tuned heating regime to account for the use of the individual classrooms by scheduled classes and by external users Evaluation of the project will be conducted after the heating season ends

6 3 Frydlant Hospital - Cogeneration Unit

In the Frydlant hospital (North Bohemia) the stand-by electricity source was out of operation and the hospital needed to secure an emergency supply in case of a power failure in the public grid Construction of a cogeneration source of heat and electricity has solved this problem and additionally has brought considerable financial benefits in the form of energy produced more

efficiently than was the case with the existing supply to the hospital This is also an example which can be replicated in a large number of hospitals in the Czech Republic

Project Schedule

March	Energy audit, proposal discussion
June	Tendering process
August	Finalizing the project documentation
September	Gas engine installation
October	Project finished
November	Trial operation

Cogeneration machinery has been installed in the self-contained building of the previous stand-by power source The original stand-by source, a diesel motor from CKD Horovice with an output of 120kW, had broken down The breakdown was caused by the freezing of the cooling system roughly two years ago At the time of the hospital's privatization no one looked after the maintenance of the equipment

In accordance with measures proposed in the audit, a JENBACHER cogeneration unit was installed The electricity produced is conducted into the existing distributors of the previous stand-by source The heat produced is conducted into the two largest gas boilers in the hospital complex, which in winter provide heating and in summer hot domestic water The unit is operated year-round The electricity covers the hospital's own needs In summer the heat is used to warm the hospital's hot domestic water The heat is also conducted into the nearby exchangers of the town's centralized heating system to warm hot domestic water Thus steady operation is ensured even during summer, when hospital demand is less and would otherwise necessitate cooling

Technical Parameters

Electricity consumption of the hospital according to DIN 4701

Minimum power demand	27 kW
Maximum power demand	123 kW
Average amount	52 kW

For this reason, an appropriate unit was proposed from the standard array with an electricity output of 70 kW and a heat output of 115 kW JENBACHER JMS 106 GS-N L

Electricity output	70 kW
Heat output	120 kW
Electric efficiency	32%
Heat efficiency	54 2%
Minimum electricity output	36kW
Minimum heat output	76kW

Basic maintenance requires oil every 1000 hours, a maintenance technician every 2000 hours Lifetime is 1,609,000 hours Annual use is assumed to be about 6,500 hours

6.5 Ivancice Hospital - Steam Generator & New Heat Supply

The Ivancice hospital (South Moravia) was faced with the problem of what method of heating it would choose following the eventual disconnection from the existing centralized heating source which had supplied the hospital with hot steam for heating, warming of hot domestic water and for technological purposes The hospital's switch to a new heat supplier and the production of its own steam for technological purposes (especially for sterilization, and partly for the kitchen as well) is likewise a way to save energy and ultimately the money spent on it By switching from one steam supply to another, more efficient, method of heating, the Ivancice hospital is a good example to follow

Project Schedule

March	Energy audit, Proposal discussion
May	Tendering process
September	Finalizing the project documentation
October	Gas and heat pipeline installation
October	The building site preparation
November	The steam generator installation—trial operation

Based on the energy audit, the hospital heat supply is being switched to a new supplier— TEPLO Ivancice At the same time proposed energy saving measures are being installed

- New heat piping system (900 meters) from existing gas boilers and cogeneration plant (2 x 0 5 MWe)
- On-site heat piping system (520 meters) is being installed
- Individual heat exchangers for the HDW for each building are to be installed
- Control and monitoring system will be installed
- New high efficiency steam generator is being installed (US AID demonstration project funds)

Total project investment	11 791 000 CZK
consisting of construction works	3 000 000 CZK
technology incl C&M	8 387 000 CZK

contractor Landis & Gyr (CZ) spol s r o , division of Landis & Staefa Brno

Current state of the demonstration project

The hospital used the SEVEn/Tysak energy audit to obtain a $100,000 grant from the Czech Energy Agency (CEA) to implement the entire project - 4 steam generators, instead of the one generator initially envisioned for the demonstration project The Municipality provided the remainder of the money needed to implement the entire project

After some communication misunderstandings between the prime contractor (Czech firm Landis and Gyr Brno) and hospital management, a meeting with the head office director in Prague solved these problems The agreed date of the heat switching (connection to the new cogeneration boilerhouse) will be kept At that time, steam will be needed for the hospital operation and it will be supplied by the new steam generator (part of the US AID demonstration project) The site-preparation for the technology installation has been completed and the steam generator is on site at the hospital

6.5 Uherske Hradiste Schools and Other Buildings

The town of Uherske Hradiste was hit by severe flooding in summer 1997 This flooding affected the entire Moravia region In addition to the human suffering and irreparable damage caused by this disaster, the region had to deal with controlling the damage to the buildings which are repairable Uherske Hradiste incurred slowly rising flood waters which damaged a large number of buildings The municipal hospital (which was completely evacuated), the schools, the 600-year-old town hall, and many other buildings had to be dried out and repaired Experts predicted that if not dried quickly, serious structural damage would occur in buildings deemed repairable

Drying a building after a flood is very energy-intensive Natural drying (opening the windows, etc) can only be utilized in a limited number of buildings and when weather permits In order to prevent additional serious damage, advanced dehumidification equipment must be applied In principle, any deep air drying system which produces air with moisture content of less than 0 001 lb of moisture per lb of air will perform well The main difference in drying technologies is in energy efficiency, or energy consumption per pound of moisture removed from the space

Andrew Popelka assessed the situation in Uherske Hradiste in early August After conferring with OAR-Prague, ten industrial grade units (MK40, made by Munters/Cargocaire) were shipped to Uherske Hradiste (USAID project funds of $14,500 were used Munters reduced the price and donated freight and technical assistance The city provided labor and ancillary equipment)

Economic Evaluation

Conventional methods of moisture removal within the industrial process, or for space/walls drying, introduce hot, dry air and exhaust the saturated (moist) air into the atmosphere In such a process, ambient air at nominal conditions (70 degrees F, 50% RH) is heated to approximately 120-140 degrees F, with corresponding relative humidity of 12-15% A pound of air under such conditions is capable of removing 004 lbs of moisture from the space For removing of 1 0 lb of moisture, 250 lbs (3,500 cu ft) of air is needed This requires approximately 1055 Wh of energy to heat the air, and 120 Wh for fan operation The hot air system thus requires about 1175 Wh per pound of removed moisture Another issue related to the hot air system is that its performance depends heavily on ambient air conditions For example, when the relative humidity of the ambient (process) air increases from nominal 50 % to 60% RH, the power requirement increases by 25%, to 1470 Wh/lb of removed water

The dehumidification units evaluated have a rated (total) power consumption (at 20 degrees C, and 60% RH) of 405 Wh/lb of water The USAID funds used to purchase this equipment with nominal capacity of 20 liters/24hr were $1,450 each At a cost of electricity of 2 4 CK/kWh, and system capacity of 20 liters/day of removed moisture, the incremental cost of this equipment will pay back the USAID contribution within 10 months Assessing payback using total cost of the dehumidifiers and other project costs, simple payback is still less than 2 years

Project Results

The economics of the demonstration do not tell the whole story, for without this equipment, it wouldn't have been possible to dry many of the City's buildings in time to prevent structural damage from freezing weather The Mayor organized City labor to run the units 24 hours a day Monitoring the results showed the equipment performed better than expected, removing 50% more moisture per day than specified As a result, they City was able to dry out their 12 school buildings and start the school year on schedule

The dehumidifiers were then moved to the City's hospital and adjoining medical offices Afterwards, they were applied to the historic town hall building and to a residential building housing pensioners

Television and newspaper reports of the demonstration praised the USAID "lightning assistance", within 2 weeks of the initial discussion with the City, the equipment was in the buildings and operating

The technology demonstrated has wide application in the Czech Republic Moisture removal (or drying) is used in many industrial and commercial processes and activities, as well as in some residential applications (To list a few pharmaceutical, food processing, electronics, long term storage of equipment and perishables, etc) Demonstration of any technology in a high-visibility project enhances dissemination of information In this case, application of efficient drying technology served two purposes 1) assisted with prevention of further, avoidable damage to the buildings, and 2) demonstrated advanced energy conservation technology which is also applicable to industrial, commercial, and residential buildings Munters was inundated with requests for quotes of their equipment as a result of publicity from the USAID demonstration

6 6 Summary of Demonstration Projects

NAME	DESCRIPTION
Frydlant Hospital	Co-generation The project, designed by the energy audit team, replaces an old back-up diesel with a gas-driven generator equipped with a co-generation system
Litomerice Hospital	Building energy management system
Mimon School	Weatherization and zoned heating controls

Ivancice Hospital	Surgical steam generators The hospital is installing 4 units to generate surgical steam (for sterilization, etc) and heat This demo project will install and evaluate a high efficiency steam generator This project is a recommendation of the energy audit performed by SEVEn and Tysak The audit was used to obtain a CEA grant to implement all 4 units, originally the demonstration was going to be one unit only
Uherske Hradiste Schools	High efficiency drying units [Alternative to 1) lower efficiency drying units employing electric heaters or 2) heating the buildings with district heat and venting moist, heated indoor air directly outside]

Cost and Savings Summary

Location	Total Project Cost	USAID Grant	Simple Payback	Energy Savings
Ivancice	$56,000	$21,450	4 2 years	1230 GJ/year
	($180,000 for all 4 units - the entire project is being implemented)			
Frydlant	$148,659	$20,000	4 years	3400 GJ/year
Litomerice	$40,000	$20,000	2 years	1850 GJ/year
Mimon	$58,250	$17,000	< 2 years	810 GJ/year
Uherske Hradiste	$30,000	$14,500	< 2 years	180 MWh

7 INFORMATION DISSEMINATION SEMINARS

At the conclusion of *Introducing energy efficiency and training programs in the Czech Republic,* two regional seminars were organized at which the results of the energy audits were presented, as well as a methodological approach to the area of energy project preparation in hospitals, ways to finance energy projects in the Czech Republic, and the demonstration projects carried out to date Seminar participants welcomed both seminars with great interest Most of the discussion focused on the technical aspects of ways to save energy in the participants' facilities and then generally on ways to secure funding for implementation Likewise very beneficial was the new, comprehensive approach to the hospital energy sector presented by the speakers

The experiences of hospitals in the USA were very interesting and, for many hospital representatives, stimulating It was shown that similar problems exist on both sides of the ocean

and the description of how American hospitals are going about solving them was undoubtedly inspiring for many

Both seminars also included presentations by suppliers of energy efficient technologies which described the results of energy efficiency projects already carried out in Czech hospitals
The Prague seminar was attended by a representative of the Ministry of Health responsible for the investment section, and he was very interested in the approach to the hospital energy sector and ways to fund proposed projects In particular, the involvement of ESCOs in hospital projects represents new possibilities in hospital investment activities, and this was shown to seminar participants by a tour of the hospital where the seminar was held This has provided the impetus for future discussions with government representatives responsible for hospital investment projects

The Ministry of Health of the Czech Republic has started discussions with SEVEn on sharing the experience gained in these particular hospitals or other ones, and there is a very good possibility of promoting ESCOs and the energy performance contracting (EPC) concept in hospitals The Czech Chamber of Commerce asked the US AID Program team for its opinion on the energy savings potential in the public sector (health care, educational, police, and army facilities, etc) and has presented these proposals to the Ministry of Industry and Trade of the Czech Republic, which is responsible for running the Czech Energy Agency After several discussions the Ministry became convinced that it would be useful to review the EPC potential in the public sector and assigned the Czech Energy Agency the task of analyzing possibilities and proposing measures within the first half of 1998 The US AID Program was one of the most important specific examples of energy savings which served as the basis for the Ministry's decision

At the same time negotiations between SEVEn and the Ministry of Industry and Trade are continuing on how to promote energy efficiency in state-owned hospitals

Representatives of cities present at the seminar likewise benefited from the practical presentation of the linkage between the technical and financial approaches, which cannot be separated from each other In the past that very often happened, and proposed/ implemented solutions were not ideal This was naturally due to the nationwide centrally planned economy, and in the public sector this mechanism often continues to this day