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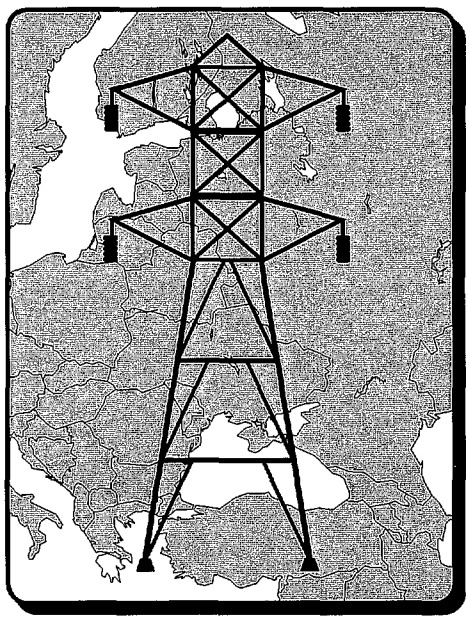
Central and Eastern Europe Regional Energy Efficiency Project EUR-0030-C-00-2053-00



Energy Pricing, Energy Efficiency, and Energy Sector Restructuring Component

Final Report
December 1996

Volume XII

Prepared for:
U.S. Agency for International Development
Bureau for Europe and NIS
Office of Environment, Energy, and Urban Development
Energy and Infrastructure Division

Prepared by:
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CENTRAL AND EASTERN EUROPE
REGIONAL ENERGY EFFICIENCY PROJECT
EUR-0030-C-00-2053-00

Energy Pricing, Energy Efficiency, and
Energy Sector Restructuring Component

Hungary
Energy Efficiency Market Development

Task Completion Memorandum

Prepared for:

U.S. Agency for International Development
Bureau for Europe and NIS
Office of Environment, Energy,
and Urban Development
Energy and Infrastructure Division

Prepared by:

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September 1996

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CENTRAL AND EASTERN EUROPE
REGIONAL ENERGY EFFICIENCY PROJECT

Task Completion Memorandum

Hungary - Energy Efficiency Market Development

Summary Task Description

The Hungary Energy Efficiency Market Development (EEMD) task is designed to serve as a catalyst to assist private Hungarian firms to develop a market for energy efficiency services, and to develop their capability to serve this market.

The major activities in the Hungary EEMD task are:

1. Training in energy efficiency for private sector engineers on market-oriented business subjects (such as management, accounting, economics and finance), energy audit techniques, hands-on use of energy efficiency monitoring equipment, performance contracting, project management, industrial management, quality, maintenance and optimization, marketing and management for energy efficiency service companies, and a certification examination (Certified Energy Manager by Association of Energy Engineers, AEE).

2. Establishment of a Hungarian chapter of AEE, supply of US energy audit equipment to the Hungarian AEE, and assistance to develop AEE as a sustainable market-oriented professional association.

3. Energy management programs in representative Hungarian facilities, predominantly industrial enterprises. Each program will include advice in energy management from Hungarian experts, an energy audit report, and a grant to be applied as cost-sharing toward the purchase of US equipment. Hagler Bailly will serve as advisor on project, participating in on-site activities and reviewing the work of the Hungarian experts. Each client enterprise will sign a contract to participate in the program, and will pay a market-based fee to the Hungarian consultants for the services. Hagler Bailly's services will be at no cost to the client enterprise.

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4. Conference and exhibition on industrial energy management. Project results will be reported to Hungarian plant directors, chief engineers, production managers, and energy managers in a conference, with related publicity. US manufacturers of energy efficiency equipment will be invited to exhibit products.

5. Assistance preliminary to financing for industrial energy efficiency investment projects. Hagler Bailly will assist efforts in Hungary to arrange financing through conventional and innovative sources.

Specific Goals and Objectives

The general goal and objective of the EEMD project will be to serve as a catalyst to accelerate the development of a market for an energy efficiency industry in Hungary, and to assist firms in the private sector to develop their capability to serve this market.

The specific objectives of the EEMD project are:

1. Foster the development and capability of Hungarian private firms to provide energy efficiency services, equipment, and financing to industrial clients;

2. Assess the climate for investments in energy efficiency projects in Hungary, and provide advice, studies, and seminars to promote increased private investment in energy efficiency;

3. Improve energy efficiency in specific pilot sites (especially industrial enterprises), through provision of energy audits and energy-saving equipment;

4. Expand Hungarian-U.S. technical and commercial ties through linkages between energy efficiency associations, engineering and energy service companies, and equipment suppliers.

Expected Outputs

There will be five major outputs of the EEMD project:

1. Training in energy efficiency for private sector engineers

2. Establishment of a Hungarian chapter of AEE.

3. Energy management programs in approximately 10 facilities, predominantly industrial enterprises.

4. Conference and exhibition on industrial energy management.

5. Assistance preliminary to financing for industrial energy efficiency investment projects.

Deliverables

- trip reports to AID
- monthly progress reports to AID
- energy audit training curriculum to AID
- energy audit training course materials to trainees - books, lecture notes
- advisory reports to energy auditors
- plant energy audit report summaries in English to AID
- energy audit equipment package (AEE Chapter)
- energy efficiency equipment for each plant
- conference agenda
- conference proceedings
- final report (task completion memorandum)

Results and Next Steps

The results of the Hungary Industrial Energy Efficiency program were positive and all program objectives and deliverables were met. The following summarizes the key results:

Training and Promotional Program

The training and promotional program was conducted over a twelve month period and consisted of three phases:

Phase I Selection - A selection criteria was developed for potential private sector energy service companies and an invitational campaign conducted through the local media, government energy agencies, utilities, Polytechnic University, and other Hungarian technical organizations. Over fifty companies were evaluated and a final selection of 11 companies was made (see Table 1.). The primary criteria for selection centered on:

- Potential for market development and provision of essential services
- Company and staff experience
- Resources and capabilities

Table 1 - Participant List

1. **Miklos Gellert, Gellert Innovation Engineering Company -** Mr. Gellert is the director of his own consulting firm located in Pecs, Hungary. He has an MSc in Mechanical Engineering and 15 years of experience in management consulting.

2. **Albin Zsebik, Jomuti Kft. -** Mr. Zsebik has PhD in Mechanical Engineering. He has been a professor at the Technical University of Budapest for the past 22 years where he completed studies on energy conservation, with an emphasis on district heating. He is also the manager of Jomuti, a privately-held technical consulting company.

3. **Laszlo Soos, EPOS-VPI** - Mr. Soos has 17 years of experience as a design engineer. Mr. Soos obtained an MSc in electrical engineering.

4. **Peter Macskassy, Comptech Ltd. -** Mr. Macskassy is the managing director and one of the founders of Comptech, a privately-held engineering and trade consulting company. He is a founding member of the Hungarian Society for Energy. Mr. Macskassy received his MSc in telecommunication engineering and doctorate in computer science. He worked for the Electronics Research Group of the Hungarian Academy of Sciences for 13 years and was the head of the measurement and process control group of the Budapest District Heating Company form 1985-1989.

5. **Tibor Nagy, Control MTI -** Mr. Nagy has an MSc in Electrical Engineering. He has been an energy consultant for two years. His work includes auditing energy production and distribution systems (i.e., Tungsram Light Source Plant).

6. **Sandor Haragos, Energomedia -** Mr. Haragos is an energy consultant with 12 years of experience. His projects include numerous energy loss surveys at industrial companies, energy conservation projects financed by third parties, and technology transfer. He has an MSc in Mechanical Engineering.

7. **Gyorgy Viragh, Kontravill -** Mr. Viragh has 8 years of experience as a design engineer. He is the director of Kontravill, a privately-held company with projects relating to heat storage efficiency in buildings, underground and above surface steam and hot water pipelines, and industrial technologies and high power electrical systems. He has a BSc in Electrical Engineering.

8. **Imre Majoros, BME -** Mr. Majoros is an assistant professor at the university with 15 years of professional experience. He has an MSc in Electrical Engineering.

9. **Gyorgy Sz Toth,** Mr. Toth has 30 years of experience as an energy consultant. He obtained an MSc in Mechanical Engineering.

10. **Mihaly Szaniszlo**, Mr. Szaniszlo is the head of a private consulting company. He has an MSc in Electrical Engineering and 20 years of experience.

11. **Tibor Bartha**, Mr. Bartha manages his own consulting firm. He as an MSc in Electrical Engineering and 15 years of professional experience.

Phase II Training - A training program was developed and designed to suit the needs of Hungarian energy service companies. The program had four main elements:

- Business/Management Training: International Management Centre
  - Principles of Running a Small Business
  - Accounting/Finance
  - Marketing/Client Relations
  - Negotiating Techniques
  - Staffing/Human Resource Development
  - Management by Objectives
  - Legal Issues/Contracting

- Technical Training - Hagler Bailly Consulting:
  - Thermal Energy Efficiency
  - Project Management
  - Performance Contracting

- Motorola University:
  - Quality System Initiation
  - Organizational Mapping & Analysis
  - Total Productive Maintenance

- Association of Energy Engineers:
  - CEM Review Course

Phase III Certification - The participating energy service companies were administered the AEE Certified Energy Manager examination, all passed and were awarded the certification.

Energy Efficiency Program Equipment

The USAID program was designed to assist the participating energy service companies in obtaining initial private sector contracts, and thus provided an energy audit 'kit' of energy measurement and monitoring equipment. This equipment was turned over to the Association of Energy Engineers and made available in an equal access basis. The initial energy audit kit consisted of:

-	Combustion Analyzers	-	Ultrasonic Leak Detectors
-	Thermocouples	-	Dissolved Solids Meter
-	Multimeter	-	Pyrometer
-	Infrared Thermometer	-	Velocity Meter

The energy audit equipment was purchased, tested, and delivered to Hungary.

Demonstration Energy Service Company Projects

Hagler Bailly provided on-site consultants to assist the participating companies in developing actual contracts for energy audits and energy efficiency projects at selected industrial enterprises. This technical assistance consisted of:

- Marketing calls to prospective clients with the energy service company
- Walk-thru energy audits
- Initial advisory audit reports
- Contract review and detailed energy audit review
- Procurement of USAID co-funded energy efficiency equipment
- Shipment and follow-up support for equipment installation
- Development of a monitoring program
- Review of project performance indicators

A total of eight industrial energy efficiency projects were developed in conjunction with five Hungarian energy service companies. Each company negotiated a contract with the selected plant for energy audit support, specification and procurement of equipment, commissioning, and start-up. Hagler Bailly assisted the CEM's in the specification of this equipment, procured the equipment in the United States, and shipped it to Hungary. The CEMs assisted the plant with clearance through customs, installation, and commissioning. Each plant assumed the liability for installation cost, and customs duties and fees.

Table 2 is a listing of projects and energy efficiency equipment that was procured.

AEE Chapters, Invitational Travel, and Regional Conference

Hagler Bailly solicited the support of the Association of Energy Engineers (AEE) in Atlanta to participate in the USAID program by establishing local chapters in Hungary, Hungary, and Hungary. The purpose of these Chapters was to establish a lasting linkage with a US energy organization actively engaged in promoting energy efficiency. AEE now has five fully chartered chapters in Eastern Europe:

Hungary:	Budapest
Bulgaria:	Sophia
	Plovdiv
Romania:	Bucharest
	Cluj

These Chapters hold regular meetings, engage in energy efficiency promotional activities, meet with Government policy makers on energy efficiency legislation, disseminate information among members, promote the services of members, and loan the energy audit equipment to members

and non-members for energy audits. The Chapters have approximately 85 members total and are actively recruiting new members. Future plans for call for technical training courses, CEM certification programs, and expanded ties with US manufacturers and service firms.

Hagler Bailly also coordinated the attendance of selected CEMs from each country at the annual AEE World Energy Conference in Atlanta for 1992, 1993, 1994, and 1995. Approximately 25 CEMs attended the event over four years.

In 1995, a regional AEE conference was held in Budapest, Hungary. The conference brought together Chapter members from all three countries and presented many interesting topics on energy efficiency. An exhibition was also held in conjunction with the conference which gave US manufacturers and representatives an opportunity to promote their products.

The next step for industrial energy efficiency in Hungary would be to build upon the private sector approach set out in this program and further support the development of a market for energy services in Hungary. USAID can support this by:

- Continued support of AEE chapter activities and CEMs
- Expansion of energy manager training and certification programs
- Demonstration energy efficiency measures at selected sites
- Promotion of DSM/IRP programs in the country
- Promotion of power sector restructuring and tariff reform
- Process engineering efficiency studies at selected industries

Table 2 - Hungarian Energy Efficiency Projects

Plant Name/Location	CEM	Project Description	Equipment
MOFA Fiberboard Factory	Miklos Gellert	Combustion Efficiency Improvement Motor Efficiency Improvement	Portable Combustion Analyzer Variable Speed Drives Digital Controller
Baranya County Hospital	Miklos Gellert	Facility Energy Management	DDC EMS System
North Hungarian Waterworks	Mihaily Szaniszlo	Motor Efficiency Improvement	Ultrasonic Flowmeter Computer/Software Electric Meter & Logger
Nitrokemia Chemical Plant	Mihaily Szaniszlo	Steam Systems Improvement	Steam Flow Meter Electric Meter & Logger Infrared Pyrometer
Dunaferr Energy Supply Company	Albin Zsebik	Combustion Efficiency Improvement Turbine Performance Improvement Steam Systems Improvement	Flue Gas Analyzer Vibration Analyzer Ultrasonic Test Kit Steam Traps
Dunaqa-Therm District Heating Company	Albin Zsebik	Facility Energy Management through Building Central Heating System Control	DDC EMS System
Buszesz Food Processing Plant	Follow-Up to Emergency Energy Program	Facility Energy Management	Demand Monitoring & Control System
Budapesti Vegymuvek Chemical Plant	Follow-Up to Emergency Energy Program	Steam Systems Improvement	Steam Flow Meter

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ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY
Sponsored by the US Agency for International Development and the Association of Energy Engineers

PROGRAM REVIEW MEETING - HUNGARY
November 14, 1996

Location: Gellert Hotel

Attendees: Certified Energy Managers; Plants participating in USAID industrial energy efficiency projects; Representatives of the Ministry of Industry; USAID and its contractors.

Objective: To discuss and review energy efficiency activities, results and future directions of: (1) support to the development of local energy service companies; (2) establishment of Hungarian Chapters of the Association of Energy Engineers; and, (3) energy efficiency project demonstrations.

0830-0900	Registration	
0900-0915	Introduction and Welcoming remarks	Dr. Tamas Jaszay, AEE Hungary
0915-0930	AID Hungary - Country Program Description	Bruce Abrams, USAID Hungary

Review of Project Results

1.	**Demonstration Projects at Industrial Plants**	**Moderator:** Hagler Bailly
0930-1045	Roundtable with managers from plants participating in demonstration projects **Topics:** Concrete results achieved by the plants with the help of the USAID Program Results and lessons learned Benefits of hiring ESCOs	
1045-1100	**Coffee Break**	
1100-1200	**Summarize Results of the Roundtable Discussion**	**Moderator:** Hagler Bailly
12:00-1330	**Luncheon with Keynote Speaker** AEE Organization and Future Trends	Al Thumann, AEE
2.	**Support to Energy Service Companies (ESCOs)**	**Moderator:** Hagler Bailly
1330-1345	Introduction (Results of the ESCO Survey, Highlight of some Results and Trends)	Laurent Pommier
1345-1400	Open Discussion	
3.	**Establishment of AEE Chapter**	**Moderator:** Al Thumann, AEE
1400-1430	AEE Chapter Status Report	Andras Morenth, AEE Hungary
1430-1500	Open Discussion	
1500-1515	**Coffee Break**	
4.	**Financing Energy Efficiency - Future Directions**	**Moderator:** Hagler Bailly
1515-1530	Global and regional trends in energy efficiency financing	Laurent Pommier
1530-1545	European financing mechanisms	*Invited: Ian Brown - EU Energy Center*
1545-1615	Group Discussion	*Borbala Csako, IFC* *Gyorgy Vero, UNICBANC*

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5.	**Discussion of Energy Efficiency Issues and Future Cooperation**	**Moderator:** Ira Birnbaum, USAID WDC
1615-1630	Planned USAID technical assistance program	Electrotek (Larry Markel)
1630-1700	Group Discussion	
2000	Dinner	Sponsored by Hagler Bailly

ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY
Sponsored by the US Agency for International Development
AND THE ASSOCIATION OF ENERGY ENGINEERS

OPEN CONFERENCE - HUNGARY
November 15, 1996

Location: Gellert Hotel

Attendees: Representatives from industrial and institutional enterprises nominated by the AEE members; Plants and vendors who participated in USAID Industrial Energy Efficiency Project and Emergency Energy Project; AEE members; Certified Energy Managers; Representatives from Government Ministries and agencies, utilities, and other assistance programs; USAID and its contractors.

Objective: To promote a market-oriented approach to energy efficiency.

0800-0830	Registration	
0830-0845	Welcoming Remarks	Dr. Miklos Poos, General Director, Ministry of Industry
0845-0900	AEE in Hungary	Dr. Tamas Jaszay, AEE Hungary

Results of Demonstration Projects — **Moderator:** Hagler Bailly

ESCO presentation with Plant Energy Manager

	CEM	Plant
0900-0930	Gyorgy Viragh, Kontravill	Richter Gedeon, Komlo
0930-0945	Ed Corcoran, Centech	Dunapack
0945-1015	Albin Zsebik, Jomuti Kft.	Dunaquatherm, Dunaferr

1015-1030	**Coffee Break**	
1030-1045	Role of USAID in Hungary	Tom Cornell, USAID
1045-1115	Szaniszlo Mihaly, Rendzertechnika	Nitrokemia, E. Vizmuvek
1115-1145	Miklos Gellert, Innovative Engineering	MOFA, Baranya Hospital
1145-1215	Open Discussion	
1215-1330	**Luncheon with Keynote Speaker** Developments in the Global Energy Efficiency Market Concurrent Press Conference	Al Thumann, AEE

AEE Chapter — **Moderator:** Al Thumann, AEE

1330-1345	Presentation of AEE	Al Thumann, AEE
1345-1400	AEE Chapter in Hungary	Andras Morenth, AEE Hungary
1400-1415	Open Discussion	

Financing Energy Efficiency Projects in Hungary — **Moderator:** Hagler Bailly

1415-1430	Global and regional trends in energy efficiency financing	Laurent Pommier
1430-1515	European financing mechanisms	*Invited: Ian Brown - EU Energy Center* *Borbala Csako, IFC* *Gyorgy Vero, UNICBANC*

1515-1530	**Coffee Break**	

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ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY
Sponsored by the US Agency for International Development
AND THE ASSOCIATION OF ENERGY ENGINEERS

OPEN CONFERENCE - HUNGARY
November 15, 1996

Location: Gellert Hotel

Attendees: Representatives from industrial and institutional enterprises nominated by the AEE members; Plants and vendors who participated in USAID Industrial Energy Efficiency Project and Emergency Energy Project; AEE members; Certified Energy Managers; Representatives from Government Ministries and agencies, utilities, and other assistance programs; USAID and its contractors.

Objective: To promote a market-oriented approach to energy efficiency.

Future Cooperative Assistance Programs		**Moderator:** Ira Birnbaum, USAID
1530-1600	Current USAID technical assistance program	Elektrotek (Larry Markel)
1600-1700	Open Discussion	
1700-1715	**Concluding Remarks**	Ira Birnbaum, USAID WDC Bruce Abrams, USAID Hungary Dr. Tamas Jaszay, AEE Hungary
1715-1830	**Conference Networking Meeting**	

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT-HUNGARY

ENERGY EFFICIENCY MARKET DEVELOPMENT

VOLUME I

ENERGY AUDIT ADVISORY REPORTS

Prepared by:

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ENERGY AUDIT ADVISORY REPORTS - HUNGARY

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TAB 5	Eszakmagyarorszagi Vizmuvek Rt.	David Keith
Tab 6	Jacob Suchard	Walter Smith
TAB 7	Komlo Futoeromu Kft.	Robert Holzer
TAB 8	Mohasci Farostlemezgyar Rt.	David Keith
TAB 9	Nitrokemia Rt.	Larry Banta
TAB 10	Richter Gedeon Rt.	David Keith

1. INTRODUCTION

The Energy Efficiency Market Development (EEMD) project has been implemented in Bulgaria, Hungary and Romania as part of the USAID's Regional Energy Efficiency Project. Its primary objective has been to encourage the development of a market for an energy efficiency industry in these countries, and to foster the development and capabilities of local private firms to serve this market. This project has included training for private energy efficiency entrepreneurs, demonstration projects, and support to the development of technical and commercial ties between the US and Eastern Europe.

2. ACTIVITIES

2.1 Training of Energy Services Firms

Local private sector energy service companies went through a competitive selection process based on the criteria of entrepreneurial spirit and commitment to the private sector; interest in energy efficiency consulting; technical expertise; and, regional diversity. They were provided a 3-4 week training program which included topics of energy auditing, energy efficiency technology, industrial production quality programs, financial analysis and business practices for consultants. They were also administered the AEE Certified Energy Manager examination (CEM) by AEE representatives, and are now certified.

2.2 Energy Audits

The local CEMs marketed in each country their services to industrial companies. The USAID program then selected 8-10 plants in each country that had agreed to sign a contact with the local consultants and pay these consultants a market-based fee for an energy audit. The plant selection criteria also required the plants to be willing to cost-share the installed equipment, to provide installation and to make the results of the demonstration project available. Replicability of potential measures to other plants in the same industry and to other industries was also considered. Hagler Bailly consultants spent about one week in each plant to train the CEMs in energy auditing techniques, provide advice, and decide on a package of equipment for the demonstration projects. Assistance continued on subsequent visits to finalize the equipment specifications.

2.3 Demonstration Projects

Based in part on the recommendations of the energy audits, some projects were selected as demonstrations. Competitiveness was also part of the selection, based on a criteria including payback, replicability, and the ability to showcase US equipment. US-made energy efficiency equipment was provided to the participating industrial plants. These plants were responsible for providing ancillary local equipment, installing and commissioning the equipment. The local consultants also designed and implemented monitoring and evaluation programs to assess the actual costs and benefits of the demonstration projects.

3. DOCUMENTS

3.1 Advisory Reports

The energy audit advisor reports assembled in Volume I represent work Hagler Bailly Consulting energy efficiency experts conducted as advisors to the local consultants.

3.2 Final Audit Reports

Volume II contains the final audit reports which represent the work conducted by the local consultants.

3.3 Monitoring Reports

Volume III contains the monitoring and evaluation reports prepared by the local consultants.

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
BARANYA COUNTY HOSPITAL, PECS

Prepared for:
Gellert Innovative Bureau of Engineering

Prepared by:
Robert Holzer

April 15, 1994

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1. Activities

During our work at Baranya County Hospital from March 28-30, 1994, we held meetings with the Economic Director, Head of the Technical Department and the Chief Engineer to review the hospital energy consumption and operations in fields related to energy. We inspected the Boiler Rooms, steam and hot water generation and distribution systems at the Central hospitals and the Pulmonary Sanatorium; collected information on the electricity and gas rate schedules, monthly energy consumptions and costs.

2. Background

The Hospital should be recognized for its interest in reducing their energy expenses, for allowing the Chief Engineer to work with us three days, and being helpful in every way in assisting us.

3. General Comments

Our work concentrated on the energy consumption and operation of the boilers and the heating and domestic hot water distribution systems.

* Recommend to the hospital management to establish and support employee based energy conservation activities.

* Review the electric and gas rate schedules, monthly energy consumption, charges and explain the consumption pattern to the hospital management.

* Recommend caulking and the installation of window seals to reduce infiltration.

3.1 Comments on the Boiler Operation

* There are large surfaces uninsulated on the heat exchangers and pipes. They should be covered with thermal insulation of sufficient thickness and quality.

* Collect climatological information to be able to calculate heating related savings.

* Heating degree days are calculated as follows:

  Average Daily Temperature = Max. daily outdoor air temp. - Min. daily outdoor air temp./2

  Degree Day = 18°C - Average Daily Temperature

  Annual Heating Degree Days = Sum of Degree Days

* Johnson Controls might give you competitive bids for the new automatic temperature controls. Their representative is located in Budapest at Madach Imre ut 3. Telephone: 122-9201.

* Gather information on the hot water circulation pump at the Central Hospital to determine the need for replacement.

3.2 Comments on the Domestic Hot Water System

* Contact manufactures representatives and ask for proposals to install new controls.

* Contact manufactures representatives and ask for proposals to install new heat exchangers.

3.3 Comments on the Electrical Systems

* Assist the hospital in continuing the installation of compact fluorescent lamps.

* Contact Tungsram and other local manufacturers to find electronic ballasts and energy efficient (T-8) fluorescent lamps.

* Consider the use of occupancy sensors to control the lights in periodically occupied rooms.

* Consider the use of occupancy sensors combined with timers for the corridor lights.

4. Project Activities

The following completion schedule was suggested by you:

Data collection	April 1, 1994
Analysis	April 11, 1994
First draft report	April 15, 1994
Translation of executive summary and recommendations, fax to advisor for quality review	April 18, 1994
Second draft report	April 25, 1994
Oral presentation to hospital	April 27, 1994
Preparation of the English language report	April 30, 1994

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
DUNAFERR ENERGIASZOLGALTATO KFT

prepared for:
Albin Zsebik, CEM

prepared by:
Larry E. Banta, Ph.D.
RCG/Hagler Bailly, Inc.

January 31, 1994

---

1. Activities

During our work together at Dunaferr Energiaszolgaltato Kft. from January 18-28, 1994, we held interviews with the General Director, Technical Director, Economic Director, and senior managers to carry out limited reviews of the technical operations. We inspected heat and power generation facilities. We reached agreement on possible equipment to be supplied for improvement of boiler efficiency, testing of steam traps, and testing of turbine vibration. We provided advice to the General Director on technical operations and business strategy.

2. Findings

Dunaferr Energy should be congratulated for taking several major steps recently to restructure its operations, including:

- Restructuring the energy generation co. into a separate limited company (Kft).
- Studies to improve efficiency of steam generation and poer generation (boilers and turbines)
- Plans for refurbishment of boilers.
- Plans for expansion of cogeneration system, using gas turbines or a large steam turbine with extraction and condensing

3. Recommendations

General Comments

There are still many areas of the plant that we have not seen. Check out the district heating water system--the turbine, heat exchangers, pumping system, etc. This is obviously a big user in the winter, and in itself a complex system.

Most of the focus of our discussions to date has been on the boilers and steam system. Over the next few weeks, look carefully at the electrical consumption. Survey the forced draft, induced draft and feedwater pump motors for the boilers, and try to determine if they are loaded in proportion to the boiler firing rate. Survey lighting. Their internal useage is nearly constant at 7 MW, regardless of their electric output. There might be ways to cut their internal fixed consumption--it seems a little strange that it is nearly independent of the steam production rate.

Specific Suggested Actions

The energy audit should develop a number of suggested actions, and from these assemble an action plan. We offer the following ideas are suggested actions for Dunaferr:

1. Stabilize Load on Larger Boilers at Optimum Levels.
Investigate stabilizing the load on the larger boilers at about 80% of capacity and using the smaller boilers to absorb load swings. Repeated large load swings seriously degrade efficiency. The largest and most efficient boilers can be base loaded at their maximum efficiency points by setting the controls to manual while allowing the smaller boilers to swing. Some careful studies should be done to determine maximum and minimum aggregate loads and how to properly stage the boilers to allow adequate swing capacity while using the most efficient boilers the most and while burning the highest percentage of industrial gases possible. **See also #4, which may impact this.

2. Repair O2 Sensor on Boiler #9 and Optimize Combustion Efficiency.
Take O2 readings on boiler #9 to determine its operating status. Find out what type of O2 sensor the #9 boiler has/needs and procurement details. I suspect they are running very high excess air in this boiler and a correction of this would constitute a very good ECO.

3. Check O2 Sensor on Boiler #2 and Optimize Combustion Efficiency.
Boiler #2 is either running too lean or has a defective O2 sensor. If the air/fuel ratio is too lean, there is a serious safety threat since the stack gases will contain CO. Check the stack to verify the O2 reading. If O2 is really 0.4%, try checking CO but be careful not to poison the CO sensor

(this would happen in a stack with more than 4000 ppm CO). It might be wise to run an initial check using the Fyrite liquid O2 analyzer. If the Fyrite tests verify the plant fixed O2 sensor reading, try taking a quick CO measurement with your electronic analyzer. Watch the CO readout, and pull the probe immediately if the reading goes beyond 4000 ppm. Adjusting the air/fuel ratio on this boiler would constitute a good ECO, since high CO readings indicate unburned fuel in the stack gases.

4. Modify Burner Firing Practices.

Find out how the air/fuel ratio controllers work for each boiler--they may be different for different equipment. From what we saw, I believe they have one large damper at the forced draft fan which sets a pressure level in the combustion air manifold. Each burner then has an individual damper to set the combustion air flow based on the firing rate. However, the four burners on the front of #9 were also mechanically linked together for the firing rate control, and I couldn't see a way to shut off the airflow to burners which were not firing. This is my speculation only, and should be verified. The system may be different for different boilers. However, if this is true they are blowing large amounts of excess air into the boiler whenever they shut down a burner. It would be much better to run all the burners at low firing rates than to shut down two and run the other two at high fire. Running all the burners might also give better heat distribution within the boiler as well, and is a no-cost ECO, since only the operating procedure need be changed.

5. Reduce Boiler Blowdown; Monitor and Control Amount of Blowdown to Maintain Acceptable Water Quality.

Get copies of the logs of their boiler water quality tests and check to see if they are blowing down too much water. They test water quality twice per shift, but don't seem to use the data in adjusting blowdown. It is likely that they simply use the tests to make sure the boiler water quality is above a certain level, and it probably never fails the test, so they don't worry about it. If this is true, they are blowing down too much water, thus wasting energy.

6. Reduce Excess Air in Boilers 3,7 and 8.

Although they are quite new, both boilers 7 and 8 were running at 5% O2 in the stack before the air preheater. Boiler #1 was at 3.4%. These readings are very high. Boiler #3 was only burning natural gas, and should be able to get down to 2% or less O2. Boilers 7 and 8 were burning mixed gases and may not be able to go that low, but they are still running about 50% excess air and they should be able to do much better than that. This may be tied in to how many burners they had shut down at the time--see suggestion #4. They may be able to trim this easily by turning on all of the natural gas burners and running them at low fire rather than running only 2 of them.

7. Find and Repair or Replace Leaking Steam Traps.

Mr. Mudra estimated that up to half of their traps were bad. The payback on leaking steam traps is usually less than a year. Make a small survey using your ultrasonic tester and see if you can find some to do the calculations on and write up.

8. Increase Steam Temperature to Turbines.
The turbines are rated for 39 bar steam at 440 C. However they are only generating 36 bar steam at temperatures from 420-430 C. They currently desuperheat the steam in the boilers by using a water spray, so increasing the temperature to the turbine would probably cost nothing. The only possible negative effect would be if they end up with too much superheat in the extraction steam.

9. See if Steam Pressure Can be Increased to Turbines. The same logic applies here as in the steam temperature issue. I have separated them because increasing the steam pressure is more complex and more costly than increasing the temperature, and should be analyzed more carefully before you suggest it. They will have to reset all of their boiler controls (this should not be difficult, but it isn't free, either). Also, although the turbines will run more efficiently at the higher steam pressure, there will also be an energy cost to boost the pressure. They will have to burn more fuel and spend more feedwater pump energy to produce the higher pressure. These differences can be easily calculated from the steam tables or Mollier diagram.

10. Institute Better System of Daily Reports to Track Èquipment Operating Efficiency.
They are very focused on collecting data and installing meters, but don't seem to be using the data as feedback to operations managers or equipment operators. Even the person responsible for supervising the operation of the boilers does not get any data on the daily efficiency of their operation.

11. Check Electric Contract Peak Demand Against Actual Needs
Analyze MVM electric bills and historical data to determine if the annual contract demand can be reduced.

12. Investigate Losses and Heat Transfer
Use portable thermocouple kit to carry out monthly performance tests to determine temperature drops along heat supply system. Investigate sections having high heat loss. Investigate substations where return temperature is high, indicating poor heat transfer.

13. Investigate the Establishment of an Energy Services Division as a Profit Center.
David suggested this during the interview with Mr. Sandor and with Mr. Kenyeres. They really need an internal group of technical people whose primary job is to identify ECOs company wide, and to contract to outside companies as time permits. All work inside or outside would be on a contract basis, bringing profits into Sandor's company to replace losses from the reduced energy sales to clients.

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Suggestions for Longer-Term Studies as Follow-on Work

1. Reduce Steam System Load Swings.

We know that some of the swing on the 6-bar system comes from the waste heat boilers at the converter. Mr. Sipos claimed that these boilers can produce swings of up to 160 t/hr of steam. They may actually be hurting themselves by running the converter boiler--at least if they only generate 6-bar steam with it. Production of that steam reduces the amount of steam that goes through the turbines to generate electricity and leads to underloading of both the boilers and turbine/generators. It greatly complicates the process of boiler dispatching and control. What is the value of 6-bar steam produced by the cogeneration system versus that produced by the converter boiler? A detailed study of this issue is beyond the scope of a normal energy audit, but you might pursue it as follow-on work under a separate contract.

2. Develop a Turbine/Generator Dispatching Strategy.

Given that they generate using extraction turbines and backpressure turbines, variations in steam demand will affect the electric generation output. See if you can get detailed enough data to see if the generator output swings are timed with the converter steam production. In any case, there may be an opportunity for some optimization of the generator dispatching. They seem to like to run all of their backpressure turbines at part load rather than running some of them hard and idling the others. They hurt the turbine and generator efficiency when they do that.

3. Reduce self-consumption of power

Check to see if operators are really using the 2-speed drives they have available for boiler fans. Begin application of adjustable speed drives (variable frequency control) in boiler fans and pumping applications, including the main supply pumps for district heating (Dunaqua-therm has tried but is limited - there seems to be a need for flow control from the supply end).

4. Total Productive Maintenance

Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

4. Next Steps

Prepare energy audit report to Hagler Bailly and USAID, using forms provided.

Complete energy audit report to Dunaferr, according to terms of your contract.

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DEAN OLIVER
ENGINEERING CONSULTANTS

TRIP TO DUNAPACK

PAPER MILL

BUDAPEST, HUNGARY

DEAN OLIVER PROJECT 94-1804/DUNAPACK
March 9, 1994

SUMMARY

The Dunapack mill is operating at a reasonable level of energy usage as compared to world standards. There are no obvious large energy reduction projects available for low capital cost. While not a direct energy project, some help could be given to this facility with regard to developing their Management Information System (MIS) on their computer network. This would make energy measuring tools more readily available to the mill supervision.

CONCLUSIONS:

1/ There do not appear to be any low cost energy reduction projects available that Dunapack can implement.

2/ The current computer data base is not utilized to provide useful management reports.

RECOMMENDATIONS:

1/ With the assistance of the mill supervision, design and develop MIS reports that will give meaningful data summaries. These could then be analyzed to monitor energy consumptions and to control them. Some statistical software may be required or desirable.

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DISCUSSION:

The consulting team of:

Ed Corcoran
Gabor Janko
Ferenc Varga
Jozsef Marton
Paul Wilson

Traveled to the Dunapack paper mill in Budapest, Hungary.

There, we met with:

Dr. Janos Hamar	Mill Director
Varga Laszlo	Power Plant Manager
Ferenc Tompa	Engineering Manager
Laszlo Sarai-Szabo	Paper Mill Technical Manager

During the first day at the mill, the following possible energy saving projects were considered:

1/ Paper Machine Drying Steam Usage
2/ Water Usage on the Paper Machines
3/ Reuse of Water from the Paper Machine Vacuum Pumps
4/ Reuse of Excess Paper Machine Water
5/ Condensate Return
6/ Sewer Losses
7/ Superheat in Steam
8/ Economizers on the Paper Machine Air Exhausts
9/ Use of Savealls for Excess Water Clarification
10/ The use of Refiners rather than Jordans
11/ Quality Improvements
12/ Improved Maintenance
13/ Salvage Winder
14/ Inventory Control
15/ Building Heating System

Upon further examination over the next three days, none of the above possible projects, except Items 12 and 15, were found to be feasible. The following reasons are given:

1/ Paper Machine Drying Steam Usages were calculated and found to be very reasonable. These calculations were generally substantiated by steam records submitted to Gabor Janko.

2/ Fresh Water Usage on the Paper Machines is limited to use on the wet end showers. Since there are no Savealls on the paper machines, the option of using clarified white water on showers in lieu of fresh water does not exist. The cost of adding Savealls is summarized in Item 9, below.

3/ Reuse of water from the Paper Machine Vacuum Pumps is not an option as there are no separators in the vacuum systems and no physical place to install them. Dirty water from the paper machines ends up in the seal water.

4/ Reuse of Excess Paper Machine Water - the secondary fiber plants are already using as much excess paper machine water as possible.

5/ Condensate Return. Overall condensate being returned to the steam plant is between 75 and 80%. This might be marginally improved. However, we could not identify any point discharges of condensate that could easily be collected and returned.

6/ Sewer Losses are not excessive.

7/ Superheat in Steam is evident only in the steam that feeds the after size press section of dryers on the No. 16 Paper Machine. This section of dryers has excess drying capacity. Therefore, ensuring a source of desuperheated steam is not economical.

8/ Economizers on the Paper Machine Air Exhausts already exist and are operating to preheat outside air being fed into the machine room.

9/ Use of Savealls for Excess Water Clarification. A Saveall would be required for each paper machine. The cost is about $1,250,000 for each Saveall. Savings would be approximately one ton per day of fiber and 800 liters/minute of water on No. 14 machine, and four tons of fiber and 1300 liters/minute of water on No. 16 machine. The cost of Savealls cannot be justified in todays market.

10/ The use of Refiners rather than Jordans would save energy since about 75% of the power that is now put into the Jordan is used to turn the device. A Refiner only consumes about 33% of the applied power in driving it. A new double disc Refiner to replace the existing Jordans on No. 16 Machine would cost about $750,000. Payback would be in the order of several years in today's economy.

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11/ Quality does not seem to be a major problem as the mill records show that only 8.4% of the gross production is rejected on No. 14 Machine and 3.7% is rejected on No. 16 Machine. An overall reject rate of about 7.5% (including winder trim, slabs and reject rolls) is a reasonable standard. Overall, the mill more than meets this.

12/ Improved Maintenance will improve the paper machine running time and efficiency. Thus, its effect on energy improvement is only indirect. One maintenance item that we felt could improve the sheet drying and surface quality of the paper on No. 16 Machine was the installation of doctors on all the dryers on this machine. The surface condition of a number of dryers is very poor, thereby decreasing the heat transfer to the sheet from the dryer and also creating a rough surface on the sheet. There also needs to be a systematic, regular cleaning of all doctors.

The downtime report for both paper machines for the month of January was reviewed. No. 14 operated at 81% up-time when holiday time was taken out. The biggest single source of downtime was planned maintenance. The balance of the downtime was largely normal papermaking problems and could be reduced somewhat. No. 16 machine operated at 89.9% uptime when holiday time was taken out. This compares very well with the North American target of 88% up-time.

13/ A Salvage Winder would allow rolls rejected for stars, poor starts and other winder related problems to be cut down and sold as narrower rolls, rather than repulped. However, a salvage winder would cost about $1,000,000. The actual need for a salvage winder has not been determined.

14/ Inventory Control does not seem to be a problem. We did not see a large inventory of raw material and finished product appears to be shipped very soon after production.

In addition, the press section on No. 16 paper machine could be replaced with a press section resembling the one on No. 14 paper machine. This would result in a reduction in moisture of about 5% in the sheet going to the dryers and would allow a production increase of about 25%. The cost for such a rebuild would be about $2,000,000. Such a project should be deferred until additional tonnage is required from this paper machine.

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BUILDING HEATING SYSTEM:

A number of areas were found to be heated in an inefficient manner. These areas should not be heated in their current fashion. These are detailed in a separate report.

MANAGEMENT INFORMATION SYSTEM Reports:

The amount of information available on the computer system is very extensive. However, so much information is available that it becomes confusing. We recommend organizing this information into digestible packages and not reporting certain information at all unless specifically requested. Some examples of this might be:

> Boiler feed water; Boiler make-up water; Steam production
>
> Steam use for each paper machine; Gross paper production from each paper machine; Net paper production from each paper machine; Paper rejects report; Tonnes of steam required per tonne of gross paper production
>
> Weight of waste to No. 16 pulper; Weight of good fiber from No. 16 secondary fiber plant; Steam used in No. 16 secondary fiber plant; Steam used per tonne of good fiber; Paper machine water used; Fresh water used; Water used per tonne of good fiber

The above are meant to be only examples, not an all-encompassing list. Actual reports would be developed with Dunapack personnel.

A number of representative Management Information Summary Reports from an operating U.S. mill are included in the Appendix for information. Also, a number of reference sheets have been included that give an overview of automation systems hierarchy and system functions. It is hoped that these latter sheets will give some insights.

In general, there are three types of information for any level of operations or management. Each level of management will place different importance on the information reported and available. Therefore, the information presented to each level of management will be somewhat different.

The three types of information fall into the following categories:

1/ Essential to run the operation or to do one's job.

2/ Good information to know, but not absolutely essential.

3/ Information that is of no use.

When creating MIS reports for different levels of management and operations, one has to know what types of information are of interest to each group of people. For example, a financial person does not want to know what the speed of a paper machine has been. He is more interested in the number of tons shipped. However, the operations supervisor needs to know the paper machine speed and the number of tons shipped.

Having identified the type of information that each level of management judges essential, this is the only information that is routinely printed out for each group of people. Information from category 2 is usually available on a computer screen and the whole screen can be printed out, if required. Category 3 information is generally not reported at all and is available only by inquiry. In this fashion, people get the information that they need without having to sort through many pages of information, some of which is of no interest to them.

STEAM SYSTEM REVIEW:

Steam traps were reviewed by Jozsef Marton. The steam distribution and condensate network was reviewed by Ferenc Varga. Separate reports by these individuals will be issued.

PAPER MACHINE STEAM AND CONDENSATE SYSTEMS:

Approximate drying requirements were calculated for both No. 14 and No. 16 paper machines. We calculated that the No. 14 machine, when on 70 gm/sq meter paper, would be expected to make 125 tons/day, given an operating time of 88%. This corresponds to an instantaneous steam usage of 2.93 tons of steam per ton of paper produced. The No. 16 machine, when on 150 gm/sq meter liner, would be expected to make 135 tons/day, given an operating time of 88%. This corresponds to an instantaneous steam usage of 2.82 tons of steam per ton of paper produced on that machine. These steam requirements were found to correspond to evaporation rates of less than 15 kilograms of water evaporated per square meter of dryer surface. This indicates that the dryer sections are capable of drying more paper than they are.

Condensate being returned from the paper machines appears to be nearly 100%. While we were at Dunapack, we could only find some condensate leakages from a few flanges that had bad gaskets. Also, no live steam was being sparged into the wire pits

or other places that are frequently used to heat the white water. It is our opinion that very little will be gained by attempting to recover more condensate. We did have difficulty in determining the amount of condensate being returned to the boiler house as the quantity of boiler make-up water was not easy to obtain. As noted in the section on Management Information System Reports, a more easily read summary of water supplied to the steam plant would be helpful.

At this time, we would like to briefly discuss the measurement of returned condensate. In general, if the condensate to be measured contains any flash steam at all, there is no known flow meter that can reliable measure such a stream. In addition, two phase flow (such as occurs in condensate lines) will rapidly destroy any meter that has moving parts. On the other hand, the quantity of boiler make-up water and the quantity of boiler feed water are both fairly readily measured in an accurate and reproducible manner. Thus, an indirect measure of condensate returned can be calculated by taking the difference between the quantity of boiler feed water used and the quantity of make-up water used. This difference is the condensate returned.

COST STANDARDS:

To give an illustration of the type of Cost and Operating Standards that are prevalent in the United States, a Standard Product Cost for two Offset grades is attached in the Appendix. These cost sheets are accompanied by a standard Manufacturing Specification & Furnish sheet and two standard Surface Size Formulations. The Standard Product Cost is used to reconcile material usages and costs each month, while the Manufacturing Specification & Furnish sheet and the Surface Size Formulation sheets are used by operations on a day-to-day basis in manufacturing.

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APPENDIX I

OBSERVATIONS:

Our overall impression is that the mill is clean and reasonably lighted. The operations sprawl over a large area that incorporates a number of buildings that have no apparent function with regard to the papermaking operations. If these outlying buildings are heated, they represent an unwarranted heating load.

In touring the secondary fiber plants, no areas for improvement were noted except for the operation of the deckers (secondary fiber thickeners). Of the two deckers, one was not in service and the second was being operated at high speed. This high speed operation prevents the fiber from forming a mat and being adequately dewatered. It also allows an appreciable amount of fiber to pass through the face wire of the decker and be sewered. As much as 10% of the secondary fiber furnished can be lost in this fashion. It is our preference to run these devices slow enough to let a dryer, thicker mat build up (i.e. about 5 mm thick). This will result in less fiber being sewered and higher solids stock in the storage chest.

In the machine room, excess white water from the paper making processes appears to be pumped back to the secondary fiber plants. Considering the mode of operation of this facility, this is a perfectly acceptable method of water conservation. The only appreciable quantities of water being sewered from the paper machines is the vacuum pump discharge. There are no separators ahead of the vacuum pumps, so all water that is drawn into the vacuum systems from the papermaking processes has to pass through the vacuum pumps where it is mixed with the seal water and is then sewered. Fiber and water balances for each machine are summarized in the block flow diagrams attached in the Appendix.

One possibility for reduced energy reduction here is to install a vacuum blower to supply vacuum for the flatboxes in the forming sections of both paper machines. Droplegs from each flatbox separator to a seal pit located in the basement of the machine room and under the flatboxes would be required on each machine. Such an arrangement would permit the use of a more energy efficient machine than a liquid ring pump and would allow the water from the seal pit to be recovered and reused.

Both paper machines have air-to-air heat exchangers on the roof (economizers) that preheat air being drawn into the machine room with air being exhausted from the machine room. As there are no hoods enclosing the paper machines, the amount of air being exhausted from the machine room is large. Thus, the temperature of the exhausted air is lower than it would be if there were hoods. However, the cost of enclosing each machine with a hood is approximately US$250,000. It is our

experience that retrofitting a hood in circumstances that exist at Dunapack do not give sufficient benefits to justify the expense. Our recommendation here is only to keep the economizers in the best operating condition as is possible.

In the stock preparation area of the No. 16 machine, a number of conical refiners were observed. These devices are highly energy (i.e. electrical power) inefficient and require fairly intensive maintenance. To replace them with twin disc devices, however, would require an expense that cannot be justified. We recommend keeping the conical refiners until such time as the required capacity exceeds that of these devices or until maintenance requirements demand replacement.

Also on No. 16 machine, a number of doctors were observed to be missing from wet end dryers. In addition, it appeared that a number of doctors had not been cleaned in some time. Both conditions can give lowered quality of the product. Regular maintenance and cleaning of the doctors is recommended. In North America, it is the practice to install oscillators on all doctors and to keep them in operation. A doctor that is not oscillating will groove the surface that it is riding against eventually causing costly damage as will as product quality deterioration.

In attempting to retrieve drawings and other data, Gabor Janko found that there was no central filing or retrieval system. One has to run down individuals who have the documents in their possession. A central filing system would be an asset.

When operating data was required, we found that incredible amounts of data were available. However, some of this was conflicting, other data was not clearly defined and some was irrelevant. When asked, most operating personnel said that they did not use this information as there is too much data presented.

There does not seem to be any correlations between the paper machine production and the steam plant operation. Some bench marks should be established here such as tons of steam used per ton of paper produced, and so on. It seems that some statistical analysis could be used to good advantage to determine what data correlates to various production figures. This would allow some derived correlations to be incorporated into Management Information Systems (MIS) reports.

The total production from the two paper machines is about 70,000 tons per year, or 200 tons per day. To support this tonnage, there are two 60 ton per hour boilers producing 112 bar steam. About 70 tons per hour of steam is being generated. This produces approximately 5.5 megawatts of power in a steam turbine/generator.

No. 14 Paper Machine

The first section of dryers is a single felted, Unirun section.

There is a Pocket Ventilation (PV) system utilizing blow boxes with the PV air being directed into the inrunning nips of the felt rolls in the pockets.

There are a total of 36 dryer drums (dryers) in service. There is a Clupac unit about 2/3's of the way down the paper machine. There are 13 dryers after the Clupac unit.

This machine uses 3 bar steam at 200 degrees C. This represents about 55 degrees of superheat. Five degrees of superheat at the paper machine is ideal. More than this will actually reduce the drying rate.

No. 14 Paper Machine if furnished with 100% secondary fiber. It manufactures liner board and is a relatively recent design by Voith. The headbox consistency is approximately 0.3%

Showers on the forming section of this machine were found to be:

Knock-off shower
Oscillating cleaning shower
Two wire return roll showers

This machine has an off-machine silo and a flume system for handling white water. It also has a primary fan pump that supplies the cleaners and a secondary fan pump that dilutes the primary cleaner Accepts and feeds them to the screens and headbox. This is an excellent arrangement.

No. 16 Paper Machine

This machine operates on 70% secondary fiber and 30% purchased pulp. The purchased pulp is unbleached softwood kraft from Russia.

No. 16 machine manufactures corrugating medium and produces a two ply sheet using a primary and a secondary headbox. The Primary headbox consistency is targeted at 0.81%. The secondary headbox consistency is 1.0%. Stuffbox consistencies are in the range of 2.5 to 3.0%

Showers on the forming section of this machine were found to be:

Knock-off shower
Fixed cleaning shower
Oscillating cleaning shower
Three wire return roll showers

The first bottom section of dryers on this machine is not felted. Additional drying could be obtained by felting the first bottom section of dryers. However, this is a very common mode of operation with board machines as it allows the sheet to fall to the basement in the event of a sheet break in this section. Felting this section of dryers invariably leads to dryer wraps during breaks and possible felt and felt roll damage.

No pocket ventilation system was observed on this machine. This generally leads to a back edge that is wetter than the front and reduced drying capacity of the paper machine.

This machine has a size press and a total of 45 dryers.

The after size press section of dryers is fed from the 12 bar steam header with no desuperheater after the reducing valve. Excessive superheat acts like noncondensibles in steam and results in lower heat transfer coefficients. Therefore, steam that has excessive superheat hurts drying. However, desuperheating has to be balanced against the cost of accomplishing this. If the quantity of steam to be desuperheated is not large, a very small, high pressure pump is required. These are very expensive. Also, small volume pumps are not reliable and high pressure pumps tend to be maintenance problems. Desuperheaters require ultra clean water at pressures of three to five bars higher than the steam pressure to get good atomization. Be careful when recommending desuperheaters.

The following temperatures were recorded at the steam joints on the paper machine:

Location	Steam Temp.	Cond. Temp.	Pressure
# 40	200 deg C	147	3 bar
Main Section	142	135	2.5 bar
Wet End	130	115	1.85 bar

It was noted that the noise level in the vicinity of dryer #42 was high. This is adjacent to the indrive for this section of dryers. The pinon gear should be inspected for wear.

The air-to-air heat exchanger for this machine was inspected. Outside air temperatures at this time were 0 degrees C. Surface temperatures were observed to be:

Identification	Wet End	Center	Dry End	
Room Air In	17	32	20	Degrees C
Room Air Exhaust	11	11	8	Degrees C

The relatively low temperature into the economizer indicate that considerable amounts of room air are being drawn into the machine hood and exhausted with the moist air from the hood. New paper machines are supplied with totally enclosed hoods that allow the air within the hood to be recycled and the hood temperatures to run much higher. Hood temperatures of 65 to 80 degrees C are not uncommon. This conserves steam to heat air and exhausts a smaller amount of hotter air than would otherwise be possible. This hotter air also permits heating the make-up air to higher temperatures.

APPENDIX II

ENCLOSURES:

Dryer Calculations for No. 14 Paper Machine

Dryer Calculations for No. 16 Paper Machine

Standard Product Costs for 60.5 gram/square meter Regular Offset

Standard Product Costs for 60.5 gram/square meter Offset Vellum

Manufacturing Specification and Furnish for 109 gm/sq m Offset

Surface Size Formula for Offset

Surface Size Formula

Information on Designing a Management Information System

DCS Screens that Illustrate Typical Information Reported

Glossary of Terms

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
DUNAQUA-THERM RT.

prepared for:
Albin Zsebik, CEM

prepared by:
David A. Keith, CEM
RCG/Hagler Bailly, Inc.

January 31, 1994

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1. Activities

During our work together at Dunaqua-therm from January 24-28, 1994, we held interviews with the General Director, Technical Director, Economic Director, and head of District Heating Dept. to carry out limited reviews of the organizational structure, financing and tariffs, technical operations, and heat conservation projects. We inspected water production and heat distribution facilities. We reached agreement on equipment to be supplied for improvement of heat substation automation. We provided advice to the General Director on operations and organization structure.

2. Findings

Dunaqua-therm should be congratulated for taking several major steps recently to restructure its operations, including:

- Reducing staff by 20%, cutting costs by 10%, and earning a profit whereas a loss had been planned.
- Plans to divest or lease ancillary operations.
- Improving public relations and customer service
- Modifying organization structure, including establishing district heating as a new department, separate from water and sewer.

- Setting up financial operations on the basis of profit centers and cost centers.
- Establishment of collections department for overdue accounts.
- Negotiation of new tariffs with local government which diverge from the old system dictated by the Ministry of Industry and Trade.
- Renegotiating bulk heat supply contracts to obtain better quality of service, and discussions toward a joint venture with the heat generation company.
- Initiating heat energy conservation projects in buildings, including the installation of metering and controls.
- Initiating heat energy conservation projects in district heating supply, including the installation of substation controls.

Dunaqua-therm management faces the following major problems:

- Difficulty in obtaining financing for investments.
- Increase in overdue accounts receivable - difficulty in collecting from customers.
- Need to finance and build wastewater treatment facility in the next 5 years.
- Coping with adverse public opinion since the end of government subsidies meant that tariffs had to be raised.
- Need to improve labor productivity, and difficulty in attracting qualified staff.
- Need to reduce costs since tariff increases are lower than rate of inflation.

3. Recommendations

The energy audit should develop a number of suggested actions, and from these assemble an action plan. We offer the following ideas are suggested actions for Dunaqua-therm:

- Develop a daily efficiency report, and use this report to improve management of operations. The report should develop performance indexes for the key elements of heat and water supply. Each index should relate the cost of energy to the

product supplied. The report should be in a single page, and should include some historical data (graphical trend) and target values (performance tests). The report should be distributed to all the Directors and heads of departments on a daily basis. Based on exceptions to good performance, management should investigate problems and stimulate action by the operators.

- Convert water production from cost center to profit center. Use the accounting system and 1993 data to establish a price of water transferred from Water Production Dept. to Water Supply Dept. Setting a price will provide a profit incentive to improve efficiency in water production, which uses 15 times more electric energy than water supply.

- Start a system to carry out quarterly (4/year) performance tests of pumps and other equipment which is connected in parallel to determine efficiency. From these tests, establish an optimum dispatch procedure for operations.

- Heat Metering - For work in buildings, separate metering and installation of thermostatic radiator valves (TRVs) into two projects. Focus on expansion of metering of heat supply (GJ) to buildings or substations as first priority to move away from the m^3-based tariff. Current plans call for metering and controls to be installed together because this is fair to the customer. However some buildings use much more energy per m^3 than standard. The customers living there need to know this as soon as possible. Set priority to first install all meters and sell heat based on GJ, then install controls. This will give customers in high-energy buildings more incentive to make changes, and they will be willing to invest more of their own money.

- Customer Energy Conservation - Within the heat supply department, establish a "demand-side management- DSM" department as a separate profit center. The DSM department should carry out projects in buildings, such as TRVs, caulking, weatherstripping, or insulation. The DSM department should first carry out analysis of the cost-benefit of projects. Based on this analysis, DSM dept. should offer customers a standard set of projects and percentage cost-sharing. The DSM department must be able to price its services to make a profit to the company, in addition to recovering the "lost revenues" from the heat that Dunaqua-therm will not sell after the new technology is installed. The DSM department should seek financing from outside sources, such as those administered by Magyar Hitel Bank.

- Heat Substations - Upgrade level of automation to improve control according to local outside temperature, supply and return temperature, and other parameters. Selected for USAID funding support.

- Seek to obtain approval from government to install adjustment clauses in tariffs, for changes in outside factors beyond control of Dunaqua-therm, most importantly inflation and the cost of heat from Dunaferr Energiszalgatato.

- Continue application of adjustable speed drives (variable frequency control) in pumping applications for district heating and water supply.

- Develop a technical and financial forecasting model of the company. This model will be useful as a decision tool in tariff planning, restructuring, and investment planning.

- Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

- Analyze MVM electric bills and historical data to determine if the annual contract demand can be reduced at any sites.

- Losses and heat transfer - Use portable thermocouple kit to carry out monthly performance tests to determine temperature drops along heat supply system. Investigate sections having high heat loss. Investigate substations where return temperature is high, indicating poor heat transfer.

4. Next Steps

Work together with Dunaqua-therm and Honeywell to develop a specification for the district heating automation. Obtain price quotation from Honeywell for various pieces of equipment. Provide information to Hagler Bailly.

Prepare energy audit report to Hagler Bailly and USAID, using forms provided.

Complete energy audit report to Dunaqua-therm, according to terms of your contract.

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
ESZAKMAGYARORSZAGI VIZMUVEK RT.
NORTH-HUNGARIAN WATERWORKS CORP.
KAZINCBARCIKA

prepared for:
Dr. Mihaily Szaniszlo, CEM

prepared by:
David A. Keith, CEM
RCG/Hagler Bailly, Inc.

March 14, 1994

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1. Activities

During our work together at Eszakmagyarorszagi Vizmuvek Rt. or North-Hungarian Waterworks Corp. (EV) January 21 and February 23-24, 1994, we held interviews with the General Director, Technical Director, Economic Director, Head of Technological Dept., Energy Manager, Director of Miskolc Region, and various technical and management staff to carry out limited reviews of the organizational structure, financing and tariffs, technical operations, and energy conservation projects. We inspected water production and distribution facilities. We reached agreement on equipment to be supplied for instruments to measure pump/motor efficiency and high efficiency pumps if additional funds are available. We provided advice to the Head of Technological Dept. and Energy Manager on management and technical issues.

2. Findings

EV should be congratulated for taking several major steps recently to restructure and improve its operations, including:

- Reorganized as a joint-stock company in 1993, with profit and loss responsibility, rather than a government department.

- Reductions in staff, for example 20% in Miskolc region

- Significant advances in energy conservation over the years, winning national awards in this field. EV has good awareness of energy conservation, as shown by the many excellent ideas were included in EV's application to join the USAID program, such as electrical energy saving projects in:

  -- high efficiency pumps
  -- high efficiency motors
  -- variable speed drives for pumps
  -- high efficiency switchgear and load centers
  -- phase-to-phase balancing equipment
  -- integrating small accounts into largeones
  -- high efficiency transformers
  -- modern lighting
  -- reducing frictional losses in pipelines

- Improving public relations and customer service

- Setting up financial operations on the basis of profit centers and cost centers.

- Establishment of collections department for overdue accounts.

- Negotiation of new water tariffs with local government.

- Installation of modern, computerized dispatching system to optimize water pumping efficiency and minimize pumping during MVM peak hours.

- Linking together small systems to achieve economies of scale.

- Performance bonuses for Directors and senior managers based on profit and loss from operations of profit and cost centers.

EV management faces the following major problems:

- Difficulty in obtaining financing for investments.

- Increase in overdue accounts receivable - difficulty in collecting from customers.

- Coping with adverse public opinion since the end of government subsidies meant that tariffs had to be raised.

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- Need to improve labor productivity, and difficulty in attracting qualified staff.

- Need to reduce costs since tariff increases are lower than rate of inflation.

EV technical problems include the following:

- Significant drought conditions in the past few years have limited the amount of water available by gravity from reservoirs fed by mountain streams. Additional electrical energy has been required for pumping from wells and lower elevation rivers.

- Pump sets (and other equipment) are generally old and inefficient. Some pump sets are only 50% efficient, and we received data that confirmed this for some pumps at the Gesztely East Peak Waterworks near Miskolc.

- Treated water storage is very limited, and not sufficient to enable pumping to stop during MVM peak hours.

- Pump sets of different sizes are installed in pumping stations, allowing some degree of flexibility without degrading efficiency, but not as much as would be obtained with variable speed drives.

3. Recommendations

The energy audit should develop a number of suggested actions, and from these assemble an action plan. We offer the following ideas are suggested actions for EV:

- Develop a daily efficiency report, and use this report to improve management of operations. The report should develop performance indexes for the key elements of heat and water supply. Each index should relate the cost of energy to the product supplied. The report should be in a single page, and should include some historical data (graphical trend) and target values (performance tests). The report should be distributed to all the Directors and heads of departments on a daily basis. Based on exceptions to good performance, management should investigate problems and stimulate action by the operators.

- Reduce degree of centralization, to put greater responsibility and authority on department heads. Profit center concept should provide an incentive to improve efficiency. Set up targets and assign greater personal responsibility for actions in

the plant, so that people come to feel they "own" their actions, problems, machines, and jobs.

- Start a system to carry out quarterly (4/year) performance tests of pumps and other equipment which is connected in parallel to determine efficiency. From these tests, establish an optimum dispatch procedure for operations.

- Install high efficiency pumps and/or motors in pilot sites (recommended for proposals to USAID).

- Test application of adjustable speed drives (variable frequency control) for pumping applications in pilot sites.

- Develop a technical and financial forecasting model of the company. This model will be useful as a decision tool in tariff planning, restructuring, and investment planning.

- Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

- Analyze MVM electric bills and historical data to determine if the annual contract demand can be reduced at any sites.

4. Next Steps for System Technique Development

Develop cost-benefit analysis for pump test set (electric kW plus flowmeters and data acquisistion), to justify USAID procurement at $10,000 level. Complete project form for this project as soon as possible.

Develop cost-benefit analysis for 2-3 high efficiency motor-pump sets, to justify USAID procurement at $50-100,000 level. Complete project forms for these projects as soon as possible. Work together with EV to develop specifications for the pump sets. Obtain price quotation from Hungarian vendors for equipment. Provide information to Hagler Bailly.

Complete energy audit, prepare energy audit report to Hagler Bailly and USAID, using forms provided.

Complete energy audit report to EV, according to terms of your contract.

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
ESZAKMAGYARORSZAGI VIZMUVEK RT.
NORTH-HUNGARIAN WATERWORKS CORP.
KAZINCBARCIKA

prepared for:
Dr. Mihaily Szaniszlo, CEM

prepared by:
David A. Keith, CEM
RCG/Hagler Bailly, Inc.

March 14, 1994

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- Improving public relations and customer service

- Setting up financial operations on the basis of profit centers and cost centers.

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EV management faces the following major problems:

- Difficulty in obtaining financing for investments.

- Increase in overdue accounts receivable - difficulty in collecting from customers.

- Coping with adverse public opinion since the end of government subsidies meant that tariffs had to be raised.

- Need to improve labor productivity, and difficulty in attracting qualified staff.

- Need to reduce costs since tariff increases are lower than rate of inflation.

EV technical problems include the following:

- Significant drought conditions in the past few years have limited the amount of water available by gravity from reservoirs fed by mountain streams. Additional electrical energy has been required for pumping from wells and lower elevation rivers.

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the plant, so that people come to feel they "own" their actions, problems, machines, and jobs.

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Complete energy audit, prepare energy audit report to Hagler Bailly and USAID, using forms provided.

Complete energy audit report to EV, according to terms of your contract.

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ETSI
CONSULTING

Date: April 14, 1994

To: Nagy, Tibor
CENTECH, LTD.
Radvany ut 34-b
Budapest, Hungary H-1118

From: Walt Smith
Subcontractor to RCG/HB

Subject: **Summary Report to CEM on Hungarian Audits**

It was a pleasure working with you and your staff in support of the Jacobs Suchard Audit. Progress in providing energy consulting services through CENTECH, LTD. is commendable. Please note the following information:

I. A List of Technical Materials Copied by You in Budapest
II. Business Strategies and Markets for ESCO's
III. Additional Items: A. Thermal B. Electrical
IV. Lists of Brainstormed Ideas: A. Thermal B. Electrical
V. Equipment Lists for Procurement
VI. Outline for Audit Report

Results from initial efforts with Jacobs Suchard look promising. The lists for equipment to be supplied by USAID (<$10K and $10-50K) will be provided in my report to RCG/Hagler Railly. Procurement specifications and savings will be provided to RCG/HB within two weeks. The quality of CENTECH's Energy Consulting Services will result in satisfied clients, repeat business, and new contracts.

I look forward to providing advice on Jacobs Suchard and others.

Best regards,

Walter Smith

Walt Smith, Principal
ETSI Consulting

wps/ehm

Enclosures

ENERGY TECHNOLOGY SERVICES INTERNATIONAL, INC.
648 Monte Vista Road, Suite 1
Candler, North Carolina 28715 U.S.A.
Business: (704) 665-9323 • Fax: (704) 665-9323 • Home: (704) 665-2520

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Information Provided to CEM and ESCO Company

I. Technical materials (copied by you in Budapest) useful in energy audits, including:

A. Unit Energy Cost Guidelines
B. Steam Audit, Project Proposal and Presentation
C. Audit Team Organization -- Example PEMEX
   (1) Thermal
   (2) Electrical
   (3) Process
D. Steam Leak/Cost Estimating Techniques
E. Step One: Establish Dollar Value
F. What's New in V-Belts: COG Belts; Half the Losses, Twice the Life
G. Calculating Energy Savings: 30 Illustrated Examples
H. Graphs on Thermal Insulation Data and Loss Estimation Techniques
I. Steam Trap Survey Analysis and Steam Trap Audit Report
J. Energy Audit Training Manual for Refinery Audit (240 pages)

II. Business Strategies and Markets for ESCO's: A wide range of Energy Conservation Opportunities (ECO's ... see report on Audit Guidance and Audits) and Energy Business Opportunities (EBO's -- just now named).

Energy Business Opportunities for the ESCO could include:

A. Recognize that consultants do five things:

(1) Teach -- directly or in the process of doing the job. Teaching <u>how</u> we identify energy waste and apply new technologies brings repeat business, new business, and client-supplier trust.

(2) Identify problems and provide solutions (for example, the Energy Audit to identify low efficiency systems and recommend corrective actions).

(3) Find opportunities for the client and develop them (for example, provide and economic feasibility study for cogeneration).

(4) Provide general technical support for interim periods (for example, the design and installation of ECO's).

(5) Provide expert advice on specific areas and in specialized technologies (for example, how to optimize the reversing cycle time of glass furnace regenerators).

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Each of these five things that a consultant does represents a business/market opportunity to the ESCO. Many discussions with the CEM's illustrated where the Energy Audit, and its many forms, fits into these five areas of consulting services.

B. Potential ESCO Markets

(1) The Energy Audit

The Energy Audit can, and should, be offered in many forms and sizes to meet the client's need. Identify a critical client (customer) need (for example, steam system problems) and propose a sharply focused scope limited to only the steam system rather than a general facility-wide audit. Other forms of an audit could focus on a specific technology (for example, lighting or variable frequency drives), or a particular part of the factory (for example, Workshop B to better utilize energy in the process technology).

(2) The Energy Management Program

The client's Energy Management Program (E.M.P.) should always be evaluated as a part of a facility-wide audit. Clients with large sites and/or multi-sites often need consulting assistance in setting up and/or maintaining the E.M.P. Propose to such clients your regular support as a resource person (1 or 2 days per month, under contract) to meet with the Factory Energy Team. Needs of the client's E.M.P. include the E.M. organization, how to strengthen employee and management energy conservation attitude, improving the structure and effectiveness of energy teams, how to audit internally, and techniques on how to monitor and report on the progress of the Energy Management Program. Provide regular guidance and technical advice under contract.

(3) Energy Markets Outside of Industrial Audits

The ESCO that provides a wider range of services (outside traditional industrial audits) will be able to obtain contracts during business down cycles and sustain a balanced work load. Some markets for consideration would include: (a) Routine assistance in the Energy Management Program and Factory Energy Team (F.E.T.'s), mentioned in Item 2 above; (b) Municipal and commercial sectors, especially in lighting markets; and (c) Equipment sales, especially of portable measuring instruments and new items introduced, including soft cover valve insulation and COG belts for V-belt drives. This business may best be done in partnership with a colleague so as not to dilute the primary technical focus of industrial energy audits.

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III. Additional Audit Evaluations and Data to Be Collected

A. Thermal System

1. Develop a good one-line steam balance (in tons/hour) accounting for all purchased steam (38,800 tons/year) to all loads or users. Document the system loads for 1993 and project what the loads might be in 1996, after planned expansions. Use the 1996 estimate as a basis for evaluating items 2 and 3 below.

2. Evaluate the economic feasibility of on-site steam generation. A Level I Analysis needs to be done as a first cut on feasibility. Current purchased steam (29,743,000 feet for 18092 tons in 1993) cost $7.27/K pounds ... rather high. An average steam load of 4.54 K pounds/hour is small and easily accommodated by packaged fire-tube boiler(s). I can provide technical guidance on this if needed.

3. Consider, as well, cogeneration of plant power. Current purchased power is also expensive at 6.2 feet/kWh (3,547M kWh in 1993 for 21,990,000 feet).

4. Survey all uninsulated steam valves, flanges and high temperature process equipment (i.e., nut roasters, etc.) for application of soft cover insulation. A total of 15 units is specified in Equipment List No. 1 for demonstration (see specification sheet).

5. See list of ideas brainstormed for thermal systems.

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III. Additional Audit Evaluations and Data to be Collected (continued)

B. Electrical Systems

1. Develop a good one-line electrical balance (in kW) accounting for all purchased power (3,547,000 kWh in 1993) to all users. This electrical balance diagram will show the NH_3 refrigeration units to consume approximately 30% of all purchased power, representing the greatest single opportunity in the electrical area.

2. See Item A3 to evaluate the economic feasibility of cogenerated power. One interesting possibility is to direct-drive a base loaded NH_3 chiller and simultaneously produce the hot water which is currently made from purchased steam.

3. Develop a one-line balance on Minusol low temperature refrigerant (-10°C) to all users. The use of this expensive source for space cooling is questionable. An excellent, no-cost idea is to raise the Minusol temperature (say from -10 to -8 or -7°C) to reduce compressor motor load, yet still meet temperature requirements of processes.

4. Establish a formal compressed air leak reduction program utilizing the ultrasonic leak detector.

5. Establish a site-wide lighting committee to implement lighting conservation and system upgrades.

6. See list of ideas brainstormed on electrical systems.

IV. List of Brainstormed Ideas

A. Thermal Systems

1. Insulate steam valves, more than 200 in need.

2. Fix steam leaks. Survey and use charts provided to calculate savings.

3. Install steam and hot water meters.

4. Idle steam segments which have no load.

5. Set up a formal steam trap program using the steam trap leak probe.

6. Insulate high temperature process units (nut roaster).

7. Use flash steam to make hot water.

8. Improve building weatherization and minimize air infiltration.

9. Eliminate steam trap bypasses.

10. Insulate hot piping systems.

11. Replace 25% of steam traps (based on survey done during first day of audit).

12. Consider O_2 control on direct-fired heaters.

13. Change one-through cooling of refiner units to closed loop system.

IV. List of Brainstormed Ideas

B. Electrical Systems

1. Raise Minusol temperature (from -10°C to say -8°C) and control to satisfy the most critical user on a "when possible" basis. The current practice of continuously controlling at a constant -10°C at the NH_3 - Minusol exchangers is using compressor power on the NH3 chillers.

2. Set up a formal compressed air leak program using and ultrasonic heat detector.

3. Replace standard V-belts with COG belts.

4. Evaluate economics of an Energy Management and Control System (EMCS) to control peak demand.

5. Evaluate on-site cogenerated electrical power.

6. Eliminate all electrical tracing (safety problems and expensive).

7. Use soft start on refiner drives.

8. Replace old fluorescent lights with electronic T8 lamps with electronic ballast.

9. Establish a Lighting Conservation Team.

10. Use energy efficient motors when replacing units.

V. List of Purchased Commodities for Kraft Jacobs Suchard

Item No.	Description	Quantities	Estimated Total Cost$
1	Removable, Soft-Cover Insulation	15	3,000
2	COG Belts for 5-45 kW Refiner Drives	60	1,800
3	Steam Traps	6	1,200
4	Infrared, Non-Contact Thermometer	1	500
5	Steam Trap, Ultrasonic Probe	1	2,000
6	Compressed Air, Ultrasonic Leak Detector	1	500
Sub-Total (less than $10,000, firm)			$10,000
7	Energy Management Demand Control (16 Pt.)	1	16,000
8	Soft-Start for Refiner Drives (30 kW)	2	5,000
9	Variable Frequency Drive (~45 kW)	1	15,000
	Contingency		4,000
Sub-Total (Additional $40,000, possible)			$40,000
Grand Total			$50,000

VI. Suggested Energy Audit Report Outline

TABLE OF CONTENTS

1.0 Executive Summary
- 1.1 Objective, Goals, Results
- 1.2 Recommendations with Economics

2.0 Introduction
- 2.1 Background
- 2.2 Purpose
- 2.3 Expectations

3.0 Audit Strategy, Organization and Plan
- 3.1 Audit Team Concepts
- 3.2 Focus and Target Areas
- 3.3 Audit Plan and Schedule

4.0 Data Collection, Available Sources
- 4.1 Annual Energy Consumption and Cost
- 4.2 Unit Energy Costs
- 4.3 Plant Infrastructure and Utility Systems
- 4.4 Energy Distribution Systems
- 4.5 Manufacturing Processes, Technologies

5.0 Data Collection, Field Work
- 5.1 Tour of Energy Systems
- 5.2 Tour of Process Technologies
- 5.3 Observations, Field Notes
- 5.4 Preliminary Identification of ECO's
- 5.5 Energy Measurements of ECO's

6.0 Energy Analysis: Supply, Distribution, Users
- 6.1 Pie Charts of Energy Supply and Cost
- 6.2 Unit Cost-Basis-of-Savings (CBOS)
- 6.3 One-Line Utility Balances
- 6.4 Block Process Flow Diagram (Technologies)
- 6.5 System Performance: Efficiency Plus Reliability
- 6.6 Non-Energy Issues: Constraints and Problems
- 6.7 Weakness Analysis

7.0 Development of Recommendations
- 7.1 Identifying Ideas to Save Energy (Brainstorming)
- 7.2 Converting Ideas into Recommendations (Economics)
- 7.3 Cost-to-Benefit Analysis (Simple Payback, ROI)
- 7.4 Selecting Leading Candidates (ROI, Risk, Fit)

VI. Suggested Energy Audit Report Outline

TABLE OF CONTENTS (continued)

8.0 Implementation Plan
- 8.1 Responsibility for Results
- 8.2 Implementation Schedule

9.0 Closing Meeting with Plant (Preliminary Results)

10.0 Appendices
- 10.1 Data, Supporting Facts, Drawings, Specifications
- 10.2 Field Notes, Observations, Measurements
- 10.3 Equipment Lists for Procurement

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
KOMLO HEAT AND POWER STATION, KOMLO

Prepared for:
Kontravill, Inc.

Prepared by:
Robert Holzer

April 15, 1994

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1. Activities

During our work at Komlo Heat and Power Station from March 31-April 1, 1994, we held meetings with the Director, Investment Manager and the Technical Manager to review the plant energy consumption and operations. We inspected the boilers, electricity, steam and hot water generation and distribution systems.

2. Background

The plant should be recognized for its interest in reducing the energy expenses. The boiler and burner improvements, installation of insulation, replacing underground pipes greatly increased it's efficiency. The management is committed to implement additional installations.

3. General Comments

Our work concentrated on energy consumption and operation of the boilers, generators and the hot water distribution systems.

* Recommend to the hospital management to establish and support employee based energy conservation activities.

3.1 Comments on the Boiler Operation

* The recommended installation of enlarged superheater for boiler #4 to generate more electricity is eligible for aid in the USAID program. The revised form can be used.

* There are uninsulated heat exchangers and pipes. They should be covered with thermal insulation of sufficient thickness and quality.

* Collect climatological information to be able to calculate heating related savings.

* Heating degree days are calculated as follows:

  Average Daily Temperature = Max. daily outdoor air temp. - Min. daily outdoor air temp./2

  Degree Day = 18°C - Average Daily Temperature

  Annual Heating Degree Days = Sum of Degree Days

* Review the cost saving calculations for the Boiler #3 superheater installation and compare with actual operating data and verify the same saving would be available for boiler #4.

3.3 Comments on the Electrical Systems

* Review the feasibility to use high efficiency motors with the new hot water circulating pump.

* Review the feasibility to use a variable frequency drive with the new hot water circulating pump.

* Recommend the installation of energy efficient lighting for interior and exterior illumination.

* Consider the use of occupancy sensors to control the lights in periodically occupied rooms.

4. Project Activities

The following completion schedule was suggested by you:

Data collection	March 15, 1994
Analysis	March 20, 1994
First draft report	April 15, 1994
Translation of executive summary and recommendations, fax to advisor for quality review	April 22, 1994
Second draft report	April 25, 1994
Oral presentation to hospital	April 25, 1994
Preparation of English language report	April 28, 1994

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
MOHASCI FAROSTLEMEZGYAR RT. (MOFA)

prepared for:
Miklos Gellert, CEM

prepared by:
David A. Keith, CEM
RCG/Hagler Bailly, Inc.

March 10, 1994

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1. Activities

During our work together at MOFA from February 18-22, 1994, we held interviews with the General Director, Technical and Sales Director, Economic Director, head of Technical Department, head of Quality Control and Environment, Chief Energetics, and other energy staff to carry out limited reviews of the organizational structure, financing, technical operations, and energy conservation projects. We inspected fiberboard production, steam generation, and heat distribution facilities. We reached agreement on equipment to be supplied - for improvement of control of defirbrators (process automation). We provided advice to the Chief Energetics on low-cost opportunities to improve operations and the organization structure.

2. Findings

MOFA should be congratulated for taking several major steps recently to restructure its operations, including:

- Reducing staff by 50%, cutting costs by 20%, and reducing the financial loss from 1992 to 1993 by 100 million Ft.
- Improving marketing, through advertising and export promotion.
- Improving quality, through ISO 9000 certification program.

- Running only one line at a time in fiberboard production, thereby reducing the fixed energy cost of operations.

- Identifying many energy conservation projects in the factory, including the installation of metering and controls.

MOFA management faces the following major problems:

- Continuing financial losses.

- The need to improve sales and marketing.

- After sales improve above a certain point (about 60% capacity), fixed costs will increase as the second lines are needed. This could cause additional losses until sales reach a higher level (about 70% capacity).

- Difficulty in obtaining financing for investments.

- Need to improve labor productivity, and difficulty in attracting qualified staff.

3. Recommendations

The energy audit should develop a number of suggested actions, and from these assemble an action plan. We offer the following ideas as suggested actions for MOFA. We suggest that you develop estimates of the costs and benefits of each.

3.1 Low-cost measures

- Incentives systems -

  (1) Institute a profit sharing plan for all workers, to encourage them to help the company move toward a positive profit position.

  (2) Provide bonuses for exceptional performance in efficiency, quality, productivity, and projects/ideas. Consider that most bonuses should be awarded only if there is a profit, or at least a major reduction in the financial loss of the company.

- Management information and control system -

The existing reports are on a computer, but do not seem to include any analysis, do not seem to be widely distributed, and do not seem to be very useful in improving the efficiency of operations. However the system in place (computer, clerk, etc.) is basically sound, and can be used to develop a good system quickly and cheaply.

(1) Develop a daily efficiency report, which should develop performance indexes for the key elements of production. Each index should relate the cost of energy to production. The report should be simple, on a single written page, and should include some historical data (graphical trend) and target values (performance tests). The report should also include key daily marketing information (number of new orders, quantity in Ft.).

(2) Use the daily report to improve daily management of operations. The report The report should be distributed to all the Directors and heads of departments each day. When there are exceptions to good performance, management should investigate problems and stimulate action by those responsible. Weekly meetings should be used to review progress and provide more feedback.

- Structure - Reduce degree of vertical organization - eliminate one or more layers to creat a more horizontal organization. Consider setting up an Executive (possibly a President and two Senior Vice Presidents), with Vice Presidents reporting to the Executive. Each Vice President would head a key function (Department), such as the 5 traditional ones in most companies - Marketing, Production, Administration, Finance, Research & Development/Investment. Energy Services should be established as one of the cost centers reporting in the Production Department. Other cost centers in the Production Department might be Chipper, Raw Board, Finished Board, Maintenance.

- Organization - Establish a system of cost centers and profit centers to put greater responsibility and authority on department heads. Setting up profit centers should be designed to provide an incentive to improve efficiency in production. Set up targets and assign greater personal responsibility for actions in the plant, so that people come to feel they "own" their actions, problems, machines, and jobs.

- Accountability - Use the existing accounting system to begin a system of "selling" energy from the energy dept. to the production depts. Use 1993 data to establish prices of steam and electricity (set a two-part tariff for energy (kWh, GJ) and

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capacity (kW, GJ/hr) wherever possible, putting fixed costs in the capacity charge).

- Financial Information - Provide monthly financial statements for all cost center and profit center managers. Provide quarterly financial statements for shareholders. Provide a quarterly newsletter or memo announcing profitability to all workers.

- Motivational Information - Provide operators with information on the cost of operation of their key machines. Provide information in a simple format, in money terms (Ft per hour). Similarly, provide information on the cost of running heating ventilators, the cost of steam leaks, and the cost of leaving lights on.

- Testing - Start a system to carry out quarterly (4/year) performance tests of defibrators and other equipment which is connected in parallel to determine efficiency. From these tests, establish an optimum dispatch procedure for operations.

- Heating system - Turn off ventilators on unit heaters wherever possible. Many were found needlessly operating, in the boilerhouse and near the fiberboard line.

- Quality - we saw the quality report for Feb 21 - 89.9% of raw boards (line V) were first quality, 91.2% of lacquered boards (line III) were first quality. Because these are series operations, of the energy, raw materials, and labor put into lacquered boards, over 18% is not up to standards. This situation bears further study, with the objective to find the causes (it could simply be a few damaged press molds).

- Raw materials - further investigations should be made on the efficiency of procurement and use of raw materials, since this makes up as much cost as energy. There may be ways to reduce waste all along the lines. There could be a need for better measurement and control in the chipper plant.

- Marketing - put in place a system to provide greater information and awareness to the workers, giving the message that 1) marketing is the key to survival, 2) quality and efficiency are the keys to success in producing something that the market will want, 3) the customer is king, and 4) all employees can help in marketing through their personal contacts and word of mouth.

- Failure analysis - institute a system to analyze returns and defects. Identify causes of problems (whether due to personnel or equipment) and ways to correct them.

- Maintenance - put in place a more responsive system of maintenance for costly failures, especially steam leaks. We observed that the main pressure relief valve on HLF boiler failed during our visit, sending an obvious (loud, visible) vent to the atmosphere of more than 1 ton per hour of high pressure steam. However, no efforts were made to dispatch a crew repair it over the weekend, which would have been the least disruptive to production and operations.

- Coal boilers - investigate integrity of valves blanking off these boilers, which are used only in emergencies. These may be leaking since the boilers seem warm/hot.

3.2 Capital investment projects

The plant has several good ideas. The ideas generated by the audit or the plant personnel should each be estimated for costs and benefits, then prioritized by payback period. After this priotiy is made, the overlapping benefits between the actions (double-counting) should be eliminated, by assuming that all higher priority (better payback) actions will be taken in order (best payback first).

- Roller-type lacquer application system for lacquered board production line, to reduce drying energy requirements and paint material costs.

- Level control for hot water accumulator for raw board press line V.

- Reconfigure all defibrators for application of adjustable speed drives (variable frequency control), and thereby save electrical energy and reduce steam bypass. Separate this out into stages - 1-2 defibrators as a pilot project for USAID funding.

- Install additional submetering for steam, and use the information for better efficiency monitoring and control. System needs integrators or data acquisition recorder.

- Install additional intermediate material storage, such as before defibrators, to enable equipment to be run at full load.

- Install simple interlocks or programmable controllers to reduce peak kW demand by shedding low priority loads.

- Shift operations requiring electric energy to MVM night hours as much as possible. One area that could be shifted may be the wood chippers. Invest in additional storage if necessary.

- Investigate opportunities to reduce heating system requirements in factory buildings through the use of infrared heaters.

- Investigate moisture content (and its variability) throughout raw board line and determine opportunities to reduce moisture content of feed to press. Determine time/temperature distribution for press, together with its influences on product quality, and possibilities to save energy at the press by reducing moisture content of the feed.

- Conduct a steam trap survey using an ultrasonic stethoscope and repair or replace leaking traps.

- Consider conducting performance tests to develop better estimates of production costs for different products.

- Develop a technical and financial forecasting model of the company. This model will be useful as a decision tool in setting prices for products, restructuring, and investment planning.

- Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

- Use computer software, planning schedules, and other techniques to improve quality department's ability to improve product quality. Move toward a system of measured quality at all levels of the process, as used in Six Sigma Quality.

- Analyze MVM electric bills and historical data to determine if the annual contract demand can be reduced at any sites.

- Losses and heat transfer - Use portable thermocouple kit to carry out monthly performance tests to determine temperature drops along heat supply system. Investigate sections having high heat loss. Investigate substations where return temperature is high, indicating poor heat transfer.

4. Next Steps

Work together with MOFA to develop a specification for the defibrator variable speed drive automation. Prepare cost/benefit form and provide information to Hagler Bailly.

Develop cost estimates and benefit estimates for all projects, and prepare project action forms and action plan.

Prepare energy audit report to Hagler Bailly and USAID, using forms provided. Submit as many action items as MOFA wants for possible funding, up to $250,000.

Complete energy audit report to MOFA, according to terms of your contract. Continue shared savings actions.

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
NITROKEMIA RT

prepared for:
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February 2, 1994

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1. Activities

During our work together at Nitrokemia Rt. from January 24-27, 1994, we held interviews with the Director of the Mechanical and Energetic Dept, Manager of the Power Dept., and engineers, technicians and operators in the energy department to carry out limited reviews of the technical operations. We inspected heat and power generation facilities, steam metering, water pumping stations, the transformer - rectifier station feeding the chlorine electrolysis shop. Nitrokemia requested that equipment to be supplied by USAID be steam metering for improvement of energy management. We recommended that you contact Honeywell and Gamma to obtain proposals for the steam meter modernization.

2. Findings

Nitrokemia should be congratulated for taking several major steps recently to improve its operations, including:

- Installation of a computer based electricity data acquisition system for monitoring and tracking
- Development of computerized reporting systems on energy usage, including graphical presentation and energy balances
- Plans for expansion of cogeneration system, using gas turbines

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3. Recommendations - Specific Suggested Actions

The energy audit should develop a number of suggested actions, and from these assemble an action plan. We offer the following ideas are suggested actions for Nitrokemia:

3.1 Actions to Improve Management Methods (low cost)

1. Modify Internal Energy Pricing Policies.

Currently, the Energy Department pays peak demand and time of day rates to the electric utility. They have in place the equipment and software to pass actual costs on to their consumers but do not do so. They are ignoring a tremendous opportunity to create incentive in their customers for load levelling and energy conservation by this policy. The energy department is doing a good job - it is not possible for them to save much energy in their operations, perhaps 5-10%. Meanwhile, the production departments have many opportunities to modify production operations (at low cost), and can save 20-30%. Because the system does not provide proper accountability and incentive to energy users, Nitrokemia incurs excessive energy cost.

2. Modify Reporting and Accountability Practices.

The reports that Mr. Halas currently receives include data on gross energy consumption broken down by energy type for each major user. However, these reports do not calculate performance ratios, correlating energy consumption with production, weather, product mix or other key parameters required to perform serious analysis or strategic planning. In our interviews, Mr. Halas indicated that such correlations to measure specific energy consumption were not performed. What they are doing thus amounts to energy accounting, rather than active energy management. Their system allows no possibility for daily tracking and diagnosis of process efficiency, real-time feedback to operations managers or other functions necessary for effective management of energy conversion and resource allocation.

Nitrokemia should develop a daily efficiency report, and use this report to improve management of operations. The report should develop performance indexes for the key elements of heat and water supply. Each index should relate the cost of energy to the product supplied. The report should be in a single page, and should include some historical data (graphical trend) and target values (performance tests). The report should be distributed to all the Directors and heads of departments on a daily basis. Based on exceptions to good performance, management should investigate problems and stimulate action by the operators.

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3. Optimize Capacity Charge on MVM Contract.

Mr. Halas told us that Nitrokemia maintains a safety margin of about 10% on the MW capacity charge, and that there were no instances in 1993 when Nitrokemia exceeded the MVM demand, so they never had to pay the penalty. We also could detect no tracking of MW demand in any of the reports that he showed us, only energy (kWh). It doesn't sound like this system is optimized - it would probably cost them less money over the course of the year to reduce the contract MW limit to the point where it is exceeded 1-5 times during the year. The savings would outweigh the penalties. We also heard that Nitrokemia was able to renegotiate their MW limit in the middle of the year. A study should be undertaken this year to determine the optimum value, then try to renegotiate or at least revise next year's contract.

4. Total Productive Maintenance

Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance, as you learned about from Motorola.

5. Supply Zones and Decentralization

The Nitrokemia complex is very large. There is no doubt that there are zones within the plant where the distribution losses for heating and compressed air systems far exceed the load at the end of the pipeline. In some cases, there are probably parts of the plant which have been shut down, but may be still supplied with steam or air. A zone study should be made to identify such opportunities - resulting in recommendations for additional valves (or plates to permanently block off old areas) to permit better control and shut-off. We think there are probably remote areas at the end of the lines where decentralization makes sense - installing a small boiler (gas or electric fired) or air compressor to serve one or two buildings there.

3.2 Actions to Reduce Electrical Energy Costs

1. Change Forced Draft Fan Motors on Main Boilers to Lower Speed and Possibly to Smaller Capacity.

The four main boilers have forced draft (FD) and induced draft (ID) fans which were sized for burning coal, and are oversized for burning natural gas. Dampers on the air side were set at about 30% open with the boilers running at 65% of capacity. The FD fans are 100 kW, 1470 Revolutions per minute (RPM). Investigate the possibility of replacing these motors with 960 RPM motors such as are used on the induced draft fans. This would allow the dampers to be opened further and fan horsepower would be reduced. Some experiments would need to be

performed to insure that the slower fan could provide adequate combustion air at full boiler load. Reduction of the fan speed by 500 RPM would reduce the fan capacity by about 35%, but will reduce the power consumption by about 70%.

If possible, the motors should be changed to a smaller power rating. Reducing the fan RPM will cause the FD fan motors to be drastically underloaded if they are kept at 100kW capacity. Underloaded motors run at reduced efficiency and lower power factor than motors whose load is greater than 50% of their rating. However, it will be necessary to make certain that a large motor is not necessary to start the fan. The safest plan would be to change one boiler to a 960 RPM, 100 kW motor and study its operation over all ranges of boiler load, including cold start. Size the motors for the other boilers based on the findings from the first boiler. Note that the power required to start a large fan like these is much lower if the dampers are kept completely closed until the fan gets up to speed. Also note that the proportioning control which sets the fan damper as a function of boiler load would need to be recalibrated.

2. Install Variable Speed Drives on Boiler Exhaust Gas Fans; Investigate Reduction in Motor Size.

The exhaust gas fans for the main boilers are also running with the dampers almost completely closed. However, these fans are powered by 960 rpm motors, and I doubt if you can find slower speed motors in the same frame size at a reasonable cost. You should check, however. If slower motors cannot be found, the fan speed could be reduced by using a variable frequency drive on the fan motor. This would reduce the required fan power greatly, and may allow the use of a lower capacity motor of 75 kW or perhaps smaller. Again, the limiting factor may be the power requirements for cold startup. I would size one drive for the 100 kW motor and install it, then use it to collect data for sizing the rest.

3. Replace Underloaded Transformers and Motors.

Both interviews with plant personnel and direct observation revealed that many transformers in the plant distribution network are oversized. This situation typically leads to low efficiency and low power factor since a high proportion of the energy goes to magnetizing currents, hysteresis and core losses. A survey should be conducted to determine which of the transformers are the most underloaded, and the economics of replacement should be explored. It may be possible to sell the oversized transformers to other plants or MVM, to reduce the cost of the project. The new transformers will also have higher efficiency. In some cases it may be possible to eliminate transformers altogether by combining two or more busses into one.

A detailed survey of motors should be carried out to identify those operating at low capacity. A simple power factor (cosine phi) test can determine actual motor load. Those motors running at

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low power factor should be replaced with smaller motors. We agree with Mr. Sajtos and recommend that a power factor meter should be acquired by Nitrokemia.

4. Institute a Demand Control System.

Load control reduces demand charges from MVM, and may reduce energy consumption from idling equipment. We recommend a detailed study of electrical loads around the plant to identify priorities for load-shedding. Significant savings may be possible through telephone communications and operator control, with central monitoring in the energy department. After the manual system is optimized, an automatic system can be considered for improved control. There are many specific load monitoring devices available in the USA, such as made by RUSTRAK.

5. Improve Chlorine Hydrolysis Cell Efficiency.

Interviews with plant personnel revealed that the chlorine production plant uses about 45% of the plant's electric energy consumption. Furthermore, the hydrolysis cells they are using consume about 3300 kWh of energy per ton of chlorine, versus about 2800 kWh/ton for modern cells. Improving cell efficiency could reduce electricity consumption by about 15% per cell, or around 6% for the overall plant. Demand would also be reduced, resulting in significant cost savings as well as energy savings. A detailed study of this project would be warranted, including investigation of replacement of old DC switches, either by direct replacement or by installing solid-state current control to the cells. The latter could involve distribution of AC current directly to the cells and using triac-based current control to eliminate the large central rectifiers. At a minimum, inventory the cells to determine the most efficient ones and schedule production to use the most efficient ones first.

6. Optimize Turbine/Generator Dispatching to Maintain Maximum System Efficiency.

Investigate the system used to dispatch the generating turbines and modify the strategy to optimize the loading of the turbine-generator sets for maximum efficiency. Currently, both turbines are run continuously, usually at reduced load. It is possible that efficiency could be improved by keeping one turbine loaded at optimum levels while the other swings with the loads. A detailed study would be required to determine the best strategy for turbine dispatching.

3.3 Actions to Reduce Thermal Energy Costs

1. Tune up boilers to Reduce Excess Combustion Air.

The boiler controls were all in working order and the general operation of the boiler seemed to be properly done. However, the boilers were running at high excess air levels.

At the time I visited the boiler house, all of the boilers were running steadily at about 22-24 tons/hour, or 65-70% of full load. The stack O2 readings were: #1: 5%; #2: 3,3%; #3: 2,8%; #4: 3,6%. For a single burner natural gas boiler such as these, they should be able to keep the stack O2 between 1-2% without difficulty. A first step would be to get the combustion air/fuel ratios adjusted by a professional company.

2. Survey and Replace Leaking Steam Traps.

In walking around the plant, numerous steam plumes were observed, indicating leaking steam traps. The payback period for leaking steam traps is usually less than one year, making this a good, low-cost ECO.

3. Replace Steam Line Insulation.

We also saw many steam lines which had degraded or missing insulation, especially in the lines going to heat the village houses and shops. Discussions with Mr. Hegyesi confirmed that heat loss from steam lines is very large. Although this represents a large capital investment, the payback for this ECO is usually attractive, making it a good, high-impact investment.

4. Increase Percentage of Condensate Returned to Boilers.

The interview with Mr. Halas revealed that only about 23% of the condensate is returned to the boiler house. Some of the condensate is contaminated in the process, however a great deal of the steam is used for process or building heat and could be returned, reducing water treatment costs and boiler blowdown requirements.

5. Install Additional Steam Metering to Aid in Cost Accounting and Energy Management.

The only metering that occurs is at the highest levels--the 6-bar and 20-bar steam headers which supply the 5 plants and the other customers. Additional metering capability at lower levels would allow accounting for the efficiency of some of the individual processes within each of the major end-user groups. This would create the ability to delegate accountability for energy conservation down to the end-users--a tactic which has been demonstrated to be very effective in other cases.

4. Next Steps

Work together with Honeywell and Gamma to assist them to prepare proposals to modernize the steam data acquisition system. Send these proposals to Hagler Bailly by fax for our review.

Prepare energy audit report to Hagler Bailly and USAID, using forms provided.

Complete energy audit report to Nitrokemia, according to terms of your contract.

USAID - HUNGARY
ENERGY EFFICIENCY MARKET DEVELOPMENT

ENERGY AUDIT ADVISORY REPORT
RICHTER GEDEON RT.

prepared for:
Gyorgy Viragh, CEM

prepared by:
David A. Keith, CEM
RCG/Hagler Bailly, Inc.

May 23, 1994

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1. Activities

During our work together at Richter Gedeon (RG) from May 9-11, 1994, we held interviews with the Deputy General Manager, Head of the Energy Department, Head of the Logistics Department, Manager of Heating Systems, Manager of Cooling Systems, and Manager of Electrical Systems, to carry out limited reviews of RG's energy department, its system of energy management, evaluate potential technical opportunities to improve energy efficiency, to identify candidate investments for USAID funding, and to discuss management. We inspected selected facilities, particularly cooling centers. We reached agreement on a candidate list of equipment to be supplied. I provided suggestions to the Deputy General Manager and Head of the Energy Department on management of operations and organization structure.

2. Findings

RG should be congratulated for its success in energy operations, including:

- Reducing staff.
- Maintaining a very reliable supply of energy to the chemical and pharmaceutical processes.
- Maintaining a high level of safety in energy supply

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- Substantial investment, leading to good success in projects to improve energy efficiency, such as:

  -- Installation of some 7,000 steam traps, which have reduced heat consumption by approximately 19%;

  -- Installation of over 200 electrical sub-meters for the 53 cost centers, which enable a system of energy management and accounting;

  -- Installation of 26 steam sub-meters (at a cost of more than 30 million HUF, or $300,000) for the 14 main production areas, which enable a system of energy management and accounting;

  -- Installation of high-efficiency (OSRAM) fluorescent lighting, using 10% less watts per tube.

  -- A project now underway to install a boiler economizer, at a cost of 7 million HUF ($70,000)

  -- A project now underway to develop software for a central system of electrical energy monitoring, at a cost of 4 million HUF ($40,000)

RG management faces the following problems:

- Slow recovery of markets.
- Difficulty in finding financing.
- Privatization.
- Need to reduce costs.

3. Recommendations

The energy audit should develop a number of suggested actions, and from these assemble an action plan. I suggest grouping in three categories:

A. General and Energy Management

These projects are opportunities which are recommended for immediate action, and require little or no expenditure. These projects affect management systems and techniques, rather than process equipment.

B. Low-cost, Short-term Improvements
These projects are low-cost improvements to process plant and equipment which are recommended for implementation in the short-term. Because of the low cost and quick payback (less than one year), these projects could be implemented from the company's annual maintenance budget. Some of these projects may be of interest for USAID funding.

C. Capital Improvements
These projects are longer term projects, requiring investment which is outside the plant's annual maintenance budget. Such projects would require more careful study.

A. General and Energy Management

A1 Develop an Energy Management System (EMS).

Findings: I could not find a system in place of daily tracking of energy efficiency. The system used for comparing energy cause and effect is based on monthly data, and is not a regular procedure, such as a computerized analysis. Monthly data is insufficient to exercise control, since the cause and effect relationship is old by the time the data is analyzed, and is blurred by different production runs and weather conditions. (Daily data is the largest aggregate which allows effective control.) There are not regular management directives to improve efficiency, since there is not a performance measurement system that management can use to determine if operations are efficient or not.

Action: A simple system, based on a daily efficiency report should be developed. The system must not end with the report - this report should used to help manage operations. The report should develop performance indexes, to relate energy usage to its main causes (production and weather). The index can be developed first by using the same assumptions and formulas used to develop the annual energy budget, except using daily data rather than annual. The index can then be corrected by the average daily ambient temperature, to account for differences in heating or cooling loads. Each index should relate the cost of energy to the product supplied. The different cost of electricity (according to the peak/day/night tariff) should be included in the cost analysis. The EMS report should be in a single page, and should include some historical data (graphical trend) and target values (performance tests). The report should be distributed to all the Directors and heads of departments on a daily basis,

and there should be a brief (30 minutes, maximum) daily EMS action meeting to discuss the performance index, develop solutions to any problems, and discuss plans for production for the next day and its implications for energy supply. After the system is working well the meetings could be changed to an exception basis - when exceptions to good performance occur, management should investigate problems and stimulate action by the operators.

Results: I expect that a 5-10% improvement in energy efficiency (energy cost per HUF production) is achievable, simply through better control of operations. Once production personnel and managers know that top management is interested and is watching, they will have a much better incentive to improve performance.

A2 Form a Technical Cost Reduction Project Team.

Findings: There are opportunities for improving energy efficiency in process operations. (For example, we observed an opportunity to recover flash steam from the fermentation area, and an opportunity to optimize operations in the supply of cooling). However, these opportunities have not been realized for fear that they would disrupt the reliability of energy supply and hence cause a loss of production, or an unsafe situation. I expect there are also other technical cost reduction projects that would improve production rates, reduce raw material consumption, optimize maintenance, optimize quality, and improve process operations. Although as a foreign outsider I cannot be sure, I think there seems to be less interaction among department heads at RG than I observe in American plants in the same industry.

Action: The concerns for reliability and safety are most important - more important than saving energy or reducing the cost of supply - because low reliability or safety runs the risk of production loss, which would be very costly. Yet other plants in the same industry share these concerns, and they have found ways to install energy saving technologies and optimize energy supply, such as the examples noted above. The method needed is to form a team to develop the project. The team should be led by RG's best process technical specialist (not an energy specialist). The team should include experts from the production departments, logistics department, process technology department, maintenance department, and energy department. Outside consultants could be used to provide fresh ideas, second opinions, or unbiased analysis. The team should be given a budget, should develop candidate projects, and should develop specific criteria to evaluate the projects (including payback, downside risk, and upside reward). The team should meet weekly, and should prepare a monthly report. The team should be given no more than 3 months to form its first

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set of decisions, so that some projects can begin quickly. Then the team should continue with those projects that require more study.

Results: I have observed this approach result in excellent projects in many factories, improving energy efficiency 10-20%. Given the existing conditions at RG, I expect similar results.

A3 Organize to promote better accountability and responsibility for energy costs

Findings: The Energy Department has responsibility for energy efficiency, yet is in no position to influence the main causes of energy consumption. Thus energy efficiency is a hobby rather than a business. The Energy Dept. allocates energy costs to the other departments, but some of the primary signals (such as the peak/day/night electric tariff, the kW demand charge, and the GJ/hour natural gas charge) are not passed on to the consumers who are responsible for RG incurring these costs. This has the effect of subsidizing some of RG's pharmaceutical products while penalizing others. The long term effect of this biased allocation of costs could be loss of competitiveness in world and local markets.

Action: There are several ways that the system of responsibility and accountability can be improved. Any number of systems could offer better incentives to save energy.

First, I suggest that the system of selling energy and setting energy prices within the plant be improved, and we had several discussions on this subject. I tried to show that to promote efficiency and responsibility, prices should include consideration of marginal (or incremental) costs, rather than simple average costs. Thus electric consumers during peak hours pay a higher price per kWh. Similarly, steam consumers during the peak steam flow pay a higher cost per GJ, since they cause the demand charge.[1]

[1] Of course there are other factors, such as labor costs, which would be higher per ton of steam on the weekend. But the cost of purchased energy (gas) is lower on the weekends, because the low demand is not responsible for the energy charge. And the allocation of cost for installed equipment should be based on peak loads too, since the equipment is sized to handle peak loads (boilers, steam lines). These factors taken together in an economic analysis, I have not yet observed a plant where steam cost of supply is higher on off-peak, such as weekend. Our discussions on this subject with Mr. Fodor were interrupted and I am not sure that I was successful in getting this point across. It is a fundamental part of market economics, but I know it is a new concept in Hungary, though MVM already applies it in making up their peak/day/night tariffs.

Second, the concept of setting up several Kft companies within Rg should be investigated. If this is done, the energy supply service should be one such Kft.[2] As we discussed, this would result in better responsibility among the energy users, and would encourage the energy supply Kft to become more efficient.

Third, a concept of profit sharing could be used. I heard about the "red shirts" (young people who had the job of turning off lights under the old system). Such a system was based on a good idea - stop wasting energy. Presumably, since the system died the job is not getting done as effectively. The same concept could be applied today, with a financial incentive. For example, if there were an accurate and fair system of measuring energy efficiency (such as the EMS described in A1), then a system of incentives could be started. Suppose energy savings resulted from two actions - investments and improved operations. Then, suppose RG decided to share the profits resulting from improved operations with the plant personnel. There are several ways to do this:

-- Identify those who are doing an effective job or contributing good ideas, and give them cash prizes,

-- Share the profits among employees, according to a scheme:

= bonus for managers
= bonus for all employees
= bonus for those departments who use energy (production)
= bonus for those departments that improve efficiency
= lottery system, putting bonus pool together, then drawing a few names out - those get large prizes (house, car, etc)

Results: Such a system could save 5-10%, depending on what results might have been achieved by other actions, such as A1 and A2.

B. Low-cost, Short-term Improvements

[2] This system has been adopted at Dunaferr, which is another AV Rt company. Dunaferr has its own power station, and so it seems simpler to adopt this solution there. However it should be able to work at RG too.

B1 Rationalize energy supply systems

The major types of projects here are rationalizations - to inspect systems and look for leaks, areas no longer used, and ways to improve maintenance. We discussed the following ideas:

- Steam distribution systems, including testing of steam traps and increase in condensate return
- Dispatching of boilers - equalize load instead of peaker/baseload
- Compressed air systems - including testing for leaks during Sundays
- Climatization (HVAC) - optimizing space conditions (temperature and humidity)
- Electric motors - identifying oversized motors (low cos phi)
- Cooling center operations - optimize based on: (1) run minimum number of compressors, (2) open all cooling tower valves to minimize delta P across compressor, (3) start/stop cooling tower fans to minimize total kWh/GJ cooling.

Start a system to carry out quarterly (4/year) performance tests of pumps and other equipment which is connected in parallel to determine efficiency. From these tests, establish an optimum dispatch procedure for operations.

Losses and heat transfer - Use portable thermocouple kit to carry out monthly performance tests to determine temperature drops along heat supply system.

Each of the areas listed above requires a project - it needs to have a budget, staff, schedule, etc. I expect savings of 5-10% are possible in each area.

I suggest you develop action forms for each of these projects. These could be good follow-on contracts for Kontravill. We can supply tools to RG through the USAID project, such as thermocouple kits, ultrasonic testers, etc.

B2 Steam, cooling, and N2 energy management system

We discussed the need to bring together the various signals to the central computer. There also needs to be software to develop the necessary reports, and a commitment from RG management to use the system to make changes to improve operations. Software would need to be developed for each of the following applications of the data:

- Weather monitoring
- Economic loading
- Identification of waste
- Billing
- Accounting
- Optimize gas contract
- Control of usage
- Checking the gas company bills
- Plans for future development and budgets
- Response to questions from management

I suggest Kontravill develop the action form for this project. We discussed possible USAID funding for hardware, if RG would pay for software.

B3 Boiler efficiency testing

We discussed the use of a flue gas analyzer to monitor combustion efficiency. I think a dissolved solids meter ($400) would also help them to optimize blowdown. I am concerned that this measure might not save very much energy, since they are doing something already with a rented instrument.

I suggest you develop the action forms for these two projects (combustion efficiency, blowdown optimization). We discussed possible USAID funding for the gas analyzer, we could also fund the solids tester (you have one in the energy audit kit).

B4 Improve pump seals

We discussed the use of better pump seals to reduce friction (save energy) and reduce cooling fluid losses.

I suggest you develop the action forms for this project. We discussed possible USAID funding for the seals - this would demonstrate the technology in a few instances, then they could move forward on their own. You should contact Chesterton, and get them involved (I sent you a fax on this subject last week, with Chesterton's contact - TPI).

C. Capital Improvements

C1 Electrical peak demand control system

We heard about the INTEX contract to bring together the data from 150 points. The next step would be to develop a set of priorities, identify ways to control the low-priority loads, and install a control

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system. This could be hard-wired, ripple (power line carrier), or radio. I expect that peak demand could be reduced by up to 10% if there was a serious goal to do schedule production and operations at minimum cost.

I suggest you develop action form for this project.

C2 High efficiency lighting

We discussed the possibility of installing a lighting retrofit, even though they already use the OSRAM tubes. Such a system would replace fixtures and ballasts, install reflectors, install occupancy sensors, and optimize lighting levels according to the task.

I suggest you develop one or more action forms for this project. We discussed possible USAID funding. You should get Tungsram involved.

C3 High efficiency electric motors

We discussed the possibility of beginning a system of replacing motors with high efficiency (HE) types. Probably the new Magnetek-EVIG joint venture, or GE, could supply them. The first step would be to acquire a few HE motors, and use them in the factory. the motors they replace could be used as an inventory. This inventory could be used in a motor rationalization program - to identify underloaded motors and replace them with smaller kW motors.

I suggest you should develop one or more action forms for this project. We discussed possible USAID funding. You should contact EVIG and learn about their j.v. with Magnetek. Please send me the specs on efficiency of EVIG standard motors, and any specs you learn on the j.v.

C4 Steam ejectors

We discussed a project to use a thermocompressor to convert flash steam from the condensate return system into usable 2.5 bar (low pressure) steam for the network. This would reduce steam demand from the boilers.

I suggest you should develop one or more action forms for this project. We discussed possible USAID funding. I am looking for a US vendor - but have found nothing so far.

C5 Heat recovery from fermentation

We discussed a project to use a thermocompressor to convert flash steam from the fermentation units into usable 2.5 bar (low pressure) steam for the network. This would reduce steam demand from the

boilers. RG indicated that this project was not feasible because of the concerns for reliability of supply, but I have seen this done successfully in other factories.

I suggest you should develop one or more action forms for this project.

C6 High efficiency air compressor

We discussed the possibility of a new air compressor, to improve the efficiency and reliability of supply.

I suggest you should develop one or more action forms for this project. Please provide information on the air compressor, including technical specifications and the efficiency of the unit they have now. I will look for a high efficiency unit so we can estimate payback.

C7 Variable frequency drives

We discussed this possibility, but did not find a suitable application yet.

I suggest you seek opportunity for application of adjustable speed drives (variable frequency control) in pumping, ventilation and compressor applications.

C8 Total productive maintenance

I suggest that you could apply the things you have learned from Motorola to RG. This would certainly include total productive maintenance, and perhaps the process mapping and six sigma quality.

Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

4. Next Steps

Work together with RG and vendors to develop a specification for the equipment. Obtain price quotation for various pieces of equipment. Provide information to Hagler Bailly.

A. For USAID procurement, we need to complete all of these steps by June 30, 1994:

(1) I need to receive a simple letter from RG "requesting USAID assistance with the following projects..."(list them, but not in great detail, but this shows they want it). If it comes in Hungarian, please provide a translation.

(2) For each of the projects, we need a justification form from you

(3) I will select some or all from RG's list based on USAID criteria (demonstrating various different U.S. technologies, distributing funds across the plants), and recommend to USAID. I will inform you of my recommendations.

(4) You, together with RG and equipment suppliers, prepare detailed specifications sufficient to purchase the equipment. (this will take time, some weeks)

(5) USAID approves (this can take 3-4 weeks).

(6) Hagler Bailly issues a purchase order to the equipment supplier. With this order, Hagler Bailly makes a legal commitment to buy the equipment, on behalf of RG.

Closing date for responses to me by fax for Steps 1 and 2 is
6:00 pm Budapest time May 27, 1994. I will act on anything sooner, if possible.

B. Complete energy audit report to Hagler Bailly and USAID, using forms provided.

C. Complete energy audit report to RG, according to terms of your contract.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT-HUNGARY

ENERGY EFFICIENCY MARKET DEVELOPMENT

VOLUME II

FINAL ENERGY AUDIT REPORTS

Prepared by:

HAGLER BAILLY CONSULTING, INC.
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FINAL ENERGY AUDIT REPORTS - HUNGARY

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TAB 3	Dunapack Rt.	Tibor Nagy, Control Quality Consulting, Ltd.
TAB 4	Dunaqua-Therm Rt.	Albin Zsebik, Jomuti, Ltd.
TAB 5	Eszakmagyarorszagi Vizmuvek Rt.	Mihaly Szaniszlo, Rendszertechnika Fejleszto Kft.
TAB 6	Komlo Futoeromu Kft.	Gyorgy Toth, Kontravill, Inc.
TAB 7	Mohasci Farostlemezgyar Rt.	Miklos Gellert, Gellert Innovative Bureau of Engineering
TAB 8	Nitrokemia Rt.	Mihaly Szaniszlo, Rendszertechnika Fejleszto Kft.
TAB 9	Richter Gedeon Rt.	Gyorgy Viragh, Kontravill, Inc.

1. INTRODUCTION

The Energy Efficiency Market Development (EEMD) project has been implemented in Bulgaria, Hungary and Romania as part of the USAID's Regional Energy Efficiency Project. Its primary objective has been to encourage the development of a market for an energy efficiency industry in these countries, and to foster the development and capabilities of local private firms to serve this market. This project has included training for private energy efficiency entrepreneurs, demonstration projects, and support to the development of technical and commercial ties between the US and Eastern Europe.

2. ACTIVITIES

2.1 Training of Energy Services Firms

Local private sector energy service companies went through a competitive selection process based on the criteria of entrepreneurial spirit and commitment to the private sector; interest in energy efficiency consulting; technical expertise; and, regional diversity. They were provided a 3-4 week training program which included topics of energy auditing, energy efficiency technology, industrial production quality programs, financial analysis and business practices for consultants. They were also administered the AEE Certified Energy Manager examination (CEM) by AEE representatives, and are now certified.

2.2 Energy Audits

The local CEMs marketed in each country their services to industrial companies. The USAID program then selected 8-10 plants in each country that had agreed to sign a contact with the local consultants and pay these consultants a market-based fee for an energy audit. The plant selection criteria also required the plants to be willing to cost-share the installed equipment, to provide installation and to make the results of the demonstration project available. Replicability of potential measures to other plants in the same industry and to other industries was also considered. Hagler Bailly consultants spent about one week in each plant to train the CEMs in energy auditing techniques, provide advice, and decide on a package of equipment for the demonstration projects. Assistance continued on subsequent visits to finalize the equipment specifications.

2.3 Demonstration Projects

Based in part on the recommendations of the energy audits, some projects were selected as demonstrations. Competitiveness was also part of the selection, based on a criteria including payback, replicability, and the ability to showcase US equipment. US-made energy efficiency equipment was provided to the participating industrial plants. These plants were responsible for providing ancillary local equipment, installing and commissioning the equipment. The local consultants also designed and implemented monitoring and evaluation programs to assess the actual costs and benefits of the demonstration projects.

3. DOCUMENTS

3.1 Advisory Reports

The energy audit advisor reports assembled in Volume I represent work Hagler Bailly Consulting energy efficiency experts conducted as advisors to the local consultants.

3.2 Final Audit Reports

Volume II contains the final audit reports which represent the work conducted by the local consultants.

3.3 Monitoring Reports

Volume III contains the monitoring and evaluation reports prepared by the local consultants.

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Baranya Hospital

by

Miklos Gellert

Gellert Innovative Bureau of Engineering

for

Hagler Bailly Consulting, Inc.

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GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
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USAID and
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General manager: Zoltán HORVÁTH

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Managing director: Miklós GELLÉRT CEM

Report date: 05. 25.

Please find enclosed our application to the USAID and the RCG/Hagler Baily company for supporting our proposal complying with the criterias of USAID. The action plan detailed below is the result of our preliminary energy auditing.

During the auditing two main units of the hospital was examined as good examples to demonstrate the situation and the opportunities of the health institutes in Hungary.

The aim of our prposal is to demonstrate the usage of the American and Hungarian products and efforts.

The reduction of the operational costs due to energy conservation in institute having tight budget is relevant and serves as a good example.

Hospital of Baranya County

Number of the proposal	Proposed measures
1. Hospital centre	Heating control Installation of a DCC control system Installation of a Excel EMC central unit Replacement of the heating circulation pump
2. Lung hospital	Installation of a microprocessor controlled, ambient air temperature dependent heating control system
3. Hospital centre	Modernisation of the DHW control system
4. Lung hospital	Modernisation of the DHW control system
5. Hospital centre	Modernisation of the heat exchanger for DHW production, replacement with a Dissasembling plates heat exchangers.
6. Lung hospital	Modernisation of the heat exchanger for DHW production, replacement with a Dissasembling plates heat exchangers.
7. Hospital centre	Introduction of hand-held thermometers
8. Hospital centre	Modernisation of the control system of the escalators

Zoltán Horváth
Hospital of Baranya County
Economic director

Miklós Gellért
Gellért Innovative Bureau of Engineering D.P.
Managing director

GELLERT INNOVÁCIÓS
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H—7635 PÉCS, BARACKOS U. 24.
PF.: 1784
TELEFON: 06-72-19661

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

Prepared for USAID and RCG/Hagler Bailly

ACTION NO H-HOSPITAL-1-DDC

HOSPIT1 ver.2

Plant name:	HOSPITAL OF BARANYA COUNTY		
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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		
ACTION No. AND BRIEF DESCRIPTION	H-HOSPITAL-1-DDC HEATING CONTROL		
AREA OF PLANT EFFECTED	HOSPITAL CENTER		

FINDINGS CONCERNING EXISTING CONDITIONS

The thermal energy for the central heating is produced by a type HOK 4 hot water boiler.
The boiler provide heating for 24 hours heating services for 7 separate buildings, containing patient rooms, medical services and offices.
The heating water is circulated by one main and another buster pumps at the margins of their capacity and they are worn out.
The boiler is controlled manually. There are no automatic controllers for the heating systems of the individual buildings.
The flow temperature is controlled manually by the operator.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

In order to achieve a more economical heating it is proposed to improve the temperature control by the means of the introduction of an automatic, ambient temperature dependent control system.
The system provides ambient air temperature reset. The system contains a three way valve, and strainer shut off valves, intelligent DDC control system with an Excel EMC or equivalent central unit.
The introduction of the automatic control system will eliminate the overheating presently occurs frequently.
It is vital to replace the heating circulation pumps with a proper one. Specifications: flow: 100m3/h, TDH greater than 13m.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Energy Mwh/year	Fuels GJ	Heat	Steam	Total cost US $/year
Baseline - existing conditions			22380			75142
After recommended action			18262			61616
Net reduction			4118			13526

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	1317		
Equipment procurement	5935		without pump
Equipment installation	2892		
Equipment commissioning	943		
TOTAL INSTALLED COST	11087	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 11087}{a: \quad 13525 - \quad c:} = 0{,}82 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY ACTION NO H-HOSPITAL-2-SANATORIU

Prepared for USAID and RCG/Hagler Bailly

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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		
ACTION No. AND BRIEF DESCRIPTION	H-HOSPITAL-2-SANATORIUM HEATING CONTROL		
AREA OF PLANT EFFECTED	LUNG SANATORIUM		

FINDINGS CONCERNING EXISTING CONDITIONS

The thermal energy for the central heating is produced by a type TP 700 hot water boiler. The boiler is controlled manually. The boiler provides heating for 24 hours a day in the heating season.

The heated buildings are the hospital and adjacing nursing homes. The hospital contains patient rooms, laboratories examination rooms and kitchen.

The flow temperature is controlled manually by the operator. There is no automatic temperature control for the heating system. The heat water circulation pump serves 7 zones without individual controllers.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

In order to achieve a more economical heating it is proposed to improve the temperature control by the means of the introduction of an automatic, microprocessor controlled ambient temperature dependent control system with daily/weekly/yearly program. (Honeywell MCR 52 or equivalent) The proposed control system contains a three way valve (ND 100).

The introduction of the automatic control system will eliminate the overheating presently occurs frequently.

Further possibilities for improving the efficiency are to apply two separate controlled circuits or thermostatic radiator valves (95 off 1/2" valves protected against vandalism)

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy	light oil			
	KW	Mwh/year	tonnes			US $/year
Baseline - existing conditions			235			116002
After recomended action			200			98602
Net reduction			35			17400

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	755		
Equipment procurement	4571		
Equipment installation	2341		
Equipment commissioning	754		
TOTAL INSTALLED COST	8421	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 8421}{a: \quad 17400 - \quad c:} = 0{,}48 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSPITAL-3-DHW-CONT

Prepared for USAID and RCG/Hagler Bailly

HOSPIT3

Plant name:	HOSPITAL OF BARANYA COUNTY		
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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		

ACTION No. AND BRIEF DESCRIPTION	H-HOSPITAL-3-DHW-CONTR MODERNISATION OF THE DHW CONTROL SYSTEM
AREA OF PLANT EFFECTED	HOSPITAL CENTRE

FINDINGS CONCERNING EXISTING CONDITIONS

The DHW is generated by three gas fired steam boilers. The same boilers also provide steam for two other buildings.
The hot water for the hospital is produced and stored in 3 storages, 5 m3 each, heated by steam through built in heat exchangers. The temperature is controlled manually. There is no automatic temperature control.
The health regulation requires the hot water temperature limited to 45 grad C. Presently the temperature is 55 - 60 grad C.
The DHW temperature is dependent on other steam users, as the laundry.
The peak hot water consumption is 15 m3/h
Some of the pipe and tank insulations are missing.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Provide and install an automatic teperature controller in the steam pipe serving the domestic hot water heaters for maintaining the required water temperature.
The proposed controller: 3 off Honeywell TS 465-65 or equivalent

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy	gas			
	KW	Mwh/year	GJ			US $/year
Baseline - existing conditions			6280			20661
After recomended action			5822			19122
Net reduction			458			1539

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	471		
Equipment procurement	7075		
Equipment installation	566		
Equipment commissioning	235		
TOTAL INSTALLED COST	8347	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 8347}{a: \quad 1439 - \quad c:} = 5{,}8 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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ECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY ACTION NO H-HOSPITAL-3-DHW-CONT

repared for USAID and RCG/Hagler Bailly

HOSPIT3

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	Miklós GELLÉRT C.E.M. managing director		
eport date	April 1994		
CTION No. AND BRIEF DESCRIPTION	H-HOSPITAL-3-DHW-CONTR MODERNISATION OF THE DHW CONTROL SYSTEM		
REA OF PLANT EFFECTED	HOSPITAL CENTRE		

NDINGS CONCERNING EXISTING CONDITIONS

The DHW is generated by three gas fired steam boilers. The same boilers also provide steam for two other buildings.
The hot water for the hospital is produced and stored in 3 storages, 5 m3 each, heated by steam through built in heat exchangers. The temperature is controlled manually. There is no automatic temperature control.
The health regulation requires the hot water temperature limited to 45 grad C. Presently the temperature is 55 - 60 grad C.
The DHW temperature is dependent on other steam users, as the laundry.
The peak hot water consumption is 15 m3/h
Some of the pipe and tank insulations are missing.

ECOMMENDED ACTION TO IMPROVE EFFICIENCY

Provide and install an automatic teperature controller in the steam pipe serving the domestic hot water heaters for maintaining the required water temperature.
The proposed controller: 3 off Honeywell TS 465-65 or equivalent

PECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels gas GJ	Heat	Steam	Total cost US $/year
eline - existing conditions			6260			20661
er recomended action			5822			19122
reduction			438			1439

ST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	471		
Equipment procurement	7075		
Equipment installation	566		
Equipment commissioning	235		
TOTAL INSTALLED COST	8347	(b)	

imated increase in annual (non-energy) operations and maintenance cost (c)

YBACK PERIOD

$$\frac{b: \quad 8347}{a: \quad 1439 - \quad c:} = 5,8 \text{ years}$$

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSP-SAN-4-DHW-CON

Prepared for USAID and RCG/Hagler Bailly

HOSPIT4

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION H-HOSP-SAN-4-DHW-CONTR
MODERNISATION OF THE DHW CONTROL SYSTEM

AREA OF PLANT EFFECTED LUNG SANATORIUM

FINDINGS CONCERNING EXISTING CONDITIONS

The DHW is generated by three oil fired steam boilers. The same boilers also provide steam for the laundry and for the kitchen
The hot water for the hospital is produced and stored in 3 storages, 2 m3 each, heated by steam through built in heat exchangers. The temperature is controlled manually. There is no automatic temperature control.
The health regulation requires the hot water temperature limited to 45 grad C. Presently the temperature is 55 - 60 grad C.
The DHW temperature is dependent on other steam users.
The peak hot water consumption is 6 m3/h
Some of the pipe and tank insulations are missing.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Provide and install an automatic teperature controller in the steam pipe serving the domestic hot water heaters for maintaining the required water temperature.
The proposed controller: 3 off Honeywell TS 465-50 or equivalent

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels light oil tonnes	Heat	Steam	Total cost US $/year
Baseline - existing conditions			85			42003
After recomended action			79			39038
Net reduction			4			1977

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	471		
Equipment procurement	5716		
Equipment installation	566		
Equipment commissioning	235		
TOTAL INSTALLED COST	6987	(b)	

Estimated increase in annual (non-energy) operations and maintenence cost (c)

PAYBACK PERIOD

b: 6987

3,5 years

a: 1977 - c:

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSPITAL-5-DHW-HE

Prepared for USAID and RCG/Hagler Bailly

HOSPIT5

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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		

ACTION No. AND BRIEF DESCRIPTION: H-HOSPITAL-5-DHW-HE
MODERNISATION OF THE DHW HEAT EXCHANGER

AREA OF PLANT EFFECTED: HOSPITAL CENTRE

FINDINGS CONCERNING EXISTING CONDITIONS

The DHW is generated by three gas fired steam boilers. The same boilers also provide steam for two other buildings.
The hot water for the hospital is produced and stored in 3 storages, 5 m3 each, heated by steam through built in heat exchangers. The temperature is controlled manually. There is no automatic temperature control.
The heat exchangers are worn out.
The peak hot water consumption is 15 m3/h
Some of the pipe and tank insulations are missing.
Thre were some experiments done to introduce infrared controlled taps at some of the key customers.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Remove the built in heat exchangers from the storages and install an external disassembling, plate type one.
In Hungary, the available appropriate heat exchangers are Ztimet and Alfa Laval made.
It would be preferred to use US made heat exchangers.
The required quantity is 3, capacity 250 kW each.
The steam pressure available ranges from 0.5 to 12 Bar any.
Replacement of thermal insulation
It is predicted to achieve significant savings by improving the quality of the hot water taps.
There are 652 taps in the hospital of what 643 are 1/2" diameters

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels gas GJ	Heat	Steam	Total cost US $/year
Baseline - existing conditions			6260			20561
After recomended action			6010			19739
Net reduction			250			822

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	471		
Equipment procurement	3924		
Equipment installation	850		
Equipment commissioning	235		
TOTAL INSTALLED COST	5480	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 5480}{a: \quad 822 - \quad c:} = 6.7 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSP-SAN-6-DHW-HE

Prepared for USAID and RCG/Hagler Bailly

HOSPIT6

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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		

ACTION No. AND BRIEF DESCRIPTION H-HOSP-SAN-6-DHW-HE
MODERNISATION OF THE DHW HEAT EXCHANGER

AREA OF PLANT EFFECTED LUNG SANATORIUM

FINDINGS CONCERNING EXISTING CONDITIONS

The DHW is generated by three gas fired steam boilers. The same boilers also provide steam for two other buildings.
The hot water for the hospital is produced and stored in 3 storages, 2 m3 each, heated by steam through built in heat exchangers. The temperature is controlled manually. There is no automatic temperature control.
The heat exchangers are worn out.
The peak hot water consumption is 6 m3/h
Some of the pipe and tank insulations are missing.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Remove the built in heat exchangers from the storages and install an external disassembling, plate type one.
In Hungary, the available appropriate heat exchangers are Zilmet and Alfa Laval made.
It would be preferred to use US made heat exchangers.
The required quantity is 3, capacity 100 kW each.
The steam pressure available is 0,7 Bar.
Replacement of thermal insulation
It is predicted to achieve significant savings by improving the quality of the hot water taps.
There are 264 taps in the hospital of whet 256 are 1/2" diameters

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Energy Mwh/year	Fuels light oil tonnes	Heat	Steam	Total cost US $/year
Baseline - existing conditions			85			42003
After recomended action			82			40323
Net reduction			3			1680

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	471		
Equipment procurement	5715		
Equipment installation	566		
Equipment commissioning	235		
TOTAL INSTALLED COST	6987	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 6987}{a: \quad 1680 - c:} = 4,2 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

108

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSPITAL-8-ESC

Prepared for USAID and RCG/Hagler Bailly

HOSPIT7

Plant name: HOSPITAL OF BARANYA COUNTY

Address: Pécs, Rákóczi Road 2. H-7623 Phone:+36 (72) 415-387 Fax +36 (72) 424-696

Zoltán HORVÁTH, general manager

Auditor's name GELLÉRT INNOVATIVE BUREAU OF ENGINEERING D.F.

Barackos út 24 H-7635 Pécs HUNGARY Phone:+36 (72) 319-661 Fax +36 (69) 319-661

Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION H-HOSPITAL-8-ESC

MODERNISATION OF THE CONTROL SYSTEM OF THE ESCALATORS

AREA OF PLANT EFFECTED HOSPITAL CENTRE

FINDINGS CONCERNING EXISTING CONDITIONS

There are 5 escalators in operation controlled individually.

As a result each call served one by one.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Introducing an introducing an intelligent, collecting-type control system would greatly improve the efficiency and comfort, the transport c and save energy. The intelligent control system collects all the calls and organises the services in the most ec in the most economical manner.

It is predicted to save 34% of the energy for operation.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak kW	Electricity Energy MWh/year	Fuels	Heat	Steam	Total cost US $/year
Baseline - existing conditions		29				1506
After recomended action		17				882
Net reduction		12				623

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design			
Equipment procurement	3019		
Equipment installation	2453		
Equipment commissioning	236		
TOTAL INSTALLED COST	5708	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 5708}{a: \quad 623 - c:} = 9.17 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO H-HOSPITAL-8-ESC

Prepared for USAID and RCG/Hagler Bailly

HOSPIT8

Plant name:	HOSPITAL OF BARANYA COUNTY		
Address:	Pécs, Rákóczi Road 2. H-7623	Phone:+36 (72) 415-387	Fax +36 (72) 424-696
	Zoltán HORVÁTH, general manager		
Auditor's name	GELLÉRT INNOVATIVE BUREAU OF ENGINEERING D.P.		
	Barackos út 24 H-7635 Pécs HUNGARY	Phone:+36 (72) 319-661	Fax +36 (69) 319-661
	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994.		

ACTION No. AND BRIEF DESCRIPTION H-HOSPITAL-8-ESC
MODERNISATION OF THE CONTROL SYSTEM OF THE ESCALATORS

AREA OF PLANT EFFECTED HOSPITAL CENTRE

FINDINGS CONCERNING EXISTING CONDITIONS

There are 6 escalators in operation controlled individually.
As a result each call served one by one.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

Introducing an Introducing an intelligent, collecting-type control system would greatly improve the efficiency and comfort, the transport c and save energy. The intelligent control system collects all the calls and organises the services in the most ec in the most economical manner.
It is predicted to save 34% of the energy for operation.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak kW	Electricity Energy MWh/year	Fuels	Heat	Steam	Total cost US $/year
Baseline - existing conditions		29				1505
After recomended action		17				882
Net reduction		12				623

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design			
Equipment procurement	3019		
Equipment installation	2453		
Equipment commissioning	236		
TOTAL INSTALLED COST	5708	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 5708}{a: \quad 623 - c:} = 9{,}17 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Dunaferr Energiaszolgaltato Kft.

by

Albin Zsebik, CEM

Jomuti, Ltd.

for

Hagler Bailly Consulting, Inc.

Energy Audit Report

Prepared for

USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise:	DUNAFERR Energy Supply Co.
Adress:	Dunaújváros 2401
	Vasmű tér 1-3.
Telephone:	(36) 25/381-186
Fax:	(36) 25/312-658
Contact Person:	Péter SÁNDOR
Title:	Energetics Manager

2. Energy Auditor information

Dates:	audit started: February 10th, 1994
	audit completed: May 31st, 1995
Energy Audit company:	Jomuti Ltd.
Energy Audit team leader:	Dr. Albin ZSEBIK
Adress:	1172 Budapest
	Almásháza u. 55.
Telephone:	(36-1) 257 7369
Fax:	(36-1) 257 7369

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3.Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

- Reduction of heat (steam) losses.
- Increase of the efficiency of energy production.
- Dicovering possibilities for utilization of the industrial waste-heat.
- Improving the efficiency of the routine maintenance.

Energy efficiency - in the energy auditor`s opinion, what were the most significant finndings of the energy audit:

- The load of larger and smaller boilers were at about 50 - 60 % of capacity.
- The combustion of boilers were bad.The air/fuel ratio was too lean.
- At the boiler they were blowing down too much water, thus wasting energy.
- The half of steam traps were bad.
- The collected operating date were not evaluated, even the person responsible for supervising the operation of the boilers does not get any data on the daily efficiency of their operation.
- There are many possibilities for utilization of the industrial waste-heat for district heating. The atached schematic circuit diagram and t - Q diagram of heat utilization showes the possibilities.
- The organization of preventive maitenancere is bad.

New experience - in the energy auditor`s opinion, what were the most significant lessons learned during the energy audit:

- There is a very high need for modernisation, but also, there is a great lack of capital.
- Some times it seems that there is not interest to save energy.

4.a Energy savings

List the energy efficiency measures ALREDY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback

4. b Historical production and energy consuption

Summarize the recent production and energy cunsumption at the plant in physical units (also list the type of units per year, i.e. tons/ year, etc.):

Year:	1991	1992	1993	1994	UNITS
electricity					
production	207492	230693	220135	180651	MWh
purchase	376732	359457	375900	430651	MWh
total	584224	590150	596035	611301	MWh
self consumption	235852	227173	237522	142940	MWh
sold to others	348372	362997	358513	468361	MWh
Steam					
production	6229009	7104970	7060360	6220638	GJ
purchase	-	-	-	-	GJ
total	6229009	7104970	7060360	6220638	GJ
self consumption	3893973	4195001	4500321	3995803	GJ
sold to others	2335036	2909969	2560039	2224835	GJ
Heating water					
production	1037197	1008211	1132805	1051120	GJ
purchase	235984	218205	204325	252350	GJ
total	1273181	1226416	1337130	1303470	GJ
self consumption	4339	3857	3075	4755	GJ
sold to others	1268842	1222559	1334055	1298715	GJ
Drink water					
production	2024	1820	1705	1807	10^3 m^3
purchase	321	244	349	286	10^3 m^3
total	2345	2064	2054	2093	10^3 m^3
self consumption	265	353	531	409	10^3 m^3
sold to others	2080	1711	1523	1684	10^3 m^3
Soft water					
production	3213	3207	2926	2769	10^3 m^3
self consumption	1891	1949	1877	1561	10^3 m^3
sold to others	1322	1258	1049	1208	10^3 m^3
Compressed air					
production	1903563	2039647	2088281	2236318	10^3 m^3
Industriel water					
pumped	180686	180940	183137	191940	10^3 m^3
self consumption	82949	78621	82806	89050	10^3 m^3
sold to others	97737	102319	1331	102890	10^3 m^3

Year:	1991	1992	1993	1994	UNITS
Energy:					
natural gas	2676438	2351157	2770867	1959987	GJ
furnunce gas	2574325	2798850	3243563	3789925	GJ
coke gas	1753167	1840178	1181361	470708	GJ
heavy fuel oil	1828520	1321656	1092686	1022313	GJ
electricity	235852	227173	237522	142940	GJ
steam	3893973	41195001	4500321	3995803	GJ
other	82949	78621	82806	82050	GJ
Energy/Production index:					
electricity/steam					
I. boiler	6,5	7,2	7,0	6,9	kWh/t
II. boiler	6,5	6,5	6,1	6,3	kWh/t
III. boiler	8,1	8,2	8,9	9,4	kWh/t
IV. boiler	7,1	6,7	6,2	6,0	kWh/t
V. boiler	6,2	6,6	6,8	6,2	kWh/t
VI. boiler	6,0	6,6	-	-	kWh/t
VII. boiler	4,6	4,4	8,2	8,7	kWh/t
VIII. boiler	5,7	5,4	6,0	7,1	kWh/t
IX. boiler	8,1	7,4	7,2	7,4	kWh/t
Total	6,9	6,5	6,7	7,2	kWh/t
steam/electricity					
I. turbine	5,17	5,26	5,1	5,26	t/MWh
II. turbine	10,47	10,44	10,7	10,87	t/MWh
III. turbine	12,34	11,65	11,9	14,05	t/MWh
IV. turbine	6,63	6,5	6,6	6,95	t/MWh
V. turbine	13,43	12,38	13,7	14,1	t/MWh
total	9,48	9,1	9,1	9,72	t/MWh
electricity/heating	6,0	6,1	5,6	5,5	kWh/GJ

Year:	1991	1992	1993	1994	UNITS
steam/ compressed air	0,629	0,626	0,626	0,601	$GJ/10^3m^3$
electricity/drink water	0,589	0,687	0,707	0,640	$kWh/10^3m^3$
	0,353	0,360	0,366	0,351	$kWh/10^3m^3$
electricity/industr. water	0,299	0,282	0,287	0,282	$kWh/10^3m^3$

5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1991	1992	1993	1994	UNITS
furnace gas	465800	503800	587164	693387	10^3HUF
coke gas	473310	415000	278716	111087	10^3HUF
natural gas	722368	658280	809132	578171	10^3HUF
heavy fuel oil	447690	346720	286913	306600	10^3HUF
electricity	919823	954127	1021345	628930	10^3HUF
other	66000	76500	85400	94200	10^3HUF

6. Previous actions

At the plant have taken several major steps to restructure its operations, including:

- Restructuring the energy generation co. into a separate limited company.
- Studies to improve efficiency of steam generation and power generation (boilers and turbines).
- Plans for refurbishment of boilers.
- Plans for expansion of cogeneration system, using gas turbines or a large steam turbine with extraction and condensing.

Except for the organisation restructuring they could`nt accomplish the plans. They did`nt made energy efficiency measures.

7. Detailed forms - required

- Natural gas consumption - 12 month audit period	Table 1.
- Furnace gas consumption - 12 month audit period	Table 2.
- Coke gas consumption - 12 month audit period	Table 3.
- Heavy fuel oil consumption - 12 month audit period	Table 4.
- Heavy fuel oil consumption - 12 month audit period	Table 5.
- Steam generation total - 12 month audit period	Table 6.
- Steam generation Boiler No. IX. - 12 month audit period	Table 7.
- Energy balance - steam	Table 8.
- Energy balance - heat in form hot water	Table 9.
- Energy balance - industriel water	Table 10.
- Electric energy consumption - 12 month audit period	Table 11.
- Electric energy consumption Boiler No. IX.- 12 month audit period	Table 12.
- Electric energy consumption for stem generation - 12 month audit period	Table 13.
- Electric energy generation - 12 month audit period	Table 14.
- Energy balance - electrical	Table 15.
- Action plan - summary of energy efficiency project opportunities	Table 16.
- Recommended action - energy efficiency opportunity	Action No. 1 - 94 - 1
	Action No. 1 - 94 - 2
	Action No. 1 - 94 - 3
	Action No. 1 - 94 - 4

8. Narrative

There is a possibility to save ~ 13 million m^3 natural gas by the utilization of the industrial waste-heat for district heating yearly. The total installation of the realization of the waste heat utilization system costs ~ 252 million HUF without, resp ~ 315 million HUF with VAT. The payback period depends on the price of natural gas. In the atached figure you can see how the payback period depends on the installation costs and natural gas price.

9. Atached figures

Figure 1. Shematic circuit diagram and t-Q diagram of the heat utilization.

Figure 2. Payback period depending on the installation costs and natural gas price.

Natural Gas Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 1.

Heat supply company's name: MOL Ltd.
Contract maximum demand (m3/h):
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period (1994):

Meter Reading Mo/day/yr	Physical Consump. 1000 m3	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.	8683	294354	86834				
Febr.	8897	301608	88974				
March	6365	216410	63841				
April	3746	127364	37572				
May	3151	107768	31792				
June	2411	82263	24268				
July	2303	78763	23235				
Aug.	1541	52549	15502				
Sept.	3412	117743	34734				
Oct.	5115	174843	51579				
Nov.	5507	186862	55124				
Dec.	6477	219461	64741				
Total	51131	1959988	578196				

Remark: the reference temperature at HDD is 20°C

Furnance Gas Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 2.

Heat supply company's name: Steel works Co..
Contract maximum demand : 2000 m3/h
Minimum charge (cost): 183 HUF/GJ
Other:

Consumption and billing data for 12- month audit period (1994):

Meter Reading Mo/day/yr	Physical Consump. units =	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.	108370	339925	62206				
Febr.	103442	322107	58946				
March	107963	334531	61219				
April	104354	320374	58628				
May	95643	295950	54159				
June	97040	298472	54620				
July	99762	309756	56685				
Aug.	99080	311638	57030				
Sept.	84246	263844	48283				
Oct.	104415	329445	60288				
Nov.	106852	343238	62813				
Dec.	99969	320645	58678				
Total	1211136	3789925	693556				

Remark: the reference temperature at HDD is 20°C

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Coke Gas Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 3.

Heat supply company's name: Coal coke works Co..
Contract maximum demand : 25 000 m3/h
Minimum charge (cost): 236 HUF/GJ
Other:

Consumption and billing data for 12- month audit period (1994):

Meter Reading Mo/day/yr	Physical Consump. units =	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.	5110	80187	18924				
Febr.	618	10642	2512				
March	121	12661	2988				
April			0				
May	915	15663	3696				
June	577	9832	2320				
July	1107	19669	4642				
Aug.	2037	34739	8198				
Sept.	3620	62030	14639				
Oct.	6709	111461	26305				
Nov.	3420	58366	13774				
Dec.	3234	55458	13088				
Total	27468	470708	111087				

Remark: the reference temperature at HDD is 20°C

Heavy fuel oil Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 4.

Oil supply company's name: MOL Rt..
Contract maximum demand :
Minimum charge (cost): 12000 HUF/t
Other:

Consumption and billing data for 12- month audit period (1994):

Meter Reading Mo/day/yr	Physical Consump. units = t	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.	6029	201160	72348				
Febr.	5129	183330	61548				
March	2870	104800	34440				
April	980	36242	11760				
May	3151	107768	37812				
June			0				
July			0				
Aug.			0				
Sept.			0				
Oct.			0				
Nov.	4039	141452	48468				
Dec.	6972	247561	83664				
Total	29170	1022313	350040				

Remark: the reference temperature at HDD is 20°C

Compressed air Consumptionby Steel wors Co. - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 5.

Compressed air supply company's name: DUNAFERR Energy Supplier Co.
Contract maximum demand (m3/h):
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period (1994):

Meter Reading Mo/day/yr	Physical Consump. 1000 m3	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.	182594						
Febr.	161161						
March	188594						
April	187400						
May	186753						
June	186385						
July	193460						
Aug.	195652						
Sept.	181698						
Oct.	186828						
Nov.	188936						
Dec.	196857						
Total	2236318						

Remark: the reference temperature at HDD is 20°C

Steam Generation total by Plant - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 6.

Boiler characteristics:

Name/number	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Manufacturer: LÁNG - BORSIG = L. B.	L.- B.	L.- B.	L.- B.	L.- B.	EGI	EGI	EGI	EGI	MHD
Type:	watertube	watertube	watertube	watertube	watertube	watertube	watertube	watertube	watertube
Type: superheted = s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.
Capacity [t/h]:	65	65	50	65	75	75	100	100	220
Year installed:	1952	1952	1953	1953	1995	1995	1991	1993	1973
Year last major overhaul:					1994	1993			
Operational:	yes	yes	yes	yes	no	no	yes	yes	yes
Steam pressure:	36	36	36	36	38	38	36	36	36
Steam temperature:	450	450	450	450	450	450	450	450	450
Stack temperature after ECO:	200	200	200	200			160	160	200
Stack gas analysis: percent O2	8 - 9	8 - 9	8 - 9	8 - 9			5 - 7	5 - 7	5 - 7
Combustion efficiency:	85	85	85	85	90	90	85	85	85

Steam generation data for 12- month audit period (1994):

	STEAM GENERATION BY PLANT:				IMPORTS	SOLD TO OTHERS:				NOTES
meter reading Mo/day/yr	Fuel Cunsump. GJ	Steam Generation tons	Steam Generation GJ	Monthly Efficiency %	Steam Purchased GJ	Steam GJ	In form hot water GJ	Losses GJ	Losses Unacconted GJ	Unusual operatting conditions
Jan.	963426	297741	826942	85,83	0	302358	227083	30520	0	
Febr.	839617	259822	725175	86,37	0	286725	210847	28360	0	
March	667802	205542	572860	85,78	0	227779	171155	22478	0	
April	488118	159234	441439	90,44	0	154474	90493	15456	0	
May	419371	130074	359007	85,61	0	61604	3200	617	0	
June	390607	118446	327825	83,93	0	71667	3100	7213	0	
July	407588	128855	355562	87,24	0	72536	3250	8258	0	
Aug.	398925	124562	342646	85,89	0	75222	4690	8523	0	
Sept.	443627	134096	370273	83,46	0	78979	4810	7896	0	
Oct.	618859	179453	498254	80,51	0	295300	156200	30012	0	
Nov.	741918	230804	641308	86,44	0	289997	195131	29841	0	
Dec.	863075	272785	759347	87,98	0	308194	228756	32123	0	
Total	7242933	2241414	6220638	85,89	0	2224835	1298715	221297		

Steam Generation by Boiler No. IX.- 12 month-audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 7.

Boiler characteristics:

Name/number	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Manufacturer	L. - B.	L. - B.	L. - B.	L. - B.	EGI	EGI	EGI	EGI	MHD
Type:	watertube	watertube	watertube	watertube	watertube	watertube	watertube	watertube	watertube
Type: superheated = s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.	s. h.
Capacity [t/h]:	65	65	50	65	75	75	100	100	220
Year installed:	1952	1952	1953	1953	1995	1995	1991	1993	1973
Year last major overhaul:					1994	1993			
Operational:	yes	yes	yes	yes	no	no	yes	yes	yes
Steam pressure:	36	36	36	36	38	38	36	36	36
Steam temperature:	450	450	450	450	450	450	450	450	450
Stack temperature after ECO:	200	200	200	200			160	160	200
Stack gas analysis: percent O2	8 - 9	8 - 9	8 - 9	8 - 9			5 - 7	5 - 7	5 - 7
Combustion efficiency:	85	85	85	85	90	90	85	85	85

Steam generation data for 12- month audit period (1994):

	STEAM GENERATION BY BOILER No IX.:				IMPORTS	SOLD TO OTHERS:				NOTES
meter reading Mo/day/yr	Fuel Cunsump. GJ	Steam Generation tons	Steam Generation GJ	Monthly Efficiency %	Steam Purchased GJ	Steam GJ	In form hot water GJ	Losses GJ	Losses Unacconted kW	Unusual operatting conditions
Jan.	442585	107718	354068	80,00						
Febr.	431358	106206	349400	81,00						
March	354405	81980	269348	76,00						
April	303189	69172	227392	75,00						
May	17358	3888	12671	73,00						
June										
July										
Aug.										
Sept.										
Oct.	335504	77453	254983	76,00						
Nov.	428411	103725	342729	80,00						
Dec.	416367	98538	324766	78,00						
Total	2729177	648680	2135357	78,24						

Table 8.

Energy balance - Steam
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Item No.	Equipment or Process Description	Maximum Load Units:MW	Average Load Units:MW	Load at Peak Demand Units: MW	Energy Consumption GJ/year	Total Energy cost: 1000 HUF/year
1	Steel works Co.				413334	168136
2	DWA Co.				331083	160521
3	Paper mill				835050	379000
4	Other				645368	293241
5	Self consumption				3995803	
Total Peak Demand						
Total Steam Consumption and cost					6220638	1000898

Table 9.

Energy balance - Heat in form hot water
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Item No.	Equipment or Process Description	Maximum Load Units:MW	Average Load Units:MW	Load at Peak Demand Units: MW	Energy Consumption GJ/year	Total Energy cost: 1000 HUF/year
1	Steel works Co.				41391	20034
2	DUNAQUA-THERM Rt.				1138991	474857
3	Coal coke works				38892	18824
4	Other				79441	40152
5	Self consumption				4755	
Total Peak Demand						
Total heat Consumption and cost					1303470	553867

Table 10.

Energy balance - Industriel water
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Item No.	Equipment or Process Description	Maximum Load Units:MW	Average Load Units:MW	Load at Peak Demand Units: MW	Energy Consumption 1000 m3/year	Total Energy cost: 1000 HUF/year
1	Steel works Co.				74956	255325
2	DWA Co.				13773	66274
3	Paper mill				8800	31000
4	Other				5361	24125
5	Self consumption				89050	
Total Peak Demand						
Total industriel water Consumption and cost					191940	376724

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 11.

Electricity supply company's name: ÉDÁSZ Rt.
Contract maximum demand (MW): 79
Minimum charge (cost): 4,5 HUF/kWh
Other:

Consumption and billing data self consuption for 12 - month audit period (1994):

meter reading Mo/day/yr	Energy Active MWh	Energy Reactive kVARh	Max. Demand MW	Max. Demand kVA	Power Factor cos o	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	21586		32,5				97137000	
Febr.	18839		27,3				84775500	
March	21028		29,5				94626000	
April	9736		15,3				43812000	
May	7017		11,5				31576500	
June	8189		13,4				36850500	
July	8488		13,6				38196000	
Aug.	7601		12,1				34204500	
Sept.	8979		15,3				40405500	
Oct.	9700		15,4				43650000	
Nov.	9862		16,1				44379000	
Dec.	11916		32,5				53622000	
Total	142941						643234500	

Peak demand during audit period (MW): 35

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Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 12.

Electricity supply company's name: ÉDASZ Rt.
Contract maximum demand (MW): 79
Minimum charge (cost): 4,5 HUF/kWh
Other:

Consumption and billing data for Boiler No. IX. for 12- month audit period (1994):

meter reading Mo/day/yr	Energy Active MWh	Energy Reactive kVARh	Max. Demand MW	Max. Demand kVA	Power Factor cos o	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	718		1,22				3231000	
Febr.	656		1,12				2952000	
March	679		1,15				3055500	
April	633		0,98				2848500	
May	51		0,86				229500	
June							0	
July							0	
Aug.							0	
Sept.							0	
Oct.	650		0,98				2925000	
Nov.	716		1,15				3222000	
Dec.	696		1,16				3132000	
Total	4799						21595500	

Peak demand during audit period (MW): 1,22

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Electricity supply company's name: ÉDÁSZ Rt.
Contract maximum demand (MW): 79
Minimum charge (cost): 4,5 HUF/kWh
Other:

Table 13.

Consumption and billing data for steam generation for 12- month audit period (1994):

meter reading Mo/day/yr	Energy Active MWh	Energy Reactive kVARh	Max. Demand MW	Max. Demand kVA	Power Factor cos o	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	1918		2,86				8631000	
Febr.	1709		2,56				7690500	
March	1697		2,47				7636500	
April	1362		2,12				6129000	
May	963		1,56				4333500	
June	874		1,35				3933000	
July	907		1,52				4081500	
Aug.	905		1,51				4072500	
Sept.	903		1,75				4063500	
Oct.	1399		2,13				6295500	
Nov.	1574		2,51				7083000	
Dec.	1968		2,96				8856000	
Total	16179						72805500	

Peak demand during audit period (MW): 2,96

Electric Energy Generation - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Table 14.

Generator characteristics:

Name/number	I.	II.	III.	IV.	V.
Manufacturer:	LÁNG	LÁNG	LÁNG	LÁNG	LÁNG
Capacity [MW]:	20	20	8,5	16,5	4,5
Year installed:	1954	1969	1963	1954	1954
Year last major overhaul:					
Drive type - steam	cond.	back pr.	back pr.	extraction	back pr.
Operational ?	yes	yes	yes	yes	yes

Generator and data for 12- month audit period (1994):

	SELF-GENERATION:		SOLD TO OTHERS:		PURCH. FROM OTHERS:		SELF CONSUMPS.:		
meter reading Mo/day/yr	Energy Active MWh	Max. Demand MW	Energy Active MWh	Max. Demand MW	Energy Active MWh	Max. Demand MW	Energy Active MWh	Max. Demand MW	Notes
Jan.	23218	35	31017	47	28722	46	21586	33	
Febr.	21244	32	28889	48	26584	42	18839	31	
March	15286	27	32251	52	37993	58	21028	32	
April	11645	22	41101	64	39192	57	9736	20	
May	12155	21	40240	66	35664	61	7017	15	
June	10411	18	40880	64	38658	62	8189	16	
July	11552	21	41415	69	38351	58	8488	17	
Aug.	12299	23	42819	64	38121	57	7601	15	
Sept.	11715	26	42314	62	39578	64	8979	15	
Oct.	11620	27	40462	64	38542	56	9700	16	
Nov.	16625	25	43200	67	36437	58	9862	18	
Dec.	22881	35	43771	66	32806	53	11916	20	
Total	180651		468359		430648		142941		

Table 15.

Energy balance - Electrical
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAFERR Energy Supplier Co.

Item No.	Equipment or Process Description	Connected Load MW	Maximum Load MW	Average Load MW	Load at Peak Billing Demand MW	Electric Energy Consump. MWh/year	Total Energy Cost 1000HUF/year
1	Steel works Co.	40	40	40	40	227096	1014708,00
2	Coal coking works Co.	9	9	9	9	60045	256944,00
3	DWA Co.	12	12	12	12	47642	238855,00
4	Other					133576	647082,00
	Total					468359,00	2157589,00
Total Peak Demand					0,00		
Total Energy Consumption and cost						468359	2157589,00

Action Plan - Summary of energy efficiency project opportunities

Prepared for USAID and RCG/Hagler Bailly

Plant name: DUNAFERR Energy Supplier Co.

Table 16.

Baseline - existing conditions

	Steam Generation t/year	Thermal Consump. GJ/year	Steam Generation t/year	lectric Energ Consumption MWh/year	Compressed air Consumption 1000 m3/year	Total Energy Cost 1000 USD/year
	2241414	5605000	2241414	14294	2236318	23761,00

Summary of recommended energy efficiency actions:

Action No.	Action Description	Steam Generation t/year	Thermal Consump. GJ/year	Steam Generation t/year	Electric Peak Demand kWh	Compressed air Consumption 1000 m3/year	Total Energy Cost 1000 USD/year	Action Project Cost 1000USD	Action Payback Period [years]
1-94-1	Vibration analyzer *							22	
1-94-2	Steam trap ultrasonic tester	2143000						7	0,444
1-94-3	O2/Co meter for Boiler No. IX.		5255000					22	0,43
1-94-4	Steam traps			2237094				5	0,23
	Pumping trap				14268,00			4	1,2
	Liquid Drainer					2236282		1	3,97
Total savings		98414	350000	4320	26	36	69,00		
Savings as percentage of base case		4,39	6,24	0,19	0,18	0,00	0,29		

* The energy saving is desribed on the atached action plan

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO.

Plant name: DUNAFERR Energy Supplier Ltd.
Address: 2400 Dunaújváros
Auditor's name: Dr.Albin ZSEBIK

Report date: April, 1994

ACTION NO. AND BRIEF DESCRIPTION: 1-94-1 Vibration analyzer

AREA OF THE PLANT AFFECTED: Machine housings

FINDINGS CONCERNING EXISTING CONDITIONS:

DUNAFERR Ltd. runs 6 steam-turbines, 3 steam-turbo blowers and a lot of other kinds of mostly rotational propulsive machines. The age of the machines is 10-40 years.
The control and maintenance is not organized properly, and because of the lack of quality instruments, the vibration has not been checked in the last years.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

nproving the efficiency of the routine maintenance. Surveying the conditions of machines and equipments, registrating the operation times by computer, maintenance scheduling by considering conditions, the operation times, idle times, economic operation, and other parameters.
The suggested vibration analyser would help surveying the conditions of equipments. The economical indices would be concerned on savings of energy, and on the other hand, on the costs increases caused by break-downs.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

See enclosed paper

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year				/year
Baseline – existing conditions						
After recommended action						
Reduction						(a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design		
Equipment procurement		
Equipment installation		
Equipment commisssioning		
TOTAL INSTALLED COST		(b)
Estimated increase in annual (non–energy) operations and maintenance cost		(c)

PAYBACK PERIOD:

$$\frac{b:}{a: - c:} = \quad \text{years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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ENCLOSURE

Plant name: DUNAFERR Energy Supplier Ltd.
Address: 2400 Dunaújváros

Auditor's name: Dr.Albin ZSEBIK

Report date: April, 1994

Action no. and brief description: 1-94-1 Vibration analyzer

Expected results-effect of recommendation:
The energy savings could be described if we presumed the break-down of the back-pressured turbine (no.4.) for 3 weeks. The turbine no.4. produced 5657 MWh electric energy in November, 1993. If it did not produce electric energy, that should be bought for 10 USD/MWh more expensive, that means an extra expense of 39.599 USD would appear.
The cost of break-down is presumed to 10.000 USD.
The break-down of turbine no.4. would cause another extra expense, because instead of the connected heat and electric energy production, the heat supply of Dunaújváros would be provided of direct heat production.
Neglecting this latter expense, the extra cost of the break-down would appear once in every 3 years, the payback period of the equipment is less than one year.
Considering the age of equipment the break-down can happen more frequently without the preventive checks.

:OMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
›ared for USAD and RCG/Hagler Bailly

.ACTION NO.

it name: DUNAFERR Energy Supplier Ltd.
ress: 2400 Dunaújváros
itor's name: Dr.Albin ZSEBIK

ort date: April, 1994

TION NO. AND BRIEF DESCRIPTION: 1-94-2 Stem trap ultrasonic tester

EA OF THE PLANT AFFECTED: steam tube network

DINGS CONCERNING EXISTING CONDITIONS:
The steam traps were checked within the framework of a specific program at the plant. There were "Gestra" and membrane-types built in, but there are a lot of other types too among the more than 2000.
By the experience of the operators, the half of the steam traps are out of order.

COMMENDED ACTION TO IMPROVE EFFICIENCY:
The check of the steam traps should be done by ultrasonic tester. The defective traps should be repaired or replaced.
The condense-loss could be reduced by 10 % by the reparational works only.

ECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year	steam(Mtons/year)			USD /year
eline – existing conditions			1,2			1332×10^3
recommended action			0,9			1200×10^3
ction			0,3			400×10^3 (a)

T–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost		Notes
Engineering design	20×10^3	USD	
Equipment procurement	100×10^3	USD	
Equipment installation	20×10^3	USD	
Equipment commisssioning	20×10^3	USD	
TOTAL INSTALLED COST	160×10^3	USD (b)	
nated increase in annual (non–energy) operations and maintenance cost	40×10^3	USD (c)	

PAYBACK PERIOD:

$$\frac{b: 160 \times 10^3}{a: 400 \times 10^3 - c: 40 \times 10^3} = 0{,}444 \text{ years}$$

OMMENDED IMPLEMENTATION SCHEDULE:

13/6

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO.

Plant name: DUNAFERR Energy Supplier Co.
Address: 2400 Dunaújváros
Auditor's name: Dr.Albin ZSEBIK
Report date: April, 1994

ACTION NO. AND BRIEF DESCRIPTION: 1-94-3 O2/CO meter for boiler No. IX.

AREA OF THE PLANT AFFECTED: boiler house

FINDINGS CONCERNING EXISTING CONDITIONS:

There are 9 boilers for steam production (6 of 50 tons/hour, 2 of 100 tons/hour and 1 of 220 tons/hour). The boilers usually operate parallel, with low loads.
The biggest boiler (no. IX.) runs with unknown combustion parameters and without O2/CO meter, the temperature of the leaving gas is often 240°C.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Boiler No IX. should run on nominal load, considering the result of the analysis of exhaust gases. An O2/CO meter should also be built in.
The changing loads should be supplied by the smaller boilers.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year	steam 10^6t/year	heat TJ/y	fuel TJ/year	USD /year
Baseline –existing conditions			1,9	4204	5605	16816×10^3
After recommended action			1,9	4204	5255	15765×10^3
Reduction			1,9	4204	350	1051×10^3 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	10.000	USD
Equipment procurement	25.000	
Equipment installation	5.000	
Equipment commisssioning	5.000	
TOTAL INSTALLED COST	45.000	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	Ø	(c)

PAYBACK PERIOD:

$$\frac{b: 45000}{a: 1051 - c: Ø} = 0,43 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPOTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO.

1-96-1*

Plant name: DUNAFERR Energy Supplier Ltd.
Address: 2400 DUNAÚJVÁROS

Auditor`s name: Dr. Albin ZSEBIK tel.+fax: 36 1 257 7369

Report date: March, 1996.

ACTION NO. AND BRIEF DESCRIPTION: 1-96-1* Speed drive

AREA OF THE PLANT AFFECTED: 3. pumps plant

FINDINGS CONSERNING EXISTING CONDITIONS:

At the 3. pumps plant are 8 pumps in parallel connection. From this pumps 3 - 5 pumps operate continuosly. Control of pumps is by throttle valve or by switching off the pumps.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Connect speed drive to the selected 2 pumps and control speed one of these pumps.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Water mill.m^3/year	Water Cost 10^3HUF/year	Electricity MWh/year	Electr.Cost 10^3HUF/year	Total cost USD/year 1./
Baseline - existing conditions	50	250.000	11.136	72.384	2,223.338
After recommended action	48,5	242.500	10.889	70.778	2,160.538
Net reduction	1,5	7.500	247	1.606	62.800

COST - BENEFIT ANALYSIS:

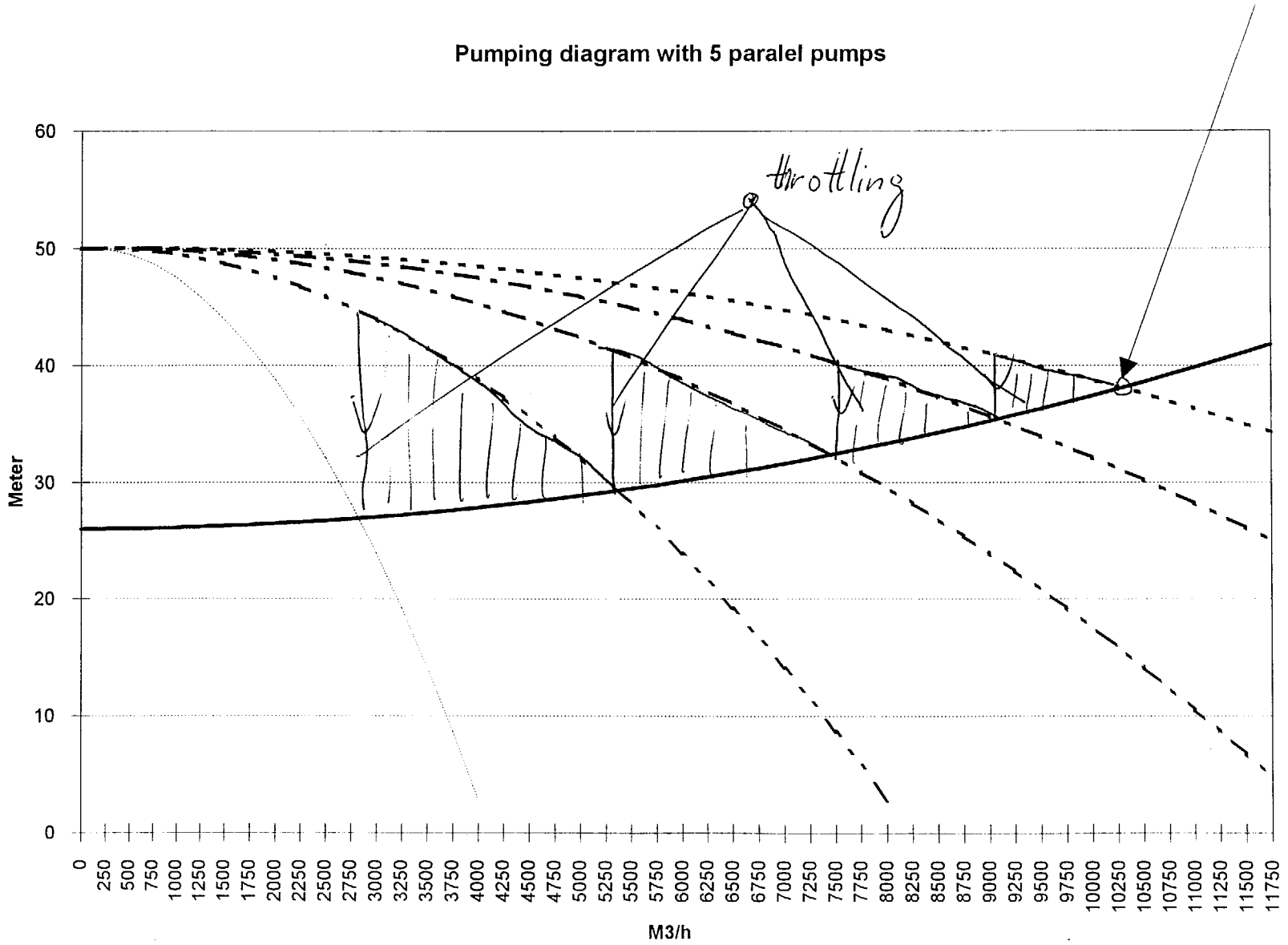
PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	1.500	
Equipment procurement	30.000	
Equipment instalation	2.500	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	35.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 35,000 / 62,800 = 0,56 years

1./ 1 USD ~ 145 HUF

Pumping diagram with 5 paralel pumps



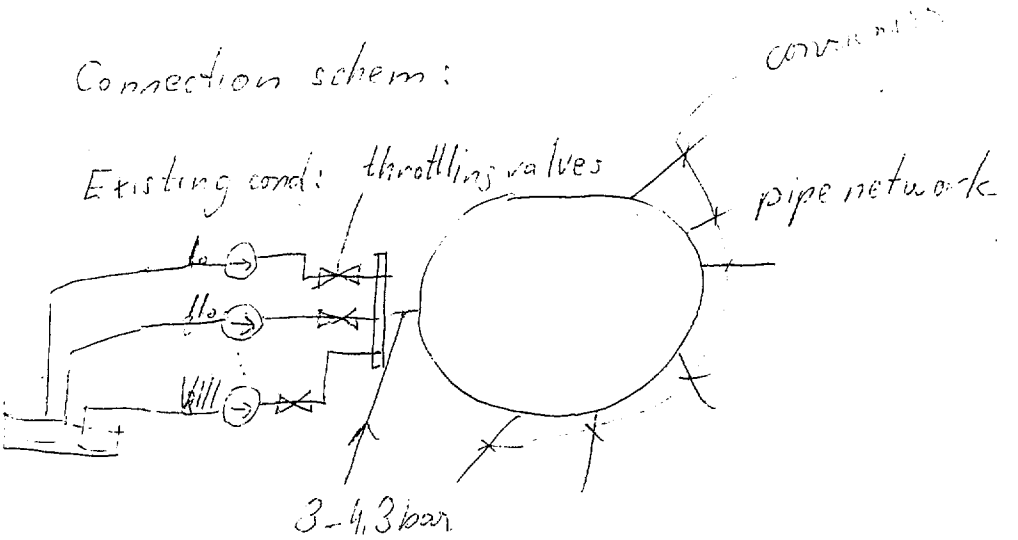
Action No 1-96-1*

Action No 1-96-1*

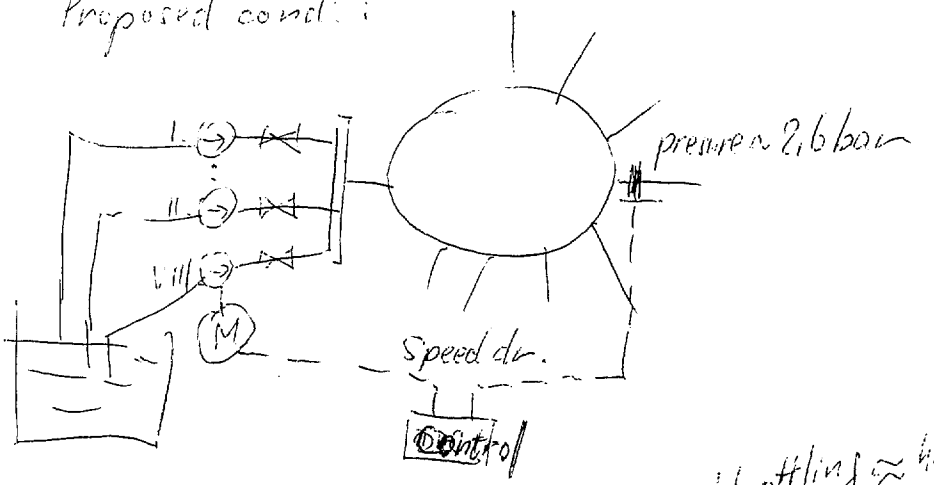
Pumps $P_n = 320 kW$
$P_{1n} = 348 kW$

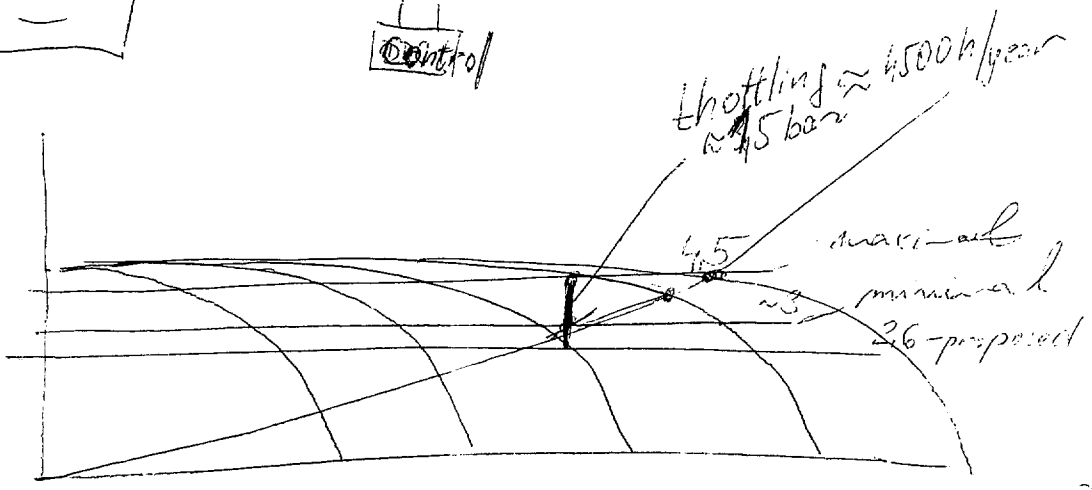
Connection schem:

Existing cond: throttling valves



Proposed cond.:





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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPOTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO.

1-96-2

Plant name: DUNAFERR Energy Supplier Ltd.
Address: 2400 DUNAÚJVÁROS

Auditor`s name: Dr. Albin ZSEBIK tel.+fax: 36 1 257 7369

Report date: March, 1996.

ACTION NO. AND BRIEF DESCRIPTION: 1-96-2 Speed drive

AREA OF THE PLANT AFFECTED: Boiler house for district heating

FINDINGS CONSERNING EXISTING CONDITIONS:

At the boiler house for district heating are 3 pumps in parallel connection. From this pumps 3 pumps operate continuosly in winter period, and 1 in sommer. Control of pumps is by throttle valve.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Connect speed drive to the selected 2 pumps and control speed one of these pumps.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Water mill.m^3/year	Water Cost 10^3HUF/year	Electricity MWh/year	Electr.Cost 10^3HUF/year	Total cost USD/year[1./]
Baseline - existing conditions			5.490	35.685	245.103
After recommended action			4.893	31.802	219.324
Net reduction			597	3.883	25.779

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	1.500	
Equipment procurement	40.000	
Equipment instalation	2.500	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	45.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 45,000 / 25,779 = 1,74 years

1./ 1 USD ~ 145 HUF

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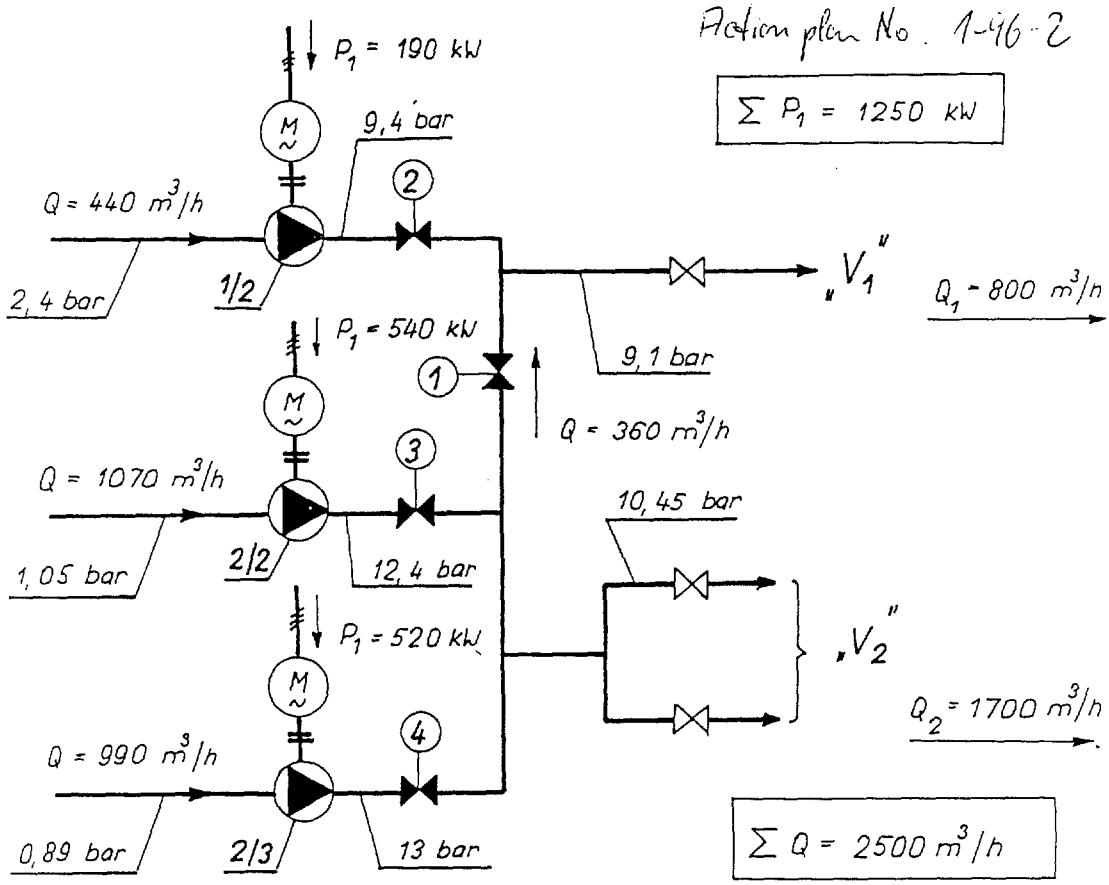
A dunaújvárosi távhőrendszer (V_1, V_2)
keringtető szivattyúinak energetikai jellemzői
„téli üzemmódban"
jelenlegi (fojtásos) szabályozással.

energy data of pumping in existing cond.

DUNAFERR

Action plan No. 1-46-2



Fojtások veszteségei:

① = 13,2 kW
② = 3,6 kW
③ = 56,8 kW
④ = 68,8 kW

ΣP_{v_f} = 142,4 kW

Fajlagos:

$$f = \frac{\Sigma P_1}{\Sigma Q} = 0{,}5 \text{ kWh/m}^3$$

12. sz. ábra

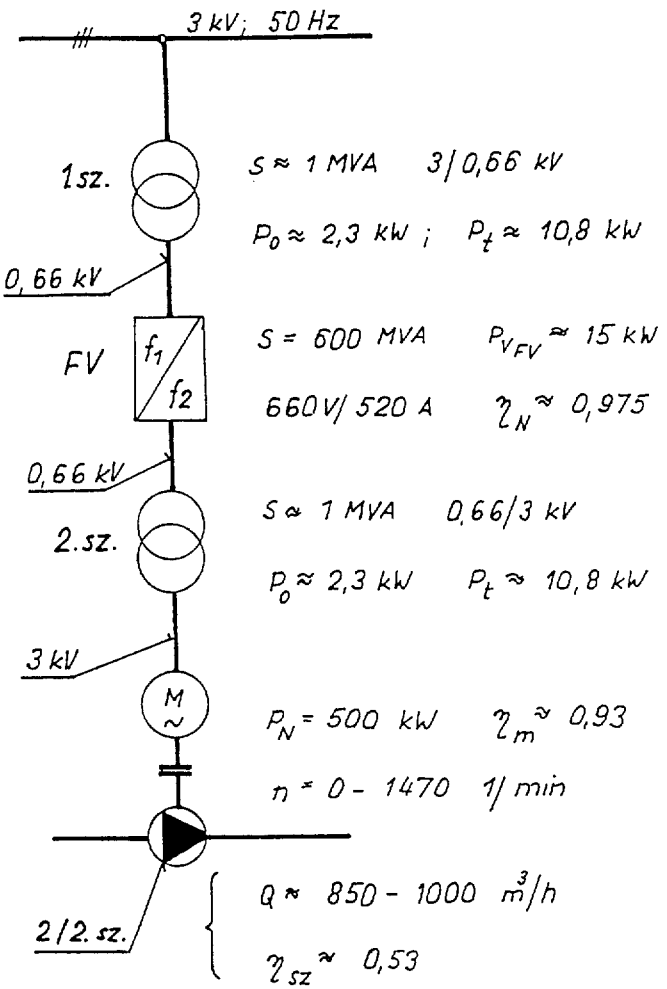
1991.

142

2/2 sz. forróvízkeringtető szivattyú energiaellátásának elvi kapcsolási sémája fordulatszámszabályozás esetén.

Theoretical scheme of connection of speed dr. for circ. pump.

DUNAFERR Action plan No -1-96-2



11. sz. ábra

1991.

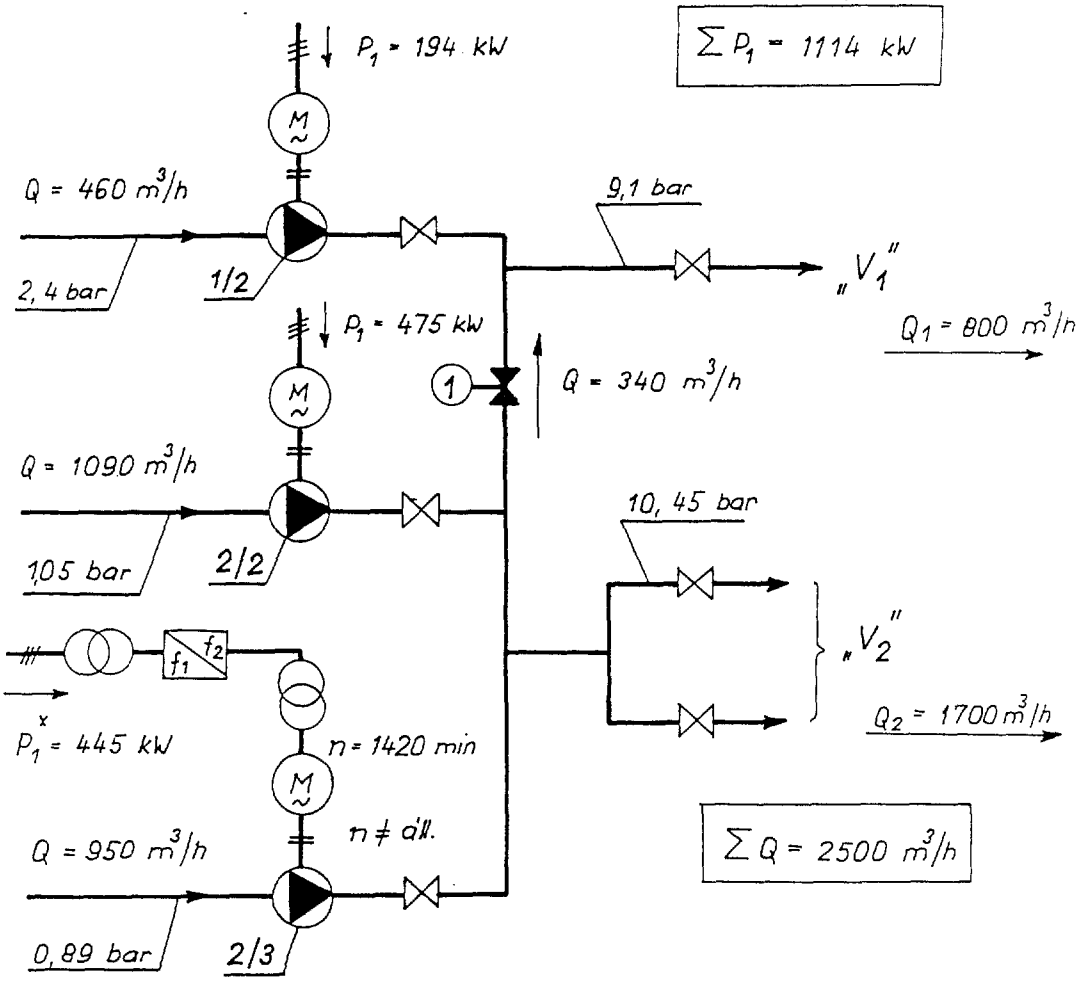
A dunaújvárosi távhőrendszer (V_1, V_2) keringtető szivattyúinak energetikai jellemzői „téli üzemmódban" fordulatszám szabályozással.

energy data of pumping in recommended cond

DUNAFERR

Action plan No 1-91 2

(2/3 sz. szivattyú szabályozva)



Fojtás veszteségei:

1 = 12,5 kW = P_{vf}

Fajlagos:

$$f = \frac{\Sigma P_1}{\Sigma Q} = \frac{1114}{2500} = 0{,}445 \text{ kWh/m}^3$$

13. sz. ábra

1991.

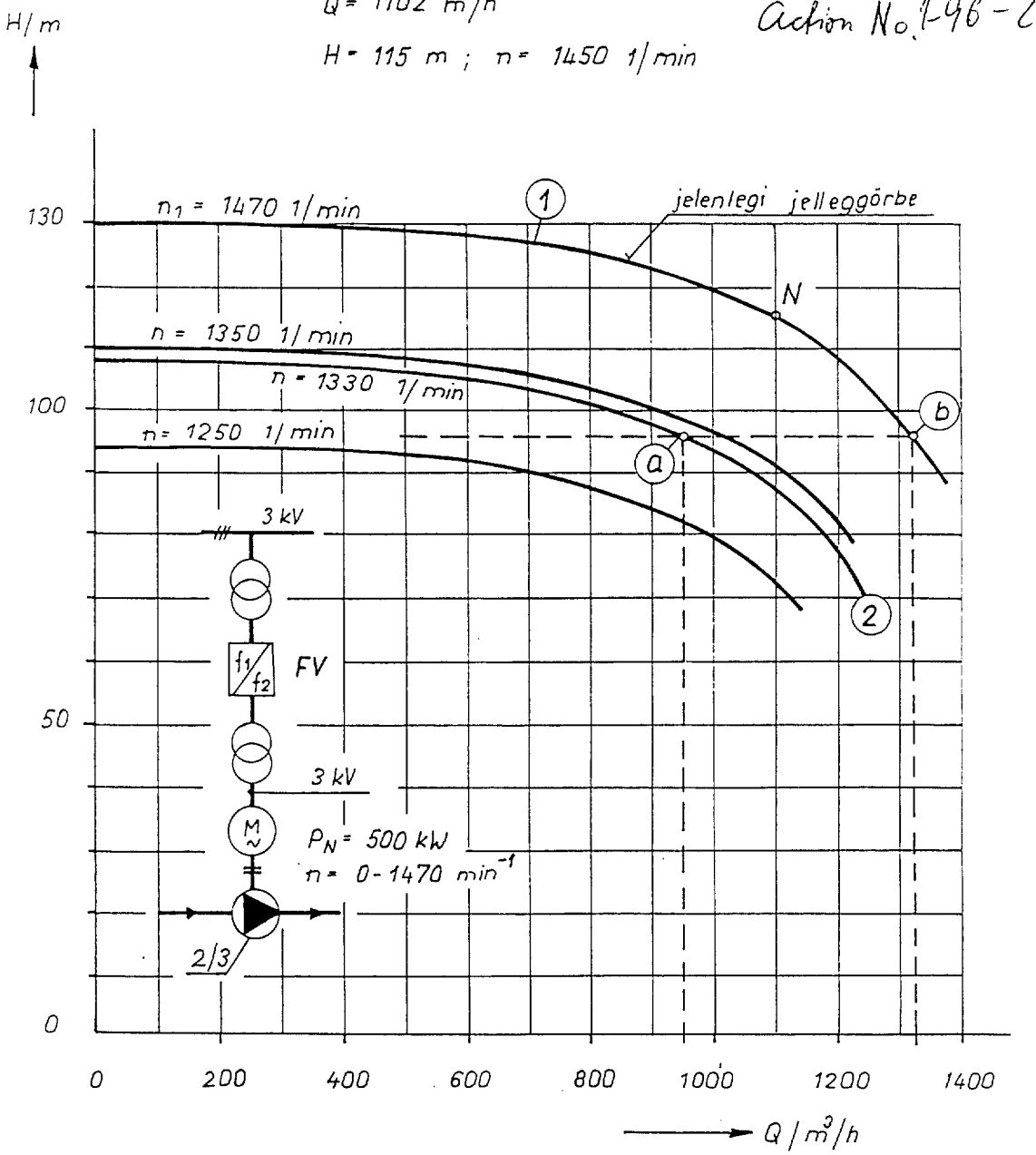
144

2/3 sz. forróvízkeringtető szivattyú üzemi jelleggörbéi fordulatszám szabályozással,

data with speed dir

Szivattyú: DFAK 300 tip.
Q = 1102 m³/h
H = 115 m ; n = 1450 1/min

DUNAFERR
Action No. 1-96-2



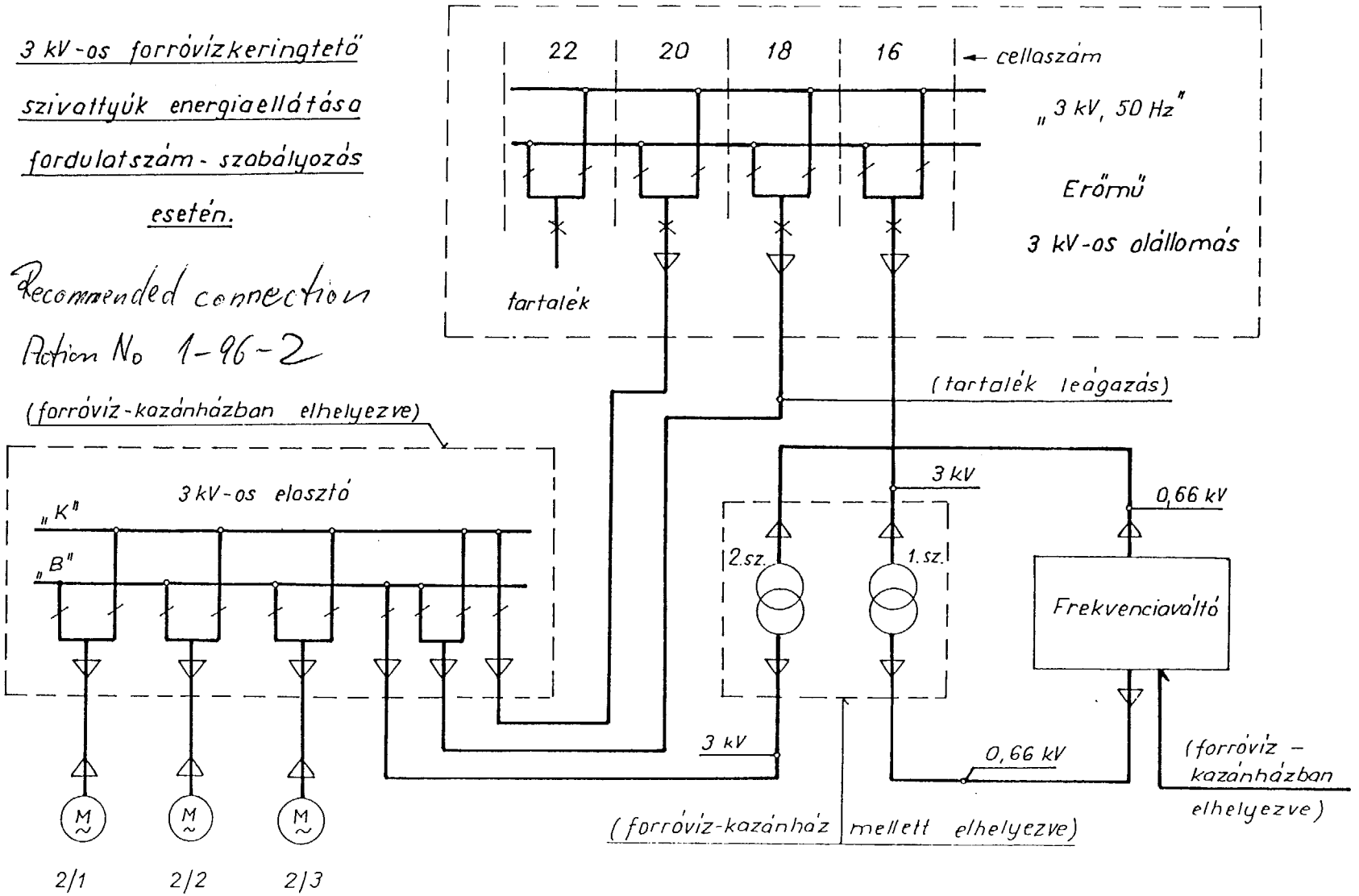
15. sz. ábra

1991.

145

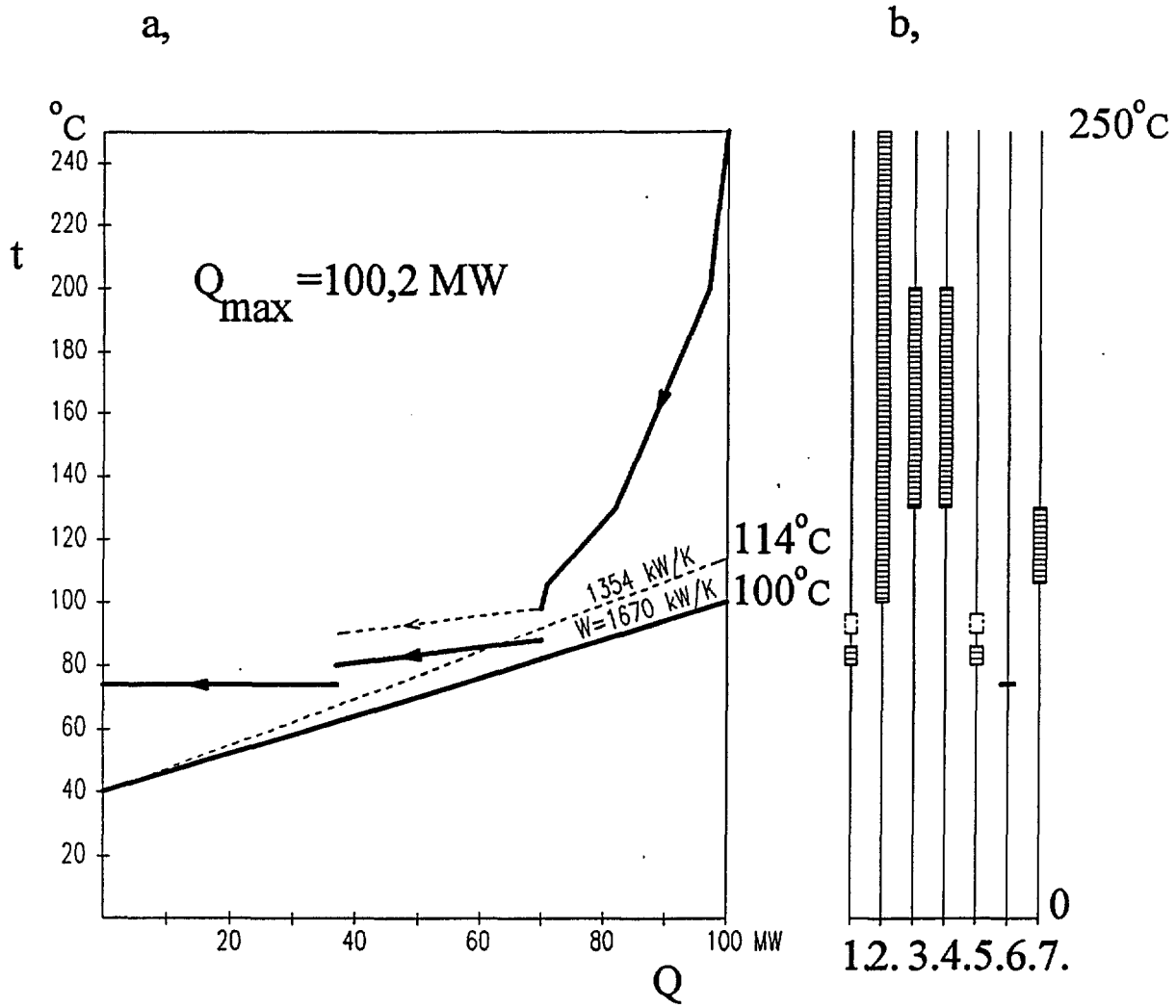
3 kV-os forróvízkeringtető szivattyúk energiaellátása fordulatszám-szabályozás esetén.

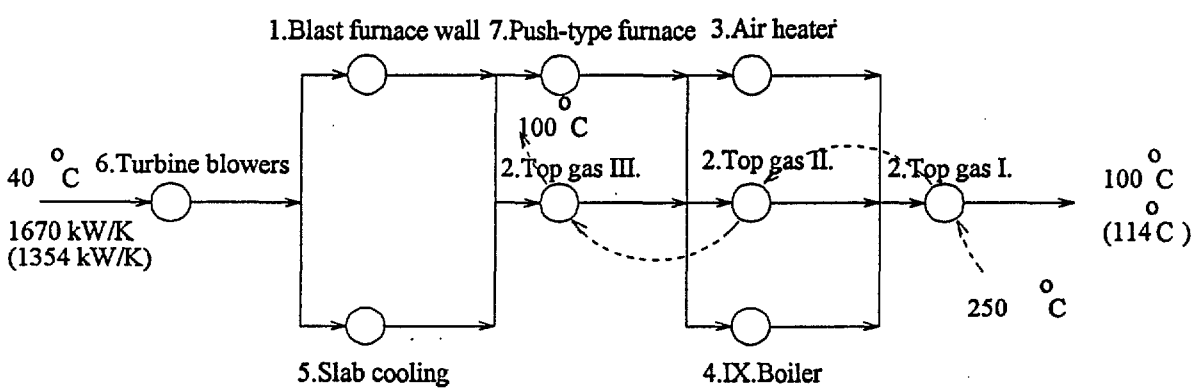
Recommended connection
Action No 1-96-2



17. sz. ábra

1991





The schematic circuit diagram and t-Q diagram of the heat utilization

FIGURE 1.

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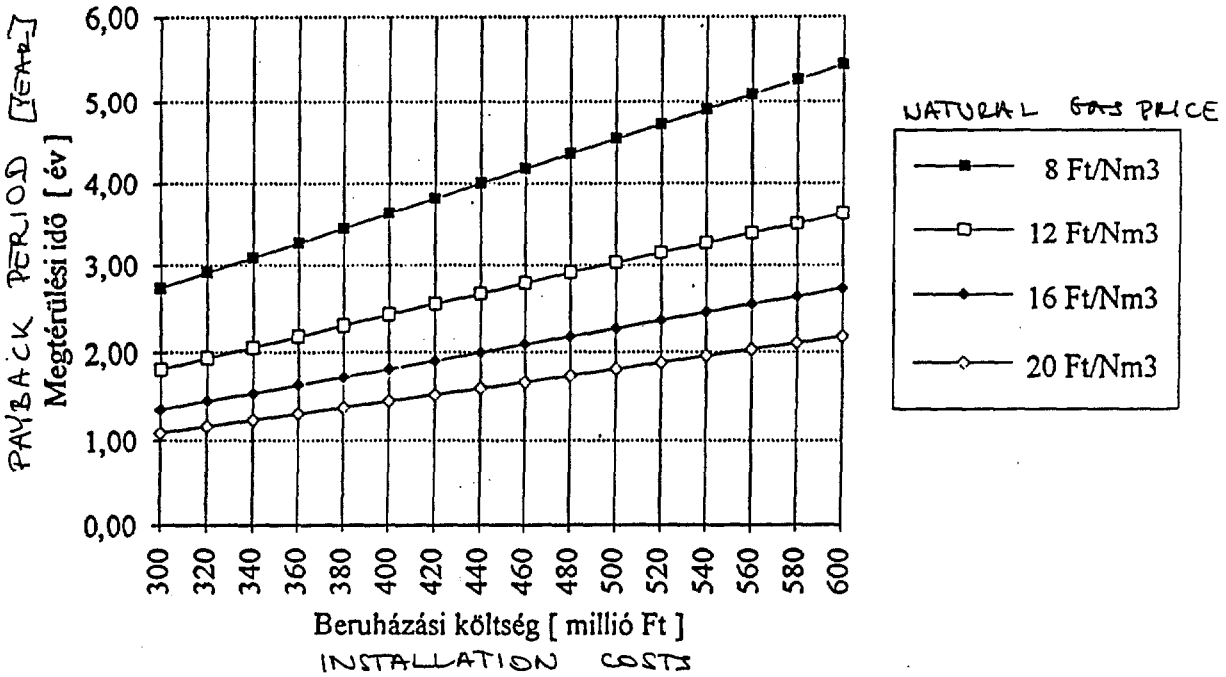
NATURAL GAS SAVING/YEAR INSTALLATION COSTS

$\Delta V_{tüa}$ = 13.767 eNm^3 ΣB = 252 millió Ft $\Sigma B_{ÁFA}$ = 315 millió Ft



2.17. ábra A megtérülési idő változása a beruházási költség és földgáz ár függvényében a vizsgált 3b. változat esetében

PAYBACK PERIOD DEPENDING ON THE INSTALLATION COSTS AND NATURAL GAS PRICES

FIGURE 2.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Dunapack Rt.

by

Nagy Tibor, CEM

Control Quality Consulting, Ltd.

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise	Dunapack Paper Mill
Address	1215 Budapest
	Duna u. 42
	Hungary
Telephone	36-1-277-1133
Fax	36-1-276-9062
Contact Person	Laszlo Varga
Title	Energy Manager
Telephone	36-1-277-1133

2. Energy auditor information

Dates - audit started: 21 Feb 94 audit completed: 25 Feb 94

Energy audit company	Controll Quality Consulting
Energy audit team leader	Tibor Nagy
Address	1118 Budapest
	Radvany u. 34/b Hungary
Telephone	36-1-267-1101
Fax	36-1-161-2040

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

Paper production

Steam distribution and use

Compressed air system

Energy data collection and management

Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

The plant makes excellent use of existing paper production equipment. The steam distribution is oversized for current levels of usage and has redundant lines. MUCH energy data is collected but not used for energy management.

New experience - in the energy auditor's opinion, what were the most significant lessons learned during the energy audit:

There are few opportunities for process energy reduction without large investment

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4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
None		/year	years
		/year	years
		/year	years
		/year	years
		/year	years
		/year	years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units (also list the type of units per year, i.e. tons/year, kWh/year etc.):

	paper & cardboard		Paper only		
Year:	1990	1991	1992	1993	UNITS
Production:					
Paper	106006	85056	76535	66420	T
Cellulose	14171	10925	4345	0	T
Cardboard	71971	54995	50667	Now a separate factory	
Energy:					
heavy fuel oil:	5.2	7.5	4.3	5.9	T
heating ~~diesel fuel~~ oil:	266.0	366.0	553.5	231.7	T
natural gas:	40958	36242	34762	26998	1000 cu m
coal:					
electricity:	109728	92686	98332	82062	MWH
steam:					
other (describe):					
Energy/Production index:					
thermal				13.83	GJ/T
electrical				1.24	MWH/T

5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	UNITS
heavy fuel oil:					
diesel fuel oil:					
natural gas:	284066	377930	347298	264215	1000 FT
coal:					
electricity:	208033	249581	281882	221107	1000 FT
steam:					
other (describe):					

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding ---

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7. **Detailed forms - required**

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

Electric energy consumption - 12 month audit period

Electric energy generation - 12 month audit period (if plant has generator)

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. **Narrative**

Provide any other information which would be useful to USAID and RCG/Hagler Bailly --

There are substantial monthly variations in the efficiency of steam production. At times, requirements are below the boiler minimum and steam is dumped. At other times, demand for turbine electricity forces production of more steam than can be used in the paper process. A better energy data system would help to better manage these conflicting requirements

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ELECTRIC ENERGY CONSUMPTION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary

Auditor's name: Tibor Nagy
Report date: 12 May 94

NOTE: Contract maximum demand varies by month. In addition, there is a supplementary de that the plant can draw on if their turb is not operational. See chart
Listed max demand shows figures for norm operating conditions (turbine operationa

Electricity contract terms:

Electricity supply company's name	Budapest Elec. Co.
Contract maximum demand (kW):	See note & chart
Minimum charge (cost):	18.10 FT/KWH
Other:	

Demand charge: 185 FT/KW/month base
385 FT/KW/month peak

Use charge: 4.70 FT/KWH peak
3.20 FT/KWH day
2.35 FT/KWH night

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading Mo/day/yr	Paper M Energy Active kWh	Total Purchased Energy Reactive MWH	Max Demand kW	Max Demand kVA	Power Factor cos 0	Load Factor	Total Cost 1000 FT	Product. Index kWh per T	Notes on plant conditions and changes
Jan/__/__	3817	4586	9320			0.46	19400	422	
Feb/__/__	2530	3270	10120			0.37	15477	379	
Mar/__/__	5026	5710	11020			0.58	23032	475	
Apr/__/__	4762	5436	12520			0.57	22628	560	
May/__/__	4367	5021	13320			0.51	21628	545	
Jun/__/__	5146	5658	13320			0.59	23721	643	
Jul/__/__	5345	5925	13320			0.60	24310	613	
Aug/__/__	5696	6322	13320			0.64	25364	617	
Sep/__/__	5457	6040	12100			0.63	24708	579	
Oct/__/__	5754	6318	12700			0.64	25485	609	
Nov/__/__	3828	4456	10930			0.46	19942	452	
Dec/__/__	3018	3515	9130			0.35	16525	372	
TOTAL	54746	62256					262220	522	

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Peak demand during audit period (kW):

ELECTRIC ENERGY GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

Generator characteristics:

Name/number				
Manufacturer	Ganz			
Capacity (MW):	12.5			
Year installed:	1960			
Year last major overhaul:	1983			
Drive type (steam, gas, diesel)	Steam			
If steam – Condensing/extraction/backpressure	Backpressure			
Operational? (yes/no)	Yes			

GENERATION DATA FOR 12–MONTH AUDIT PERIOD:

	SELF–GENERATION BY PLANT				SOLD TO OTHERS:				PURCHASED FROM OTHERS				NOTES
Meter Reading Mo/day/yr	Energy Active MkWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active MkWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active MkWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Unusual Operating conditions Conv KWH/GJ
Jan/__/__	4283		9187		569				4586		9320		278
Feb/__/__	3124		8686		570				3270		10120		273
Mar/__/__	3391		8358		591				5710		11020		268
Apr/__/__	2145		6539		486				5436		12520		259
May/__/__	827		3715		435				5021		13320		213
Jun/__/__	1077		4482		338				5658		13320		214
Jul/__/__	1095		3883		386				5925		13320		260
Aug/__/__	1429		4568		404				6322		13320		234
Sep/__/__	1546		4656		491				6040		12100		227
Oct/__/__	2410		9969		406				6318		12700		238
Nov/__/__	3656		9035		505				4456		10930		245
Dec/__/__	3349		11561		425				3515		9130		247
TOTAL	28350				5606				62256				

Prepared for [illegible] and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

Item No.	Equipment or Process Description	Connected Load kW	Maximum Load kW	Average Load kW	Load at Peak Billing Demand kW	Electric Energy Consumption MWh/year	Total Energy Cost /year
1	Paper Machine 14					35844	
2	Paper Machine 15					1132	
3	Paper Machine 16					27360	
4	Cardboard Factory					4572	
5	Compressors					2053	
6	Infrastructure					4788	
7	Water supply					1651	
8	Other mechanical					106	
9	Boiler House					8261	
10	Network losses					3805	
11	External sales (except cardboard)					1034	
						90606	
TOTAL PEAK DEMAND (equals maximum billing demand)							
TOTAL ELECTRIC ENERGY CONSUMPTION AND COST (equals total billed consumption)							

FUEL, STEAM OR HEAT ENERGY CONSUMPTION – 12 MONTH AUDIT PERIOD
ENERGY TYPE: Natural gas
Prepared for USAID and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy

Report date: 12 May 94

Supply contract terms:

Fuel or heat supply company's name	Municipal Gas Works
Contract maximum demand:	6800 nor cu m/hr
~~Demand~~ ~~XXXX~~ ~~Minimum~~ charge (cost):	287000 FT/MJ/hr
~~Use charge~~ ~~XXXX~~ ~~Other~~	238 FT/GJ (winter) 233 FT/GJ (summer)

CONSUMPTION OR BILLING DATA FOR 12-MONTH AUDIT PERIOD
FOR: (NAME OF ENERGY FORM):

GJ in paper machines only

Meter Reading Mo/day/yr	Physical Consumption units 1000 m3	Thermal Consumption GJ	Total Cost 1000 FT	Monthly Heating Degree-Days HDD	Heating Index GJ/HDD	Product. Index GJ per: ton	Notes on plant conditions and changes
Jan/__/__	3044	103496	34021			3.81	
Feb/__/__	2625	89254	30721			3.09	
Mar/__/__	2937	99871	32807			3.44	
Apr/__/__	2008	68269	24859			3.55	
May/__/__	1505	51196	18375			3.20	
Jun/__/__	1606	55613	19669			3.23	
Jul/__/__	1629	55401	19559			3.30	
Aug/__/__	1851	62961	22069			3.18	
Sep/__/__	1882	63991	22372			3.17	
Oct/__/__	2393	81348	26799			3.89	
Nov/__/__	2850	96904	32725			4.20	
Dec/__/__	2695	91617	30832			4.11	
TOTAL	26998	917921	314808			3.52	

Note: Heating degree-days based on reference temperature of ____C

STEAM GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

Boiler characteristics:

Name/number				
Manufacturer	Lang	Lang		
Type (firetube/watertube)	watertube	watertube		
Type (saturated/superheated)	superheated	superheated		
Capacity (tons/hour)	60	60		
Year installed:	1960	1960		
Year last major overhaul:	1971	1970		
Operational? (yes/no)	yes	yes		
Steam pressure: Bar	112	112		
Steam temperature: Cent	500	500		
Stack temperature, after economizer: Cent	130	130		
Stack gas analysis: percent O2	1-1 1/2 %	1 - 1 1/2%		
Combustion efficiency:				
Blowdown analysis: dissolved solids PPM				

STEAM GENERATION DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading Mo/day/yr	STEAM GENERATION BY PLANT: Fuel NG Consumption GJ	Steam Generation tons	Steam Generation GJ	Monthly Efficiency %	IMPORTS: Steam Purchased GJ	STEAM SALES AND DISTRIBUTION TO CONSUMERS: Paper GJ	Card-board GJ	Infra-struct GJ	Turbine GJ	Sales GJ	Boiler House GJ	Netwrk Losses & Unaccounted GJ	NOTES: Unusual Operating conditions
Jan/ /	119712	48682	107782	90.03		41358	5582	22266	15406	5842	24005	5253	
Feb/ /	104137	41310	94302	90.56		26729	4759	32600	11443	5872	18138	4596	
Mar/ /	113754	41297	101687	89.39		41374	5741	20375	12632	4733	25472	5076	
Apr/ /	82085	28318	75622	92.13		34491	4949	9775	8274	2677	18545	3623	
May/ /	54261	18038	48507	89.40		29513	3576	2007	3881	1512	15252	2566	
Jun/ /	59813	20505	55141	92.19		28403	2984	3125	5021	935	18496	2714	
Jul/ /	59337	19597	52239	88.04		31903	3174	3189	4719	826	13773	2628	
Aug/ /	70114	24239	56240	80.21		32536	3808	2084	6095	642	21864	3085	
Sep/ /	71411	23103	61234	85.83		33080	4010	5560	6760	1287	17572	3142	
Oct/ /	89346	29955	79462	88.94		40334	4358	13266	10126	2070	16172	3973	
Nov/ /	113414	38412	102413	90.30		41417	5135	23075	14900	4757	19140	4990	
Dec/ /	104630	34342	92518	88.42		38864	3692	24560	13554	3584	16224	4624	
TOTAL	1042014	367801	927207	88.98		420007	51768	161882	112311	34737	224603	46270	

~~249 Fuel oil~~
9315 Heating oil
1051578 TOTAL GJ

ENERGY BALANCE – FUEL, STEAM OR HEAT
ENERGY TYPE: Steam
Prepared for USAID and RCG/Hagler Bailly

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

Item No.	Equipment or Process Description	Maximum Load units: GJ/hr	Average Load units: GJ/hr	Load at Peak Demand units:	Energy Consumption units: GJ /year	Total Energy Cost FT /year
1	Paper ~~Paper Mach 14~~ Paper Mach 16	~~59.95~~ 47.97	65.94		420007	126989000
2	Cardboard ~~Card. MH-1~~ Card. Simon	~~21.11~~ ~~15.82~~	9.96		51768	15652000
3	Infrastructure		18.5		161882	48945000
4	Turbine		13.82		112311	33957000
5	Sales		4.20		34737	10503000
6	Boiler House losses				224603	67909000
7	Network losses				46270	13990000
	TOTAL PEAK DEMAND					
	TOTAL ENERGY CONSUMPTION AND COST (equals total billed consumption)				1051578	317994000

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 1

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

ACTION NO. AND BRIEF DESCRIPTION:
Management reports - Develop effective energy management reports

AREA OF THE PLANT AFFECTED: Entire plant

FINDINGS CONCERNING EXISTING CONDITIONS:
A large amount of energy data is now collected, but is not used to produce comprehensive management reports

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:
Use the existing data collection systems, augmented with additional sensors and network software, to develop reports useful for the Energy Manager, the Production Manager, and the Plant Manager

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:	Total cost
	Peak kW	Energy MWh/year	Nat Gas GJ	MFT/year
Baseline – existing conditions	13320	62256	1042014	485
After recommended action	13320	60388	1010754	470
Net reduction		1868	31260	15 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost (1000 FT)	Notes
Engineering design	100	
Equipment procurement	2000	
Equipment installation	400	
Equipment commisssioning	100	
TOTAL INSTALLED COST	2600	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	50	(c)

PAYBACK PERIOD:

$$\frac{b: 2600}{a: 15000 - c: 50} = 0.17 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary

Auditor's name: Tibor Nagy

Report date: 12 May 94

ACTION NO. AND BRIEF DESCRIPTION:
Steam Trap Management - systematic checks & repairs

AREA OF THE PLANT AFFECTED:
Steam distribution network

FINDINGS CONCERNING EXISTING CONDITIONS:

A review of steam traps indicated that numerous traps are functioning poorly

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Set up a computer-based system to systematically track maintenance checks and promptly take action when traps fail; as part of this, set up a steam trap testing and repair facility. Use the existing ultrasound detector for the trap checks.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:		Total cost	
	Peak kW	Energy MWh/year	Nat gas GJ		Mill FT/year	
Baseline –existing conditions				1042014	264	
After recommended action				1021174	259	
Net reduction				20840	5	(a)

COST–BENEFIT ANALYSIS: 1000 FT

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	-	
Equipment procurement	1325	
Equipment installation	100	
Equipment commisssioning	-	
TOTAL INSTALLED COST	1425	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	750	(c)

PAYBACK PERIOD:

$$\frac{b: 1425}{a: 5284 - c: 750} = 0.31 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 3

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary
Auditor's name: Tibor Nagy
Report date: 12 May 94

ACTION NO. AND BRIEF DESCRIPTION:
Steam Network Rationalization - close or remove unused lines

AREA OF THE PLANT AFFECTED:
Steam distribution network

FINDINGS CONCERNING EXISTING CONDITIONS:

There are 11 steam lines that could be closed down for at least a major pa rt of the year.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Close unneeded lines; install valves in backup lines or winter heating lines so they can be closed down when not needed.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:		Total cost	
	Peak kW	Energy MWh/year	Nat gas GJ		Mill FT/year	
Baseline –existing conditions				1042014	264	
After recommended action				1032892	262	
Net reduction				9122	2	(a)

COST–BENEFIT ANALYSIS: 1000 FT

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	195	
Equipment procurement	1260	
Equipment installation	800	
Equipment commisssioning	-	
TOTAL INSTALLED COST	2255	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	50	(c)

PAYBACK PERIOD:

$$\frac{b: 2255}{a: 2313 - c: 50} = 1.0 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 4

Plant name: Dunapack Paper Mill
Address: 1215 Budapest, Duna u. 42, Hungary

Auditor's name: Tibor Nagy
Report date: 12 May 94

ACTION NO. AND BRIEF DESCRIPTION:
Compressed Air Leak Reduction

AREA OF THE PLANT AFFECTED:
Paper Production

FINDINGS CONCERNING EXISTING CONDITIONS:

Checks showed large numbers of leaks at air connections at paper machines.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Use an ultrasound leak detector and an associated maintenance program to systematically reduce leakage.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year				1000 FT /year
Baseline –existing conditions		2280				9200
After recommended action		2166				8740
Net reduction		114				460 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost (1000 FT)	Notes
Engineering design	-	
Equipment procurement	70	
Equipment installation	-	
Equipment commisssioning	-	
TOTAL INSTALLED COST	70 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	40 (c)	

PAYBACK PERIOD:

$$\frac{b: 70}{a: 460 - c: 40} = 0.17 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Dunaqua-Therm Rt.

by

Albin Zsebik, CEM

Jomuti, Ltd.

for

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Dunaqua-Therm Rt.

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Albin Zsebik, CEM

Jomuti, Ltd.

for

RCG/Hagler Bailly

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Energy Audit Report
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise:	DUNAQUA-THERM Co.
Address:	Dunaújváros 2400
	Építõk útja 7.
Telephone:	(36) 25/ 311-925, 311-332
Fax:	(36) 25/ 311-925, 313-623
Contact Person:	Csaba Pomázi
Title:	District Heating Manager

2. Energy auditor information

Dates-	audit started: February 10th, 1994.
	audit completed: May 31st, 1994
Energy audit company:	Jomuti Ltd.
Energy audit team leader:	Dr. Albin Zsebik
Address:	1172 Budapest, Almásháza u. 55.
	Hungary
Telephone:	(36) 60/ 314-346

3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

- The organisational structure of DUNAQUA-THERM Co. with special care for cost and energy saving
- The operation of heat distribution centres situated in the town, consumer sub-stations, and a thorough heat loss analysis of the distributional network
- Modernisation of the secondary heating systems - possibilities of reconstruction, and ways of financing

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Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

- The total lack of task-oriented organisational structure
  - The individual organizational units are not profit centralised
  - They don't follow the efficiency of the energy consumption (there are no daily efficiency reports)
  - They don't evaluate the monthly energy consumption efficiency reports
- Out of date supplier and consumer instruments and equipment
  - The settlement of accounts in heat supply are not based on measurements, therefore the consumers have no interest in energy saving
- The prodigal operation determined by these instruments and equipment
- Serious losses at all three sub-systems (heat production, heat supply and heat consumer systems)

New experience - in the energy auditor's opinion, what were the most significant lessons learned during the audit:

- There is a very high need for modernisation, but also, there is a great lack of capital. The situation is made even worse by the over subsidised Hungarian price system in district heat supply

4.a Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback

The implementation of the project plans is under process.

4.b Historical production and energy consumption

Summarize the recent production and energy consumption at the plat in physical units (also list the type of units per year, i.e. tons/year, kWh/year, etc.):

Year:	1990	1991	1992	1993	UNITS
Energy:					
electricity:	6782	6463(*)	6064(**)	6463(***)	MWh/year
heat:	1,252	1,23	1,182	1,156	10^6GJ/year

(*) Decrease because of the start of the first frequency converter (the speed control of pump)
(**) The start of the second frequency converter
(***) Start of extra water production pumps

Energy/Production index:

3,29 kWh/GJ in year 1993. (The electric energy demand / heat demand)
0,557 kWh/m^3 in year 1993. (The electric energy demand / water demand)

5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	UNITS
heavy fuel oil:					
diesel fuel oil:					
natural gas:					
coal:					
electricity:	263,86	292,91	327,51	397,26	10^3USD
other (describe):					
heat	2.710,00	2.960	3.103,62	3.900,52	10^3USD

6. Previous actions

Frequency drives were first used in Hungary few years ago. Among the first ones two ELIN frequency controllers were used at two heating circulation pumps in Dunaújváros. So than they have changed the speed of the pumps by manual adjustment. The automatic regulation will be realized after the modernization of the domestic consumer systems and sub-stations.

In order to reduct the heat requirement and modernize the heating system of the residences heat detecting (thermovision) pictures have been made of 2000 buildings (~200.000 flats). With the help of these pictures the order of the buildings for the modernization has been made, serving fully the marketing activity.

7. Detailed forms - required

Complete and attach the following forms:

- Electric energy consumption - 12 month audit period	Table 1 - 8.
- Heat energy consumption - 12 month audit period (complete for each major fuel type for areas studied)	Table 9.
- Energy balance - heat	Table 10.
- Energy balance - electrical	Table 12.
- Action plan - summary of energy efficiency project opport	Table 11.
- Recommended action - energy efficiency opportunity	Action No. 2 - 95 - 1
	Action No. 2 - 95 - 2
	Action No. 2 - 95 - 3

8. Narrative

As the continuation of the Action No 2-94-1 project the Dunaqua-therm started to realize the action No 2-94-2 project both from its own sources and from the German coal-aid, using 50 million Hungarian Forints (HUF). The realization is almost ready and to the modernization Honeywell controllers and thermostatic radiator valves have been used.

The realization of the Action No 2-94-4 project has been started and extended to all residence buildings. The financial demand of the modernization is ~ 500,000.000 HUF (~ 4,160.000,-USD).
The half of it is covered by own sources but to the other half a sponsor is needed. Discussions are going on with the Honeywell company and with EBRD. Other American sponsors might join too.

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 20
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ø	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	2540	960	10		0.866	127	16996	
Febr.	2700	360	11		0.980	135	16227	Drainage water cleaning grid
March	2620	260	11		0.985	131	15268	
April	2300	160	11		0.992	115	13724	
May	2060	360	10		0.956	103	13176	
June	1680	360	12		0.928	84	11462	
July	2140	60	10		0.999	107	13096	
Aug.	1420	-	9		1.000	71	10051	
Sept.	2800	-	11		1.000	140	16294	
Oct.	2720	-	11		1.000	136	16490	
Nov.	3000	-	10		1.000	150	18375	
Dec.	3460	-	11		1.000	173	20709	
Total	29440	2520				1472	181868	

Peak demand during audit period (kW): 12

Table 1.

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 30
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos o	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	5280	1080	-		0.976	176	35470	
Febr.	6960	1395	25		0.968	232	41081	Drainage water lifting over
March	4500	960	29		0.964	150	32842	
April	6360	1305	29		0.966	212	39026	
May	5610	1215	-		0.955	187	36543	
June	4260	829	-		0.963	142	31760	
July	4770	1155	18		0.945	159	33773	
Aug.	5220	1185	25		0.951	174	35257	
Sept.	5760	1170	25		0.960	192	36656	
Oct.	5265	1155	25		0.954	176	35406	
Nov.	6915	1335	26		0.964	231	40246	
Dec.	8535	1815	26		0.957	285	46191	
Total	69435	14599				2316	444251	

Peak demand during audit period (kW): 29

Table 2.

173

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 40
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos o	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	9480	-	39		1.000	237	46295	
Febr.	7200	60	39		1.000	180	38988	machines, lighting
March	6540	-	36		1.000	164	36743	
April	5580	-	39		1.000	140	33522	
May	3060	-	36		1.000	77	25519	
June	3060	-	39		1.000	77	25405	
July	3180	-	36		1.000	80	25865	
Aug.	3540	-	39		1.000	89	26865	
Sept.	3420	60	38		1.000	86	22690	
Oct.	5043	-	-		1.000	126	29013	
Nov.	6600	-	33		1.000	165	33222	
Dec.	9540	-	-		1.000	239	46265	
Total	66240	120				1660	390392	

Peak demand during audit period (kW): 39

Table 3.

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 300
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ø	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	-						-	
Febr.	-						-	
March	67000	7600	220		0.985	223	390540	Pumping (water production)
April	101400	36300	240		0.892	338	542305	
May	115000	36900	252		0.917	383	581166	
June	131000	39300	260		0.928	437	624841	
July	133300	52200	-		0.873	444	664788	
Aug.	101000	22900	300		0.810	337	539367	
Sept.	120800	22300	300		0.957	403	568590	
Oct.	100800	18300	300		0.961	336	500740	
Nov.	125800	19500	288		0.971	419	581175	
Dec.	119300	18800	288		0.969	398	559038	
Total	1115400	274100				3718	5552550	

Peak demand during audit period (kW): 300

Table 4.

175

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 400
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ø	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	-						-	
Febr.	-						-	
March	61200	12000	-		0.974	153	446387	Pumping (water production wells)
April	164400	28200	-		0.974	411	780286	
May	107100	19500	-		0.972	268	593513	
June	177300	32400	-		0.971	443	824650	
July	175200	30600	336		0.972	438	814311	
Aug.	105000	18000	354		0.972	263	582240	
Sept.	169800	29100	-		0.973	425	796570	
Oct.	140400	22800	355		0.977	351	703646	
Nov.	132000	20400	352		0.978	330	673245	
Dec.	151500	23100	326		0.979	379	737201	
Total	1383900	236100				3461	6952049	

Peak demand during audit period (kW): 355

Table 5.

176

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 280
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ø	Load Factor h/month	Total Cost HUF/month	Notes
Jan.	385752			440			2707807	
Febr.	411628			440			2867998	- Heating circulator pumps - Hot water circulator pumps - Lighting
March	317247			440			2284812	
April	332873			440			2380593	
May	158183			440			1299258	
June	32439			440			507882	
July	45968			440			613962	
Aug.	31561			440			561940	
Sept.	34333			440			536244	
Oct.	102084			440			950721	
Nov.	293513			440			2152456	
Dec.	373227			440			2911456	
Total	2518808						19775129	

Peak demand during audit period (kW):

Table 6.

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 320
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ϕ	Load Factor h/month	Total Cost HUF/month	Notes Contract maximum demand: [kW]	
Jan.	151337	2700	256		0.960	473	652317	320	
Febr.	124846	10500	256		0.951	390	576627	320	Pumping (district heat production)
March	115711	12000	293		0.946	362	548302	320	
April	42021	3600			0.939	131	313382	320	
May	914	-			0.960	23	26607	40	
June	610	-			0.960	15	25234	40	
July	610	-			0.960	15	25234	40	
Aug.	914	300			0.854	23	28959	40	
Sept.	1219	-			0.960	30	27338	40	
Oct.	42327	3900			0.949	212	249532	200	
Nov.	123323	10200			0.952	385	575945	320	
Dec.	139767	13500			0.949	437	626991	320	
Total	743599	56700				2496	3676468		

Peak demand during audit period (kW): 293

Table 7.

Electric Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Electricity supply company's name
Contract maximum demand (kWh): 240
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period:

meter reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max. Demand kW	Max. Demand kVA	Power Factor cos ø	Load Factor h/month	Total Cost HUF/month	Notes Contract maximum demand: [kW]	
Jan.	99600	-	232		1.000	415	456855	240	
Febr.	89800	-	232		1.000	374	425542	240	Pumping (district heat production)
March	74700	-	160		1.000	311	377498	240	
April	61800	-			1.000	258	336630	240	
May	2900	-			1.000	73	32800	40	
June	2100	-			1.000	53	30166	40	
July	2000	-			1.000	50	29957	40	
Aug.	800	-			1.000	20	25992	40	
Sept.	1100	-			1.000	28	27113	40	
Oct.	32900	-			1.000	219	192261	150	
Nov.	76300	100			1.000	318	384247	240	
Dec.	92300	-			1.000	385	434920	240	
Total	536300					2504	2753981		

Peak demand during audit period (kW): 232

Table 8.

Heat Energy Consumption - 12 month audit period
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Heat supply company's name: Dunaferr Energy Supplier Ltd.
Contract maximum demand (kWh): 125000
Minimum charge (cost):
Other:

Consumption and billing data for 12- month audit period (1993):
Name of energy form: Hot water

Meter Reading Mo/day/yr	Physical Consump. units =	Thermal Consump. GJ	Total Cost 1000HUF	Monthly Heating HDD	Heating Index GJ/HDD	Product. Index GJ/	Notes
Jan.		198710	76288	603,88	329,06		
Febr.		187388	72243	622,05	301,24		
March		148128	58880	478,02	309,88		
April		78812	35196	226,80	347,50		20 days (the heating finished at 10.30pm, on 2nd)
May		18256	14568				
June		17652	14353				
July		18439	14667				
Aug.		15877	13682				
Sept.		17503	14242				
Oct.		65326	30676	156,24	418,11		14 days (the heating started at 6.30am, on18th)
Nov.		192859	74147	561,90	343,23		
Dec.		196354	75298	538,47	364,65		
Total		1155304	494240	3187,36	362,46		for the heating season

Remark: the reference temperature at HDD is 20°C

Table 9.

Energy balance - Heat

Prepared for USAID and RCG/Hagler Bailly

Plant name: DUNAQUA-THERM Co.

Item No.	Equipment or Process Description	Maximum Load Units:MW	Average Load Units:MW	Load at Peak Demand Units: MW	Energy Consumption GJ/year	Total Energy cost: 1000 USD
1	Residental heating	70	43	71	685911	2907,67
2	Residental hot water supply	21	8	21	190120	816,67
3	Public heating	30	16	32	263418	1155,99
4	Public hot water supply	1	0,1	1	15855	62,07
Total Peak Demand				125		
Total Energy Consumption and cost					1155304	4942,4

Table 10.

Table 11

Action Plan - Summary of energy efficiency project opportunities
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Baseline - existing conditions

	Thermal Consump. GJ/year	Water Consump. m3/year	Cost of Repair USD/year	Electricity Consumption kWh/year	Total Energy Cost USD/year
	1154969	84000	3000000	6460000	2945000,00

Summary of recommended energy efficiency actions: Savings

Action No.	Action Description	Thermal Consump. GJ/year	Water Consump. m3/year	Cost of Repair USD/year	Electricity Consumption kWh/year	Total Energy Cost USD/year	Action Project Cost USD	Action Payback Period [years]
2-94-1	Modernisation of consumer sub-stations	335	1296		6720	3300	10200	3,19
2-94-2	Modern. of the public district heat cons.	23000				145000	500000	3,44
2-94-4	Modern. of resid. district heating sub-st.	1874			10000	13180	37930	2,7
2-95-2	Leak detector	5000	24000	1500		46800	19000	0,44
2-95-1	Portable ultrasonic flowmeter	30000				93000	43000	0,46
2-95-4a	Mod. of resid. distr. heating sub-stations	3073			12264	12533	32500	2,6
Total savings		63282	25296	1500	28984	313813		
Savings as percentage of base case		0,43	30,11	0,05	0,45	10,66		

Energy balance - Electrical
Prepared for USAID and RCG/Hagler Bailly
Plant name: DUNAQUA-THERM Co.

Item No.	Equipment or Process Description		Connected Load Units:kW	Maximum Load Units:kW	Average Load Units: kW	Load at Peak Billing Demand kW	Electric Energy Consump. kWh/year	Total Energy Cost USD/year
1	Drainage water	Table 1.				20	29440	1818,68
		Table 2.				30	69435	4442,51
		Total				50	98875	6261,19
2	Water production	Table 3.				40	66240	3903,92
		Table 4.				300	1115400	55525,50
		Table 5.				400	1383900	69520,49
		Total				740	2565540	128949,91
3	District heating	Table 6.				280	536300	27539,81
		Table 7.				320	743599	36764,68
		Table 8.				240	2518808	197751,29
		Total				840	3798707	262055,78
Total Peak Demand						1630,00		
Total Energy Consumption and cost							6463122	397266,88

Table 12.

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2-94-1

Plant name: DUNAQUA-THERM Co.
Address: 2401 Dunaújváros, Építők útja 7.
Auditor's name: Dr.Albin ZSEBIK
Report date: April, 1994.

ACTION NO. AND BRIEF DESCRIPTION: 2-94-1 Modernization of consumer sub-stations

AREA OF THE PLANT AFFECTED: Consumer sub-station at Károlyi Mihály str. 8.

FINDINGS CONCERNING EXISTING CONDITIONS:

The heated volume of the flats in town is 2.400.000 m^3, charged in Lump sum system. The totally unregulated residental consumer sub-stations and heating networks are prodigal.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY: We suggest to settle a pattern consumer sub-station before the common modernization of sub-stations and heating systems, in order to test the equipment, check the regulating algorithms, and to get accurate information of the savings by the better heat utilization and the reduction of the temperature of the returning water.
The settling up of the pattern sub-station takes place in a living house of 40 flats built In 1967, with 300 kW designed heating load and 280 m^3/month hot running water. The thermostatic radiator-valves, "cost-dividers" and watermeters have already been placed in the flats for cold and hot water, separately.
The reconstruction of sub-stations are based on changing water-flow regulation with digital regulators, which would autonomously serve the regulation of the sub-station, and would keep contact with a central computer.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year	heat GJ/year	water m^3/year		USD/year
Baseline – existing conditions	3,5	16.800	1.380	3.360		$11x10^3$
After recommended action	3,5	10.080	1.045	2.064		$7,7x10^3$
Reduction	0	6.720	335	1.296		$3,3x10^3$ (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	$0,5x10^3$	USD
Equipment procurement	$10x10^3$	USD
Equipment installation	$0,5x10^3$	USD
Equipment commisssioning	$0,1x10^3$	USD
TOTAL INSTALLED COST	$10,2x10^3$	USD (b)
Estimated increase in annual (non–energy) operations and maintenance cost	$0,1x10^3$	USD/year (c)

PAYBACK PERIOD:

$$\frac{b: 10,2x10^3}{a: 3,3x10^3 - c: 0,1x10^3} = 3,19 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

MMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
red for USAD and RCG/Hagler Bailly

ACTION NO.
2-94-2

Plant name: DUNAQUA-THERM Co.
Address: 2401, Dunaújváros, Építők útja 7.
Auditor's name: Dr.Albin ZSEBIK

Report date: April, 1994.

ACTION NO. AND BRIEF DESCRIPTION: 2-94-2 Modernisation of the district heating consumption of public buildings in town

AREA OF THE PLANT AFFECTED: district heating sub-stations in public buildings in town

FINDINGS CONCERNING EXISTING CONDITIONS:

There are totally unregulated public consumer systems running in town, with a heated volume of 520.000 m^3, charged in lump sum system.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Common modernisation of consumer sub-stations and systems, building thermostat setting in, reconstruction of sub-stations

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year		heat TJ/year		USD /year
Baseline – existing conditions				105		660×10^3
After recommended action				82		515×10^3
..eduction				23		145×10^3 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	35×10^3	USD
Equipment procurement	367×10^3	
Equipment installation	88×10^3	
Equipment commisssioning	10×10^3	
TOTAL INSTALLED COST	500×10^3 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	Ø (c)	

PAYBACK PERIOD:

$$\frac{b: 500 \times 10^3}{a: 145 \times 10^3 - c: 0} = 3{,}44 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

OMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2-94-4

Plant name: DUNAQUA-THERM Co.
Address: 2401, Dunaújváros, Építők útja 7.
Auditor's name: Dr.Albin ZSEBIK
Report date: April, 1994.

ACTION NO. AND BRIEF DESCRIPTION: 2-94-4 Modernisation of the residental district heating sub-stations and the heating system

AREA OF THE PLANT AFFECTED: district heating sub-stations in residental buildings in town

FINDINGS CONCERNING EXISTING CONDITIONS:

There are totally unregulated residental consumer systems running in town, with a heated volume of 2.500.000 m^3, charged in lump sum system.

OMMENDED ACTION TO IMPROVE EFFICIENCY:

Common modernisation of consumer sub-stations and systems, building thermostat settings in, reconstruction of sub-stations at those buildings with 400 flats, where the energy loss is the greatest, and the carrying out is the easiest. This would serve as an example for the rest of the buildings.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:		Total cost	
	Peak kW	Energy MWh/year		GJ/year	USD /year	
Baseline – existing conditions	23,3	68		10.410	73.080	
recommended action	23,4	58		8.536	59.900	
Net reduction				1.874	13.180	(a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	2.000	
Equipment procurement	30.000	
Equipment installation	4.500	
Equipment commisssioning	1.400	
TOTAL INSTALLED COST	37.930 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	-1.000 (c)	

PAYBACK PERIOD:

$$\frac{b: 37.930}{a: 13.180 + c: 1.000} = 2,7 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO

2-95-1

Plant name: DUNAQUA-THERM
Addres: 2401 DUNAÚJVÁROS, Építők útja 7.

Auditors name: Dr. Albin ZSEBIK tel.+fax: 36 1 257 7369

Report date: April, 1995.

ACTION NO. AND BRIEF DESCRIPTION: 2-95-1 Portable ultrasonic flowmeter

AREA OF THE PLANT AFFECTED: District heating company in DUNAÚJVÁROS

FINDINGS CONSERNING EXISTING CONDITIONS:

There are totally unregulated residential and public consumer systems running in town, with yearly heat demand ~ 950 TJ.

Scattering of room temperature is vast (see picture above) and average temperature in rooms is very hight.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

To regulate the water flow in the primery and secondary heating network systems could help to decrease the scattering and push down the average temperature (pushing down the average temperature with 1°C results saving energy ~ 6 %.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Heat GJ/year	Water m^3/year	Cost of rep. 10^3HUF/year	Total cost USD/year[1./]
Baseline - existing conditions	950.000	---	---	2,945.000
After recommended action	920.000	---	---	2,852.000
Net reduction	30.000	---	---	93.000

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	20.000	
Equipment procurement	20.000	
Equipment instalation	2.000	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	43.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 43.000 / 93.000 = 0,46 years

1./ 1 USD ~ 120 HUF

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPOTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO

2-95-2

Plant name: DUNAQUA-THERM
Addres: 2401 DUNAÚJVÁROS, Építők útja 7.

Auditors name: Dr. Albin ZSEBIK tel.+fax: 36 1 257 7369

Report date: April, 1995.

ACTION NO. AND BRIEF DESCRIPTION: 2-95-2 Leakage detector

AREA OF THE PLANT AFFECTED: District heating system in DUNAÚJVÁROS

FINDINGS CONSERNING EXISTING CONDITIONS:

The lengh of district heating network in Dunaújváros is ~ 53 km. The age of the piplines is 30 - 40 years. The control and maitenance is not organized properly, and because of the old age the pipes often leaks. It is very difficult to find the leakage covered by the ground. It takes a long time and it is costly.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Improving the efficiency of the routine maitenance. Surveying the ages and conditions of pipes, registrating it by computer, and analyse how the leakings depends on the age and materials of the pipes.

By changing demaged and old pipes the leakages can be prevented.
The suggested leak detector would help

- to surveying conditions of pipes,
- to find place of the leakinges with ease,
- to cut down the cost of repair, decrease the hot water loses.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Heat GJ/year	Water m^3/year	Cost of rep. 10^3HUF/year	Total cost USD/year 1./
Baseline - existing conditions	17.000	84.000	3.000	143.500
After recommended action	12.000	60.000	1.500	96.700
Net reduction	5.000	24.000	1.500	46.800

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	500	
Equipment procurement	18.000	
Equipment instalation	500	
Equipment commissioning	----	
TOTAL INSTALLED COST	19.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 19.000 / 46.800 = 0,44 years

1./ 1 USD ~ 120 HUF

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPOTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO

2-95-4a

Plant name: DUNAQUA-THERM

Addres: 2401 DUNAÚJVÁROS, Építők útja 7.

Auditors name: Dr. Albin ZSEBIK tel. + fax: 36 1 257 7369

Report date: June, 1995.

ACTION NO. AND BRIEF DESCRIPTION: 2-95-4a Modernisation of the residential district heating substations (by Direct Digital Control and information network with **Johnson Controls equipments**)

AREA OF THE PLANT AFFECTED: District heating system in DUNAÚJVÁROS

FINDINGS CONSERNING EXISTING CONDITIONS:

At the present time the domestic substations are equipeped with more than 10 years old analoque controlers. They are in a bad state of repair and are not able to provide efficient control. They can not be programmed by the date and time.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

To modernize sellected 8 substations (where the energy loss is the greatest and the carriing out is the easiest) with DDC system a modern control system. To programing they to calkulate the accurate heat demand of the buldings, the informations gather by the wired information network, and shutting off the heating in nightime also saves heat energy and electricity.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Heat GJ/year	Electricity kWh/year	Cost 10^3HUF/year	Total cost USD/year 1/
Baseline - existing conditions	27.281	82.358	11.886	99,050
After recommended action	23.345	69.465	10.382	86,517
Net reduction	3.073	12264	1.504	12,533

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	2.500	
Equipment procurement	26.500	(22,880 from Johnson Controls)
Equipment instalation	2.500	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	32.500	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 32,500 / 12,533 = 2,60 years

1./ 1 USD ~ 120 HUF

2-96-1

Plant name: DUNAQUA-THERM

Addres: 2401 DUNAÚJVÁROS, Építők útja 7.

Auditors name: Dr. Albin ZSEBIK tel. + fax: 36 1 257 7369

Report date: June, 1995.

ACTION NO. AND BRIEF DESCRIPTION: 2-96-1 Modernisation of the residential district heating substations (by Direct Digital Control and information network)

AREA OF THE PLANT AFFECTED: District heating system in DUNAÚJVÁROS

FINDINGS CONSERNING EXISTING CONDITIONS:

At the present time the domestic substations are equipeped with more than 10 years old analoque controlers. They are in a bad state of repair and are not able to provide efficient control. They can not be programmed by the date and time.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

To modernize sellected 10 substations (where the energy loss is the greatest and the carriing out is the easiest) with DDC system a modern control system. To programing they to calkulate the accurate heat demand of the buldings, the informations gather by the wired information network, and shutting off the heating in nightime also saves heat energy and electricity.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Heat GJ/year	Electricity kWh/year	Cost 10^3HUF/year	Total cost USD/year[1./]
Baseline - existing conditions	34.100	102.948	14.858	102,469
After recommended action	29.181	86.831	11.831	81,593
Net reduction	4.919	16.117	3.027	20,876

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	2.500	
Equipment procurement	30.000	
Equipment instalation	2.500	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	36.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 36,000 / 20,876 = 1,72 years

1./ 1 USD ~ 145 HUF

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPOTUNITY
Prepared for USAID and RCG/Hagler Baily

ACTION NO

1-96-1

Plant name: DUNAFERR Energy Supplier Ltd.
Address: 2400 DUNAÚJVÁROS

Auditor's name: Dr. Albin ZSEBIK tel.+fax: 36 1 257 7369

Report date: March, 1996.

ACTION NO. AND BRIEF DESCRIPTION: 1-96-1 Speed drive

AREA OF THE PLANT AFFECTED: 3. pumps plant

FINDINGS CONSERNING EXISTING CONDITIONS:

At the 3. pumps plant are 8 pumps in parallel connection. From this pumps 3 - 5 pumps operate continuosly. Control of pumps is by throttle valve or by switching off the pumps.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Connect speed drive to the selected 2 pumps and control speed one of these pumps.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION:

	Heat GJ/year	Electricity MWh/year	Cost 10^3HUF/year	Total cost USD/year[1./]
Baseline - existing conditions		11.136	72.384	499,200
After recommended action		9.743	63.329	436,752
Net reduction		1.393	9.055	62,448

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost USD	Notes
Engineering design	1.500	
Equipment procurement	30.000	
Equipment instalation	2.500	
Equipment commissioning	1.000	
TOTAL INSTALLED COST	35.000	

Estimated increase in annual (non-energy) operetion and maintenance cost ----

PAYBACK PERIOD: 35,000 / 62,448 = 0,56 years

1./ 1 USD ~ 145 HUF

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Eszakmagyarorszagi Vizmuvek Rt.

by

Mihaily Szaniszlo, CEM

Rendszertechnika Fejleszto Kft

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise	Északmagyarországi Regionális Vízművek Rt. /ÉV Rt./
Address	3700 Kazincbarcika
	Tardonai út 1.
Telephone	/36-48/ 310-811
Fax	/36-48/ 310-015
Contact Person	Lénárt László
Title	head of department
Telephone	/36-48/ 310-811

2. Energy auditor information

Dates - audit started: 1994.jan.14. audit completed: 1994.aug.31.

Energy audit company	Rendszertechnika Fejlesztő KFT
Energy audit team leader	Dr.Szaniszló Mihály CEM
Address	1088 Budapest
	Vas u. 15/b. III/40. Hungary
Telephone	/36-1/ 138-1638, /36-1/ 117-3370
Fax	/36-1/ 117-3370

RENDSZERTECHNIKA
FEJLESZTŐ KFT
1088 Budapest, Vas u. 15/B III/40.

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

1. Electric energy consumption

Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

Due to the decreased water demand the installed pumps work only with throttled operation several times that results a significant loss and surplus energy consumption.

We can expect the decrease of energy consumption of the pumps as a result of the installation of the speed regulator.

Pumps sets /and other equipment/ are generally old and inefficient. Some pump se are only 50% efficient, and we received data that confirmed this for some pumps at the Gesztely East Peak Waterworks near Miskolc.

Having purchased modern pumps that fit the current situation more it will be possible to achieve an operation with optimal efficiency.

The electrical parameters of the new pumps are better, therefore it will be possible to decrease the electric power demand.

The limitation of the electric power need can be decreased, as well.

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4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units (also list the type of units per year, i.e. tons/year, kWh/year etc.):

Year:	1990	1991	1992	1993	UNITS
Production:					
Drinking water	49783	38985	35272	36727	10^3m^3
Industrial water	17361	9025	6439	6975	10^3m^3
Lifted water	25454	22197	18793	20804	10^3m^3
Waste water	2812	2454	2076	1908	10^3m^3
Agricultural water	3261	1092	2063	0	10^3m^3
Total:	98761	73753	64643	66414	10^3m^3

Energy:

Name	Unit	1990		1991		1992		1993	
		Mennv	GJ	Mennv	GJ	Mennv	GJ	Mennv	GJ
Petrol	T	348	14616	310	13020	220	9240	167	7014
Heavy fuel oil	T	900	37800	700	29400	360	15120	251	10542
PB gas	T	1	47	1	47	2	94	2	94
Paraffin	T			1	42				
Fuel oil	T	662	27804	614	25788	465	19530	563	23646
Coal	T	243	3540	296	4145	198	2990	176	2642
Coke	T	24	548	21	495	17	400	21	494
Brikett	T	21	462	17	321				
Wood	T	34	425	27	337	4	50	13	163
Warm water	GJ		6417		3102		2019		2057
Natural gas	Em3	645	21740	703	23750	593	20020	622	21057
Electricity	Mwh	46566	167638	34894	125618	31822	114559	33061	119020
Total:			**281037**		**226065**		**184022**		**186729**

Energy/Production index:

	1990	1991	1992	1993	UNITS
thermal	2.84	3.06	2.85	2.81	10^3m^3
electrical	0.47	0.47	0.49	0.50	10^3m^3

5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Name	1990	1991	1992	1993
Petrol	15280	21951	19005	13131
Heavy fuel oil	22108	27595	18045	14411
PD.gas	15	22	46	66
Paraffin	11	44		
Fuel oil	19171	25225	22055	30845
Coal	719	1000	789	741
Coke	151	167	158	221
Briketl	72	142		
Wood	89	77	10	34
Warm water	2384	1252	930	1224
Natural gas	7176	10159	6683	7496
Electricity	174769	173540	149946	153381
Total:	241945	261174	217667	221550

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding ---

EV has good awareness of energy conservation, as shown by the many excellent ideas were included in EV's application to join the USAID program.

Difficulty in obtaining financing for investments.

Increase in overdue accounts receivable - difficulty in collecting from customers.

The efficiency of the pumps having worked for more than 20 years became very low, at the same time due to the changed water supplying capacity of the wells most of them works in throttled operation mode.

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7. **Detailed forms - required**

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

Electric energy consumption - 12 month audit period

Electric energy generation - 12 month audit period (if plant has generator)

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. **Narrative**

Provide any other information which would be useful to USAID and RCG/Hagler Bailly --

_____

_____

_____

_____

_____

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ELECRTIC ENERGY CONSUMPTION-12 MONTH AUDIT PERIOD

Prepared for USAID and RCG/Hangter Baiily

Plant name: ÉV.Rt. Borsodszirák I.telep
Address: 3701 Kazincbarcika Tardonai ut 1.sz
Auditor's name: Begala Lajos
Report data: 1993

Electriciti contract terms:

Electriciti suppty company's name	ÉMASZ Rt.
Contract maiximum demand (KW)	470
Minium charge (cost)	
Other	

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERICD:

Meter Reading	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Power Factor cos fi	Load Factor	Total Cost	Product index kWh/m3	Notes on piant conditians and changes
jan	160062	18950	384	387	0.993	0.82	730723	0.53	
febr	122259	12231	381	383	0.995	0.81	677605	0.50	
márc	168217	42670	372	384	0.968	0.79	781859	0.46	
ápr	175110	29336	390	396	0.986	0.83	862986	0.51	
máj	185546	21967	384	387	0.993	0.82	897828	0.46	
jún	124113	37791	445	466	0.954	0.95	713308	0.31	
júl	176895	13706	448	449	0.997	0.95	857859	0.49	
aug	204291	9137	432	432	0.999	0.92	978244	0.54	
szept	201833	9027	472	472	0.999	1.00	1011292	0.59	
okt	153461	6864	430	430	0.999	0.91	811692	0.49	
nov	177676	7947	435	435	0.999	0.93	891087	0.58	
dec	172696	7724	418	418	0.999	0.89	886753	0.60	
TOTAL	2022159						10101235	0.50	

Peak demand during audit period (kW) 472

ELECRTIC ENERGY CONSUMPTION-12 MONTH AUDIT PERIOD

Prepared for USAID and RCG/Hangter Baiily

Plant name: ÉV.Rt. Kazincbarcika II.telep
Address: 3701 Kazincbarcika Tardonai ut 1.sz
Auditor's name: Begala Lajos
Report data: 1993

Electriciti contract terms:

Electriciti suppty company's name ÉMASZ Rt.	
Contract maiximum demand (KW)	180
Minimum charge (cost)	
Othe	

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Power Factor cos fi	Load Factor	Total Cost	Product index kWh/m3	Notes on piant conditians and changes
jan	67342	9998	148	150	0.989	0.82	309870	0.49	
febr	68511	11059	148	150	0.987	0.82	333298	0.56	
márc	70632	10953	144	146	0.988	0.80	339844	0.49	
ápr	67207	9024	144	145	0.991	0.80	329893	0.50	
máj	67336	9997	141	143	0.989	0.78	329680	0.50	
jún	63271	9812	160	162	0.988	0.89	316227	0.48	
júl	65067	10090	156	158	0.988	0.87	322101	0.48	
aug	72465	12140	148	150	0.986	0.82	359596	0.54	
szept	63511	10252	146	148	0.987	0.81	338737	0.50	
okt	72877	20420	156	162	0.961	0.87	364022	0.54	
nov	68634	11079	148	150	0.987	0.82	346052	0.43	
dec	114346	18458	151	153	0.987	0.84	493972	0.44	
TOTAL	861199						4183292	0.49	

Peak demand during audit period (kW) 160

Plant name:
Address:

Auditor's name:

Report date:

BASELINE – EXISTING CONDITIONS

	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year
BASE CASE						

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year	Action Project Cost	Action Payback Period (years)
1.	WELL-PUMPS /BORSODSZIRÁK/			235 MWh/year				7,045	3,45
2.	PUMPS AND FREQUENCY CHANGER /KAZINCBARCIKA/			182 MWh/year				4,733	4,47
TOTAL SAVINGS				417 MWh/year					
SAVINGS AS PERCENTAGE OF BASE CASE									

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and HCG/Hagler Bailly

ACTION NO 1

Plant name NORTH HUNGARIAN WATERWORKS Co (NHW Co)
Address 3700 KAZINCBARCIKA, Tardonai ut 1 HUNGARY

Auditor's name

Report date

ACTION NO AND BRIEF DESCRIPTION CHANGE OF SUPPLYING PUMPS AT THE DRINKING WATER TREATMENT PLANT, INSTALLATION OF ONE SPEED REGULATOR WITH FREQUENCY CHANGER FOR ONE WELL PUMP.

IMPACT REPORT AFFECTED DRINKING WATER TREATMENT PLANT No.II.KAZINCBARCIKA

FACTS CONCERNING EXISTING CONDITIONS

THE EFFICIENCY OF THE PUMPS HAVING WORKED FOR MORE THAN 20 YEARS BECAME VERY LOW, AT THE SAME TIME DUE TO THE CHANGED WATER SUPPLYING CAPACITY OF THE WELLS MOST OF THEM WORKS IN THROTTLED OPERATION MODE.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

HAVING PURCHASED MODERN PUMPS THAT FIT CURRENT CIRCUMSTANCES MORE, IT WILL BE POSSIBLE TO OPERATE WITH AN OPTIMAL EFFICIENCY.
THE ELECTRICAL PARAMETERS OF THE NEW PUMPS ARE BETTER, THEREFORE THE DECREASE OF THE ELECTRIC POWER CONSUMPTION CAN BE ACHIEVED.

DESCRIPTION ABOUT THE PLANNED INSTALLATION CIRCUMSTANCES OF THE SPEED REGUALTOR CAN BE FOUND IN APPENDIX 1.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak kW	Electricity Energy MWh/year	Fuels, heat and steam	Total cost MFt/year	
Baseline - existing conditions	N: 180 Cs: 180	602		2,178	
After recommended action	N : 180 Cs: 180	420		1,520	
Net reduction		182		0,658	(a)

COST-BENEFIT ANALYSIS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	0,250	
Equipment procurement	3,943	
Equipment installation	0,540	
Equipment commissioning	-	
TOTAL INSTALLED COST	4,733 (b)	
Estimated increase in annual (non-energy) operations and maintenance cost	-0,400 (c)	

PAYBACK PERIOD

b 4,733 / a 0,658 - c -0,400 = 4,47 years

RECOMMENDED IMPLEMENTATION SCHEDULE

BEST AVAILABLE COPY

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
prepared for USAID and RCG/Hagler Bailly

ACTION NO 2.

Plant name NORTH-HUNGARIAN WATERWORKS Co (NHW Co)
Address 3700. KAZINCBARCIKA, TARDONAI ÚT 1. HUNGARY

Auditor's name

Report date

ACTION NO AND BRIEF DESCRIPTION CHANGE OF SUPPLYING PUMPS AT THE DRINKING WATER TREATMENT PLANT

AREA OF THE PLANT AFFECTED DRINKING WATER TREATMENT PLANT, BORSODSZIRÁK

FINDINGS CONCERNING EXISTING CONDITIONS

THE EFFICIENDY OF THE SUPPLYING PUMP BECAME VERY LOW, AT THE SAME TIME DUE TO THE CHANGED WATER SUPPLYING CAPACITY OF THE WELLS MOST OF THE PUMPS OPERATES IN THROTTLED OPERATION MODE.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

HAVING PURCHASED MODERN PUMPS THAT FIT THE CURRENT SITUATION MORE, IT WILL BE POSSIBLE TO ACHIEVE AN OPERATION WITH OPTIMAL EFFICIENCY.

THE ELECTRICAL PARAMETERS OF THE NEW PUMPS ARE BETTER, THEREFORE IT WILL BE POSSIBLE TO DECREASE THE ELECTRIC POWER DEMAND.

THE LIMITATION OF THE ELECTRIC POWER NEED CAN BE DECREASED, AS WELL.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION.

	Electricity Peak kW	Electricity Energy MWh/year	Fuels, heat and steam	Total cost MFt /year	
Baseline – existing conditions	N: 370 Cs: 370	1450		5,944	
After recommended action	N : 300 Cs: 300	1215		4,400	
Net reduction	70	235		1,544	(a)

COST–BENEFIT ANALYSIS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	0,250	
Equipment procurement	5,595	
Equipment installation	1,200	
Equipment commissioning	–	
TOTAL INSTALLED COST	7,045 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	–0,500 (c)	

PAYBACK PERIOD:

$$\frac{b\ 7,045}{a\ 1,544 - c\ -0,500} = 3,45 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE

BEST AVAILABLE COPY

PROPOSED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and RCG/Budapest Daily

ACTION NO 3

Name: NORTH HUNGARIAN WATERWORKS Co (NHW Co)
Address: 3700, KAZINCBARCIKA, TARDONAI ÚT 1. HUNGARY

Project name

Project date

Project no. and brief description: CHANGE OF WELL-PUMPS AT THE DRINKING WATER TREATMENT PLANT

Name of the plant affected: DRINKING WATER TREATMENT PLANT, BORSODSZIRÁK

Describe existing conditions:
THE EFFICIENCY OF THE WELL-PUMPS (32 pieces) OPERATING FOR MORE THAN 20 YEARS AND THAT OF THE SUPPLYING PUMPS BECAME VERY LOW, AT THE SAME TIME DUE TO THE CHANGED WATER SUPPLYIN CAPACITY OF THE WELLS MOST OF THE PUMPS OPERATES IN THROTTLED OPERATION MODE.

Proposed action to improve efficiency:

HAVING PURCHASED MODERN PUMPS THAT FIT THE CURRENT SITUATION MORE IT WILL BE POSSIBLE TO ACHIEVE AN OPERATION WITH OPTIMAL EFFICIENCY.
THE ELECTRICAL PARAMETERS OF THE NEW PUMPS ARE BETTER, THEREFORE IT WILL BE POSSIBLE TO DECREASE THE ELECTRIC POWER DEMAND.

THE LIMITATION OF THE ELECTRIC POWER NEED CAN BE DECREASED, AS WELL.

Results/benefits – effect of recommendation:

	Electricity: Peak kW	Electricity: Energy MWh/year	Fuels, heat and steam:		Total cost MFt/year	
Baseline – existing conditions	N: 370 Cs: 370	2017			6,46	
After recommended action	N: 310 Cs: 310	1273			3,65	
Net reduction		744			2,81	(a)

Cost/benefit analysis:

Project cost estimate:	Cost	Notes
Engineering design	--	
Equipment procurement	8,45	
Equipment installation	1,96	
Equipment commissioning	--	
Total installed cost	10,41	(b)
Estimated increase in annual (non-energy) operations and maintenance cost	0,500	(c)

PAYBACK PERIOD

$$\frac{b: 10,41}{a: 2,81 - c: 0,500} = 3,15 \text{ years}$$

Recommended implementation schedule:

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ACTION – ENERGY EFFICIENCY OPPORTUNITY
USAD and RCG/Hagler Bailly

ACTION NO 4.

name: NORTH HUNGARIAN WATERWORKS Co (NHW Co)
ress: 3700. KAZINCBARCIKA, TARDONAI ÚT 1. HUNGARY

uthor's name:

port date:

CTION NO. AND BRIEF DESCRIPTION: THE CHANGE OF THE PUMPS, MOTORS AT THE DRINKING WATER PUMPING
TATIONS, THE INSTALLATION OF THE THE SPEED REGULATOR WITH FREQUENCY CHANGER.

REA OF THE PLANT AFFECTED: DRINKING WATER PUMPING STATION, VADNA

NDINGS CONCERNING EXISTING CONDITIONS.

HE PUMPS INSTALLED 25 YEARS AGO DO NOT FIT THE CURRENT HYDRAULIC PARAMETERS, IT IS
OSSIBLE TO SATISFY THE CHANGING WATER DEMAND ONLY WITH A BAD EFFICIENCY

ECOMMENDED ACTION TO IMPROVE EFFICIENCY:

FTER THE INSTALLATION OF MODERN PUMPS AND SPEED REUGALTOR WHICH FIT THE CURRENT AND
XPECTED WATER DEMAND IT WILL BE POSSIBLE TO OPERATE WITH AN OPTIMAL-EFFICIENCY.
HE ELECTRIC PARAMETERS OF THE NEW PUMPS ARE BETTER, THIS HELPS TO ACHIEVE THE DECREASE
F THE ENERGY CONSUMPTION.
T THE SAME TIME EVEN THE ELECTRIC POWER DEMAND OF THE NEW PUMPS IS LESS THAN THAT OF THE
IRST IT ONES, SO IT WILL BE POSSIBLE TO LIMIT THE ELECTRIC POWER NEED DURING EVERY DAY AND
EAK CONSUMPTION.

XPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:		Total cost MFt /year	
	Peak kW	Energy MWh/year				
aseline – existing conditions	N: 250 Cs: 100	734			3,435	
ter recommended action	N: 160 Cs: 50	412			1,944	
et reduction		322			1,491	(a)

OST – BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,100	
Equipment procurement	3,800	
Equipment installation	0,800	
Equipment commissioning	0,300	
TOTAL INSTALLED COST	5,000	(b)
Annual increase in annual (non-energy) operations and maintenance cost	-0,200	(c)

PAYBACK PERIOD:

$$\frac{b: 5,000}{a: 1,49 - c: -0,200} = 2,96 \text{ years}$$

ECOMMENDED IMPLEMENTATION SCHEDULE:

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'COMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
mated for USAID and RCG/Hagler Bailly

ACTION NO 5

nit name: NORTH HUNGARIAN WATERWORKS Co (NHW Co)
dress: 3700. KAZINCBARCIKA, TARDONAI ÚT 1. HUNGARY
ager's name:
port date:

TION NO AND BRIEF DESCRIPTION: CHANGE OF WELL-PUMPS AT THE DRINKING WATER TREATMENT PLANT

ME OF THE PLANT AFFECTED: DRINKING WATER TREATMENT PLANT, BORSODSZIRÁK

NDINGS CONCERNING EXISTING CONDITIONS

HE EFFICIENCY OF THE WELL-PUMPS (32 pieces) OPERATING FOR MORE THAN 20 YEARS AND THAT
F THE SUPPLYNG PUMPS BECAME VERY LOW, AT THE SAME TIME DUE TO THE CHANGED WATER SUPPLYING
APACITY OF THE WELLS MOST OF THE PUMPS OPERATES IN THROTTLED OPERATION MODE.

ECOMMENDED ACTION TO IMPROVE EFFICIENCY:

AVING PURCHASED MODERN PUMPS THAT FIT THE CURRENT SITUATION MORE, IT WILL BE POSSIBLE TO
CHIEVE AN OPERATION WITH OPTIMAL EFFICIENCY.
HE ELECTRICAL PARAMETERS OF THE NEW PUMPS ARE BETTER, THEREFORE IT WILL BE POSSIBLE TO
ECREASE THE ELECTRIC POWER DEMAND.

HE LIMITATION OF THE ELECTRIC POWER NEED CAN BE DECREASED, AS WELL.

PECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:		Total cost	
	Peak kW	Energy MWh/year			MFt/year	
aseline – existing conditions	N: 370 Cs: 370	2017			6,46	
ter recommended action	N: 310 Cs: 310	1273			3,65	
t reduction		744			2,81	(a)

OST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost		Notes
Engineering design	—		
Equipment procurement	8,45		
Equipment installation	1,96		
Equipment commissioning	—		
TOTAL INSTALLED COST	10,41	(b)	
timated increase in annual (non-energy) operations and maintenance cost	-0,500	(c)	

PAYBACK PERIOD:

$$\frac{b: 10,41}{a: 2,81 - c: -0,500} = 3,15 \text{ years}$$

ECOMMENDED IMPLEMENTATION SCHEDULE:

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ENERGY ACTION - ENERGY EFFICIENCY OPPORTUNITY
USAID and BOGA Hungary Partly

ACTION NO. 6

NORTH HUNGARIAN WATERWORKS Co (NHW Co)
3700 KAZINCBARCIKA, Tardonai ut 1 HUNGARY

DESCRIPTION: CHANGE OF WELL-PUMPS AND SUPPLYING PUMPS AT THE DRINKING WATER TREATMENT PLANT, INSTALLATION OF A SPEED REGULATOR WITH FREQUENCY CHANGE

PLANT AFFECTED: DRINKING WATER TREATMENT PLANT No II KAZINCBARCIKA

OPERATING EXISTING CONDITIONS

EFFICIENCY OF THE PUMPS HAVING WORKED FOR MORE THAN 20 YEARS BECAME VERY LOW, THE SAME TIME DUE TO THE CHANGED WATER SUPPLYING CAPACITY OF THE WELLS MOST OF WORKS IN THROTTLED OPERATION MODE .

RECOMMENDATION TO IMPROVE EFFICIENCY

THE PURCHASED MODERN PUMPS THAT FIT CURRENT CIRCUMSTANCES MORE IT WILL BE ABLE TO OPERATE WITH AN OPTIMAL EFFICIENCY
ELECTRICAL PARAMETERS OF THE NEW PUMPS ARE BETTER, THEREFORE THE DECREASE OF ELECTRIC POWER CONSUMPTION CAN BE ACHIEVED. AT THE SAME TIME THE ELECTRIC POWER NEED CAN BE LIMITED DURING EVERY DAY AND PEAK CONSUMPTION.

ENERGY - EFFICIENT RECOMMENDATIONS

	Electricity Peak kW	Electricity Energy MWh/year	Fuels (oil and steam)	Total cost MFt/year	
Existing conditions	N: 180 Cs: 180	860		2,77	
Recommended action	N: 140 Cs: 140	437		1,58	
Savings		423		1,19	(a)

FINANCIAL ANALYSIS

INSTALLED COST ESTIMATE	Cost	Notes
Engineering design	0,250	
Equipment procurement	4,86	
Equipment installation	0,540	
Other (commissioning)	--	
TOTAL INSTALLED COST	5,65 (b)	
Increase in annual (non-energy) operations and maintenance cost	-0,300 (c)	

PAYBACK PERIOD:

b/(a-c) = 5,65 / 1,19 = 3,79 years

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and RCG/Hagler Bailly

ACTION NO. 7

Plant name: Északmagyarországi Vízművek Rt
Address: 3700 Kazincbarcika, Tardonai út 1.

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: Az ivóvíztermelő telepen a kútszivattyúk cseréje, frekvenciaváltós fordulatszámszabályzó beépítése.

AREA OF THE PLANT AFFECTED: Szalonnai víztermelő telep

FINDINGS CONCERNING EXISTING CONDITIONS:

A kútszivattyúk tárolásra glóbuszra dolgoznak, ahol a víz elveszti energiáját, majd innen egy ujabb szivattyuval jut el a hálózatba az ivóviz.
A magas nyomásszint miatt az indításoknál gyakran keletkezik csőtörés.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

A kútszivattyúk közvetlenül a hálózatra dolgoznak és a beépitett frekvenciaváltóval mindig optimálisan üzemelnének és meggátolnák a nyomáslengések kialakulását.
Ezzel villamosenergia megtakaritás, hálózati veszteség csökkenés és jelentős hálózatkarbantartási költség csökkenése is várható.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity Peak kW	Electricity Energy MWh/year	Fuels, heat and steam		Total cost M Ft/year
Baseline – existing conditions	N:120 Cs:120	350			1,690
After recommended action	N:100 Cs:100	249			1,120
Net reduction		101			0,570 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,05	
Equipment procurement	2,700	
Equipment installation	0,100	
Equipment commissioning	--	
TOTAL INSTALLED COST	2,85 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	-0,450 (c)	

PAYBACK PERIOD:

$$\frac{b: 2,85}{a: 0,570 - c: -0,450} = 2,79 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 9

Plant name: NORTH HUNGARIAN WATERWORKS Co (NHW co)
Address: 3700 KAZINCBARCIKA, Tardonai ut 1 HUNGARI

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: INSTALLATION OF A SPEED REGULATOR WITH FREQUENCY CHANGE

AREA OF THE PLANT AFFECTED: DRINKING WATER TREATMENT PLANT No II. KAZINCBARCIKA

FINDINGS CONCERNING EXISTING CONDITIONS:

THE UNITS OF THE PUMPS BUILT IN 25 YEARS AGO DON'T FIT TOGETHER WITH THE CHANGED HYDRAULIC PARAMETERS, THE SATISFACTION OF THE FLUETUATING DEMANDS ON WATER CAN BE PROVIDED ONLY WITH A BAD EFFICIENCY.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

AFTER THE INSTALLATION OF THE SPEED REGUALTOR IT WILL BE POSSIBLE TO REALIZE AN OPERAION WITH OPTIMAL EFFICIENCY.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year				MFt/year
Baseline – existing conditions	N: 180 Cs:180	76,2				0,44
After recommended action	N: 140 Cs:140	23,3				0,134
Net reduction		52,9				0,306 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	–	
Equipment procurement	3,45	
Equipment installation	0,05	
Equipment commissioning	–	
TOTAL INSTALLED COST	3,5	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	–0,5	(c)

PAYBACK PERIOD:

$$\frac{b: 3,5}{a: 0,306 - c: 0,5} = 4,3 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 1

Plant name: NORTH HUNGARIAN WATERWORKS Co (NHW co)
Address: 3700 KAZINCBARCIKA, Tardonai ut 1 HUNGARI

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: INSTALLATION OF A SPEED REGULATOR WITH FREWUENCY CHANGER AT THE

AREA OF THE PLANT AFFECTED: DRINKING WATER PUMPING STATION VADNA.

FINDINGS CONCERNING EXISTING CONDITIONS:

THE UNITS OF THE PUMPS BUILT IN 25 YEARS AGO DON'T FIT TOGETHER WITH THE CHANGED HYDRAULIC PARAMETERS, THE SATISFACTION OF THE FLUETUATING DEMANDS ON WATER CAN BE PROVIDED ONLY WITH A BAD EFFICIENDY.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

AFTER THE INSTALLATION OF THE SPEED REGULATOR IT WILL BE POSSIBLE TO REALIZE AN OPERATION WITH OPTIMAL EFFICIENCY.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				MFt /year	
Baseline – existing conditions		801,3				4,624	
After recommended action		366,9				3,271	
Net reduction		234,4				1,353	(a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,05	
Equipment procurement	3,422	
Equipment installation	0,05	
Equipment commissioning	–	
TOTAL INSTALLED COST	3,522	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	–	(c)

PAYBACK PERIOD:

b: 3,522 / a: 1,353 – c: – = 2,6 years

RECOMMENDED IMPLEMENTATION SCHEDULE:

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Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 11.

Plant name: NORTH HUNGARIAN WATERWORKS Co (BGW co)
Address: 3700 KAZINCBARCIKA Tardonai út 1. HUNGARY

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: THE CHANGE OF THE PUMP, MOTOR AT THE DRINKING WATER PUMPING STATIONS:

AREA OF THE PLANT AFFECTED: DRINKING WATER PUMPING STATION, VADNA

FINDINGS CONCERNING EXISTING CONDITIONS:

THE PUMPS INSTALLED 25 YEARS AGO DO NOT FIT THE CURRENT HYDRAULIC PARAMETERS, IT IS POSSIBLE TO SATISFY THE CHANGING WATER DEMAND ONLY WITH A BAD EFFICIENCY

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

AT THE SAME TIME EVEN THE ELECTRIC POWER DEMAND OF THE NEW PUMPS IS LESS THAN THAT OF THE CURRENT ONES, SO IT WILL BE POSSIBLE TO LIMIT THE ELECTRIC POWER NEED DURING EVERY DAY AND PEAK CONSUMPTION.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year				MFt/year
Baseline – existing conditions		801.3				4.6
After recommended action		595,6				3,4
Net reduction		205,7				1,2 (a)

COST – BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,100	
Equipment procurement	5,738	
Equipment installation	0,200	
Equipment commissioning	—	
TOTAL INSTALLED COST	6,038	(b)
[illegible] (non-energy) operations and maintenance cost	-0,500	(c)

PAYBACK PERIOD:

$\frac{(b)\ 6,038}{(a)\ 1,2 - (c)\ -0,5}$ = 3,5 years

RECOMMENDED IMPLEMENTATION SCHEDULE:

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and RCG/Hagler Bailly

ACTION No. 12

Plant name: NORTH HUNGARIAN WATERWORKS Co (NHW co)
Address: 3700 KAZINCBARCIKA, Tardonai ut 1 HUNGARI

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: THE CHANGE OF THE PUMP, MOTOR AT THE DRINKING WATER PUMPING STATIONS, THE INSTALLATION OF THE SPEED REGULATOR WITH FREQUENCY CHANGER. DRINKING WATER PUMPING STATION, VADNA

AREA OF THE PLANT AFFECTED:

FACTORS CONCERNING EXISTING CONDITIONS:

THE PUMPS INSTALLED 25 YEARS AGO DO NOT FIT THE CURRENT HYDRAULIC PARAMETERS, IT IS IMPOSSIBLE TO SATISFY THE CHANGING WATER DEMAND ONLY WITH A BAD EFFICIENCY

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

BY THE INSTALLATION OF MODERN PUMPS AND SPEED REGULATOR WHICH FIT THE CURRENT AND EXPECTED WATER DEMAND IT WILL BE POSSIBLE TO OPERATE WITH AN OPTIMAL-EFFICIENDY.
THE ELECTRIC PARAMETERS OF THE NEW PUMPS ARE BETTER, THIS HELPS TO ACHIEVE THE DECREASE OF THE ENERGY CONSUMPTION.

AT THE SAME TIME EVEN THE ELECTRIC POWER DEMAND OF THE NEW PUMPS IS LESS THAN THAT OF THE CURRENT ONES, SO IT WILL BE POSSIBLE TO LIMIT THE ELECTRIC POWER NEED DURING EVERY DAY AND PEAK CONSUMPTION.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam		Total cost
	Peak kW	Energy MWh/year			MFt/year
Baseline – existing conditions		801,3			4,624
After recommended action		301,1			1,737
Net reduction		500,2			2,887 (a)

COST BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,100	
Equipment procurement	9,160	
Equipment installation	0,200	
Equipment commissioning	–	
TOTAL INSTALLED COST	9,460 (b)	
Estimated increase in annual (non-energy) operations and maintenance cost	T=0,500 (c)	

PAYBACK PERIOD:

$$\frac{b\ 9,46}{a\ 2,887 - c\ 0,500} = 2,8 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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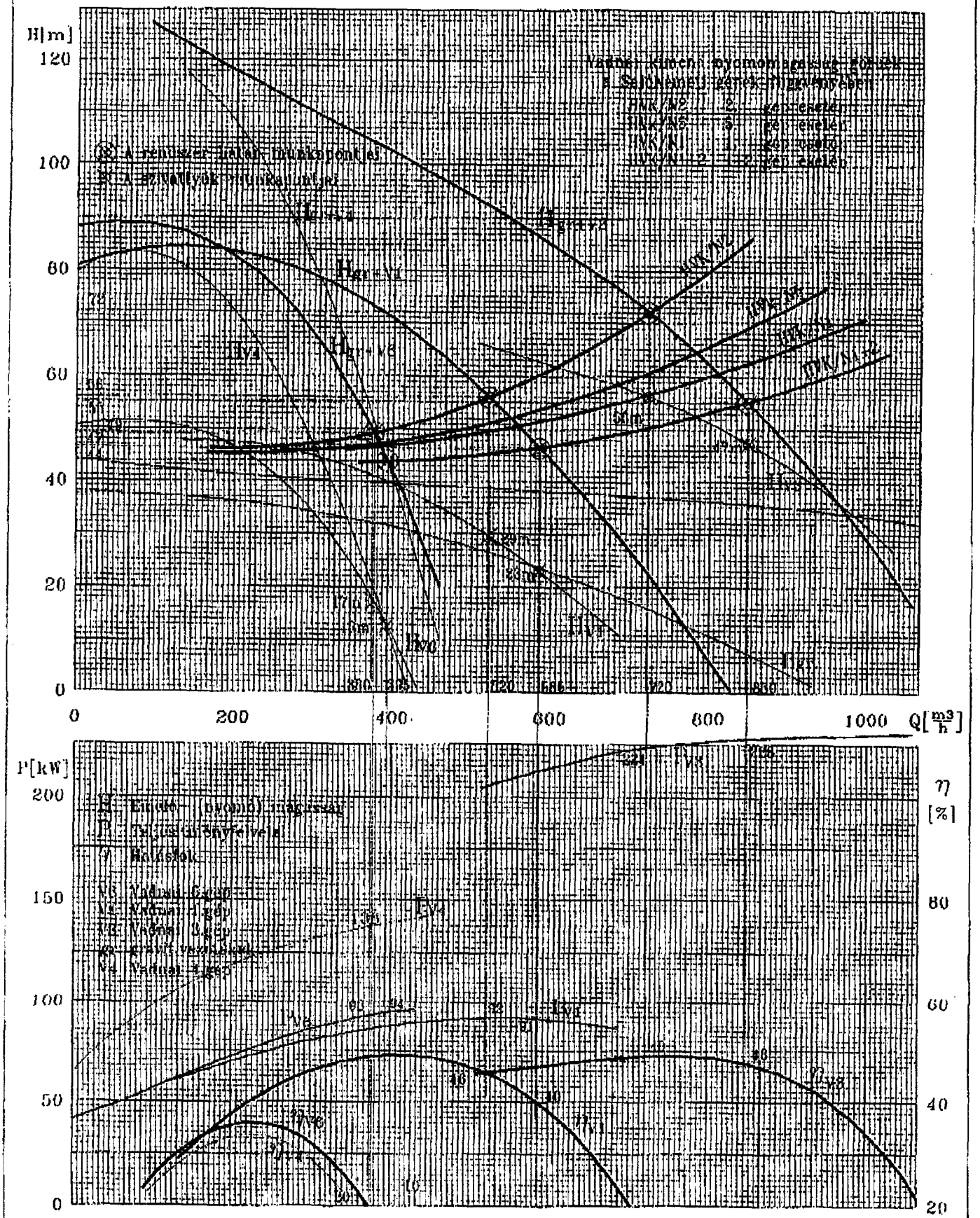

Efficiency of the /Vadna/ pumps.

Mell.sz:

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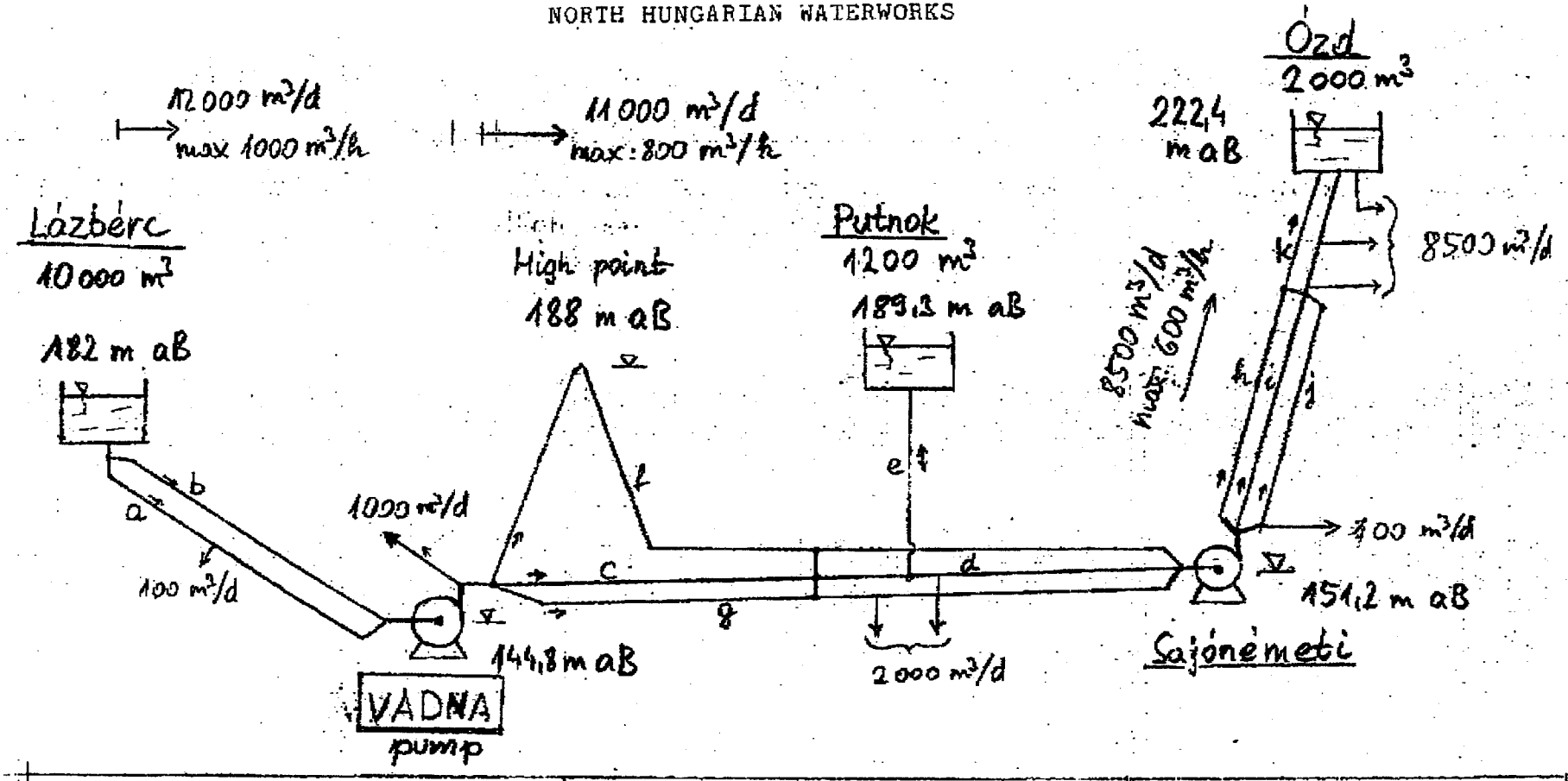
NORTH HUNGARIAN WATERWORKS



a	DN 300 mm	9500 m long	c	DN 300 mm	7,500 m long	h	DN 350 mm	5000 m long
b	DN 600 "	9500 "	d	DN 300	8500	i	DN 500	5000
			e	DN 200	500	j	DN 600	5000
			f	DN 600	15000	k	DN 500, DN 350 & another	2 500
			g	DN 400	16 000			

m aB ⇒ ground level
meter above sea Balti

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Appendix 1.

Planned Installation Circumstances of Speed Regulator

The speed regulator controls the diving pump installed into the water producing driven well.

The water level of the well can be used for control, this we want to be held at the max. suction head so that the well would produce the max. water amount. A further advantage of this method is that it prevents suction which would be big enough to damage the well, furthermore the potenial starting-stopping would take place only slowly, and this would decrease silting up. At the moment controlling of the wells is done by adjusting, throttling the bolt-lock. This is not continouos, what more it is also wasting of energy.

We would like to install the speed regulator into one well for a trial, an so evaluating the results we would like to continoue the installation of speed regulators into the other wells, too, depending on our financial circumstances.

The above equipment would be installed into the well No 2 at the Kazincbarcika Water Treatment Plant No 2. Data of the well:

- ground level	:	135.4 m above Balti
- diameter	:	NA 300
- depth of well	:	8.5 m
- average static condition water level	:	5.58 m
- average operational water level	:	5.86 m
- min. operational water level	:	6.49 m
- max. operational water level	:	5.70 m
- average water production	:	148 l/min (8.88 m3/h)
- min. water production	:	120 l/min (7.20 m3/h)
- max. water production	:	340 l/min (20.4 m3/h)

Data of built-in pump:

- producer	:	Mezőgép EMU
- type	:	K 64. 1-2 + U4-22
- capacity	:	Q = 20 m3/h
- head	:	H = 20 m
- power	:	P = 2.2 kW/3.2 kW

The average water production in case of throttled operation is provided by the pump with 1.8 kW power.

In case of operation with speed regulator the same amount of water is produced with 0.55 kW power. The difference is 1.25 kW, (70% decrease!) and this means saving of 10,590 kWh electric power in case of 8,470 operation hours per year. Beside this the lifetime and utilization of the well will be longer, as well.

Technical Data of Current Built-In Equipments

I. Kazincbarcika Water Treatment Plant No II.

a.) Data of pumps

		Measured values
- Producer	: GANZ-MÁVAG	-
- Type	: TGT 125-4,0	-
- Capacity	: Q = 119 m3/h	191 m3/h
- Head	: H = 90 m	51 m
- Revolution per minute	: n = 1450 r.p.m.	-
- Quantity	: 2 pieces	-
- Pump efficiency	: η = 72 %	46 %
- Operation hours per year	: 3470, 7000 h/y	
- Time of installation	: 1966	

b.) Data of electric motors

	1.	2.	Measured values
- Producer :	EVIG	EVIG	-
- Type :	RH225 M4	AF 127 M4	-
- Power :	P = 55 kW	66 kW	57 kW, 68 kW
- Revolution per minute:	n =1450 rpm	1450 rpm	-
- Voltage :	u = 380	380 V	-
- Quantity :	1 piece	1 piece	-

II. Borsodszirák Water Treatment Plant No 1

No 1.

a.) Data of pumps

			Measured values
- Producer	:	GANZ-MÁVAG	-
- Type	:	TGT 225/1.1	-
- Capacity	:	Q = 270 m3/h	234 m3/h
- Head	:	H = 97 m	57 m
- Revolution per minute	:	n = 1450 r.p.m.	-
- Quantity	:	1 piece	-
- Pump efficiency	:	η = 76 %	61 %
- Operation hours per year	:	6800 h/y	
- Time of installation	:	1957	

b.) Data of electric motor

- Producer	:	EVIG	-
- Type	:	RH 280 M4	-
- Power	:	P = 132 kW	102 kW
- Voltage	:	U = 380 V	-
- Quantity	:	1 piece	-

No.2.

a.) Data of pump

			Measured values
- Producer	:	GÁNZ-MÁVAG	-
- Type	:	TGT 150/1.2	-
- Capacity	:	Q = 165 m3/h	178 m3/h
- Head	:	H = 77 m	58 m
- Revolution per minute	:	n = 1450 r.p.m.	-
- Voltage	:	U = 380 V	-
- Quantity	:	1 piece	-
- Pump efficiency	:	η = 79 %	48 %
- Operation hours per year	:	8000 h/y	
- Time of installation	:	1957	

b.) Data of electric motor

- Ptroducer	:	EVIG	-
- Type	:	RH 225 M4	-
- Power	:	P = 95 kW	55 kW
- Voltage	:	U = 380 V	-
- Quantity	:	1 piece	-

No.3.

a.) Data of pump

			Measured values
- Producer	:	GANZ-MÁVAG	-
- Type	:	TGT 225/1.0	-
- Capacity	:	Q = 319 m3/h	307 m3/h
- Head	:	H = 77 m	67 m
- Revolution per minute	:	n = 1450 r.p.m.	-
- Voltage	:	U = 380 V	-
- Quantity	:	1 piece	-
- Pump efficiency	:	η = 79 %	61 %
- Operation hours per year	:	3300 h/y	
- Time of installation	:	1957	

b.) Data of electric motor

- Producer	:	EVIG	-
- Type	:	RH 280 S4	-
- Power	:	P =110 kW	96 kW
- Voltage	:	U = 380 V	-
- Quantity	:	1 piece	-

Technical Data of Planned Equipments

I. Kazincbarcika Water Treatment Plant No 2.

a.) Data of Pump

- Producer : Chesterton
- Type : Fr. A80 x 100-330, Ø 260
- Capacity : Q = 175 m3/h
- Head : H = 76 m
- Revolution per minute : n = 2900 rpm
- Quantity : 2 pieces
- Pump efficiency : η = 72 %
- Operation hours per year: 2100, 6000

b.) Data of electric motor

- Producer : EVIG
- Type : RZ 250 M2
- Power : P = 55 kW
- Revolution per minute: n = 2900 rpm
- Voltage : u = 380 V
- Quantity : 2 pieces

c.) Data of frequency changer

- Producer : Allen-Bradley
- Type : 1336S - B005 - AJ - EN -HJB
- Power (kW) : 3,7
- Programmer: Producer : Allen-Bradley
  Type : 1201 - HJB 1

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II. Borsodszirák Water Treatment Plant No.1

No 1.

a.) Data of pump

- Producer : Chesterton
- Type : Fr. A80 x 100-330, ∅ 299
- Capacity : Q = 200 m3/h
- Head : H = 100 m
- Revolution per minute : n = 2900 rpm
- Quantity : 1 piece
- Pump efficiency : η = 72 %
- Operation hours per year: 6800 h/y

b.) Data of electric motor

- Producer : EVIG
- Type : RZ 290 M2
- Power : P = 90 kW
- Revolution per minute : n =2900 rpm
- Voltage : U = 380 V
- Quantity : 1 piece

No.2.

a.) Data of pump

- Producer : Chesterton
- Type : Fr. A80 x 100 - 330, ∅ 254
- Capacity : Q = 200 m3/h
- Head : H = 60 m
- Revolution per minute : n = 2900 rpm
- Quantity : 1 piece
- Pump efficiency : η = 70 %
- Operation hours per year: 8000 h/y

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b.) Data of electric motor

- Producer : EVIG
- Type : RZ 250 M2
- Power : P = 55 kW
- Revolution per minute : n = 2900 rpm
- Voltage : U = 380 V
- Quantity : 1 piece

No.3.

a.) Data of pump

- Producer : Chesterton
- Type : Fr. A100 x 15 - 250, ∅ 242
- Capacity : Q = 400 m3/h
- Head : H = 56 m
- Revolution per minute : n = 2900 rpm
- Quantity : 1 piece
- Pump efficiency : η = 80 %
- Operation hours per year: 3090 h/y

b.) Data of electric motor

- Producer : EVIG
- Type : RZ 290 M2
- Power : P = 90 kW
- Revolution per minute : n = 2900 rpm
- Voltage : U = 380 V
- Quantity : 1 piece

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Note:

- The efficiency of the planned pumps is estimated by using the data valid at the operation site of the pump.
- The capacity of the excisting pumps and also the data valid for the operational site of the pumps are also measured by the ultrasonic flowmeter provided by USAID under Project I. The actual loading of the motors are based both on the power readings from the Rustrak and the hand-held clamp-on meters.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Komlo Heat and Power Station

by

Gyorgy Toth, CEM

Kontravill, Inc.

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise	KOMLÓI FŰTŐERŐMŰ KFT
Address	7300 Komló, Bem u. 24.
Telephone	(36-1) 06-72-481-227
Fax	(36-1) 06-72-485-972
Contact Person	Aipl, József
Title	chief of investment group
Telephone	36-06-72-481-227

2. Energy auditor information

Dates - audit started: 25. 01. 1994. audit completed: 10. 04. 1994.

Energy audit company	KONTRAVILL
Energy audit team leader	Dr. Sz. Tóth, György
Address	1154 Budapest ,
	Domaháza 28. Hungary
Telephone	(36-1) 271-9553
Fax	— " —

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

Oil fired steam boylers and central distributing pump station of the district heating system

Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

Steam boylers aren't working on the same temperature. Every supply circle is provided with reducer.

Efficiency of boylers could be improved with superheater extension.

New experience - in the energy auditor's opinion, what were the most significant lessons learned during the energy audit:

Unsufficient temperature relations in the boylers cause dew-point problems, and corrosion frequently.

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4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units (also list the type of units per year, i.e. tons/year, kWh/year etc.):

Year:	1990	1991	1992	1993	UNITS
Production:					
steam	326870	309416	237014	260018	t/y
hotwater	606915	623421	494176	527679	GJ/y
electr.energy	2468592	20693040	18737640	19159560	kWh/y
Energy:					
heavy fuel oil:	7638	20743	19745	21146	t/y
diesel fuel oil:	69	60	75	31	t/y
natural gas:	-	-	-	-	-
coal:	51377	12353	-	-	t/y
electricity:	2841330	2503609	2525820	2286415	kWh/y
steam:	-	-	-	-	-
other (describe):					
Energy/Production index:					
thermal	1,460	1,365	1,3453	1,3500	kJ/kJ
electrical	8631	6524	6169	6250	kJ/kWh

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5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	UNITS
heavy fuel oil:	58987	213179	185061	220703	th.Ft/y
diesel fuel oil:	1229	2330	3313	1417	"
natural gas:	-	-	-	-	-
coal:	127103	41252	-	-	th.Ft/y
electricity:	2869	2844	2842	2644	"
steam:	-	-	-	-	-
other (describe):					

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding ---

- changing the coal firing to heavy fuel oil
- eliminate the corner firing to bottom one

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7. **Detailed forms - required**

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

Electric energy consumption - 12 month audit period

Electric energy generation - 12 month audit period (if plant has generator)

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. **Narrative**

Provide any other information which would be useful to USAID and RCG/Hagler Bailly --

_____

_____

_____

_____

_____

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FUEL, STEAM OR HEAT ENERGY CONSUMPTION – 12 MONTH AUDIT PER'
ENERGY TYPE: FUEL
Prepared for USAID and RCG/Hagler Bailly

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.

Auditor's name: Dr. Sz. Tóth - Virágh

Report date: 25. 01. 1994

Supply contract terms:

Fuel or heat supply company's name	MOL Rt.
Contract maximum demand:	–
Minimum charge (cost):	–
Other:	

CONSUMPTION OR BILLING DATA FOR 12-MONTH AUDIT PERIOD
FOR: (NAME OF ENERGY FORM):

Meter Reading Mo/day/yr	Physical Consumption units = t	Thermal Consumption GJ	Total Cost th.Ft	Monthly Heating Degree-Days HDD	Heating Index GJ/HDD	Product. Index GJ per:	Notes on plant conditions and changes
Jan/31/93	3435	136497	39211,2	289	472,3		
Feb/28/93	3532	139631	40989,1	280	498,7		
Mar/31/93	3061	121374	34425,5	93	1305,1		
Apr/30/93	1545	61337	17169,8	24	2555,7		
May/31/93	470	18710	5222,2	–			
Jun/30/93	382	15200	4226,1	–			
Jul/31/93	367	14530	4039,8	–			
Aug/31/93	354	14015	3355,3	–			
Sep/30/93	506	20033	4507,6	–			
Oct/31/93	1307	52811	11774,7	42	1257,4		
Nov/30/93	3055	123761	27636,2	330	357,0		
Dec/31/93	3132	126169	28145,3	307	410,9		
TOTAL	21146	844068	220702,8	1365	618,4		

Note: Heating degree-days based on reference temperature of 12°C

STEAM GENERATI[illegible] 2 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

Boiler characteristics:

Name/number	3/1	4/1	6/1-7/1	
Manufacturer	LÁNG	LÁNG	MHD	
Type (firetube/watertube)	watertube	watertube	firetube	
Type (saturated/superheated)	superheated	superheated	superheated	
Capacity (tons/hour)	28	25	22	
Year installed.	1958	1954	1976	
Year last major overhaul:	1993	1993	1993	
Operational? (yes/no)	yes	yes	yes	
Steam pressure: (bar)	32,0	32,0	22,0	
Steam temperature: °C	410	373,0	230	
Stack temperature, after economizer: °C	220	248	230	
Stack gas analysis: percent O2	8,6	7,6	6,9	
Combustion efficiency: %	83,1	81,2	85,0	
Blowdown analysis: dissolved solids PPM				

STEAM GENERATION DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading Mo/day/yr	STEAM GENERATION BY PLANT: Fuel Consumption GJ	Steam Generation tons	Steam Generation GJ	Monthly Efficiency %	IMPORTS: Steam Purchased GJ	STEAM SALES AND DISTRIBUTION TO CONSUMERS: GJ	GJ	GJ	GJ	GJ	GJ	Losses & Unaccounted GJ	NOTES: Unusual Operating conditions
Jan/31/93	136497	41289	110499	80,71	-	3127							Dew-point corro-
Feb/28/	139631	41481	112290	80,30	-	3132							sion in ECO
Mar/31/	121374	36340	98969	81,46	-	3530							"
Apr/30/	61337	19052	52182	84,90	-	2369							"
May/31/	18710	6529	16079	85,94	-	1566							"
Jun/30/	15200	5485	13419	87,08	-	984							"
Jul/31	14530	5178	12646	87,03	-	1695							"
Aug/31/	14015	4995	12248	87,39	-	1672							"
Sep/30/	20033	7142	17491	86,41	-	2529							"
Oct/31/	52811	16412	44822	84,87	-	2421							"
Nov/30/	123761	37533	102960	83,19	-	3387							"
Dec/31/	126169	38582	106506	84,42	-	3149							"
TOTAL	844068	260018	700111	82,94	-	29561							

ELECTRIC ENERGY CONSUMPTION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.

Auditor's name: Dr. Sz. Tóth - Virágh

Report date: 25. 01. 1994.

Electricity contract terms:

Electricity supply company's name	DÉDÁSZ RT
Contract maximum demand (kW):	NO CONTRACT
Minimum charge (cost):	–
Other:	

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Power Factor cos 0	Load Factor	Total Cost	Product. Index kWh per: *	Notes on plant conditions and changes
Jan/31/93	10638		50		–		16257	7,6971	*Electric en.consumption per
Feb/28/93	13444		50		0,94		18943	6,9569	heat sales to consumers kWh/GJ
Mar/31/93	9626		50		–		17084	8,2619	
Apr/30/93	185222		800		0,75		237994	13,4018	
May/31/93	382721		800		0,75		414011	27,6014	
Jun/30/93	356802		800		0,72		384287	30,7960	
Jul/31/93	362467		800		0,72		413937	32,4355	
Aug/31/93	346141		800		0,72		407147	32,1304	
Sep/30/93	360846		800		0,76		396155	23,5324	
Oct/31/93	240111		800		0,74		304431	14,0897	
Nov/30/93	8912		50		0,58		17875	7,8276	
Dec/31/93	9485		50		–		15428	8,0145	
TOTAL	2,286415		–				2643549	10,9229	

Peak demand during audit period (kW): 800

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ELECTRIC ENERGY GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh

Report date: 25. 01. 1994

Generator characteristics:

Name/number	1			
Manufacturer	GANZ			
Capacity (kW):	5900			
Year installed:	1986			
Year last major overhaul:	steam			
Drive type (steam, gas, diesel)	back pressure			
If steam – Condensing/extraction/backpressure	yes			
Operational? (yes/no)				

GENERATION DATA FOR 12–MONTH AUDIT PERIOD:

	SELF–GENERATION BY PLANT				SOLD TO OTHERS:				PURCHASED FROM OTHERS				NOTES
Meter Reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Unusual Operating conditions
Jan/31/93	3210000	1480920	7000		2449390	585200			10638	–	50		Purchased for
Feb/28/93	3208320	1344000	6000		2515609	501620			13444	1820	50		waterwork and
Mar/31/93	3066960	1488000	4500		2363754	634000			9626	–	50		powerstation
Apr/30/93	1423080	898560	3000		1021400	403200			185222	157920	800		
May/31/93	–	–	–		–	–			382721	336140	800		
Jun/30/93	–	–	–		–	–			356802	339080	800		
Jul/31/93	–	–	–		–	–			362467	331100	800		
Aug/31/93	–	–	–		–	–			346141	330260	800		
Sep/30/93	–	–	–		–	–			360846	301280	800		
Oct/31/93	1097640	633960	3000		811729	330820			240111	211540	800		
Nov/30/93	3483600	1651200	4000		2786572	829640			8912	2940	50		
Dec/31/93	3669960	1956000	6000		2944513	983360			9485	–	50		
TOTAL	19159560	9452640			14892967	4267900			2286415	2010820	–		

ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994.

BASELINE - EXISTING CONDITIONS

	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^3Ft/year	Total Energy Cost Ft/year *
BASE CASE	844068			800	6553	19500	47840	220703

* $.10^3$

SUMMARY OF RECOMMENDED EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^3Ft/year	Total Energy Cost Ft/year	Action Project Cost Ft	Action Payback Period (years)
1.	Extension of superheater	827170			800	6553	20000	49440	216285	3,79	0,63
	surface at TH boyler Nr. 4										
	by 30 %										
TOTAL SAVINGS		16880					500	1600	4418		
SAVINGS AS PERCENTAGE OF BASE CASE		2,0									

Note: Assumes that the actions are taken in order of best payback p[illegible] first, in order to take into account the interaction between the var[illegible] measures.

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAID and RCG/Hagler Bailly

ACTION NO.

Plant name: KOMLÓI FŰTŐERŐMŰ KFT
Address: 7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994.

ACTION NO. AND BRIEF DESCRIPTION: Extension of superheater surface

AREA OF THE PLANT AFFECTED: Backpressure electric energy generation

FINDINGS CONCERNING EXISTING CONDITIONS: The surface of the superheater planned originally for coal firing is not sufficient to heat enough the steam, for that reason the inlet temperature of steam is lower than it could be. On such a way generated electr. energy is less.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY: Extension of the superheater surface the superheated steam temperature will be higher, the efficiency of boyler will be higher the flue gas loss lower. The fuel consumption will be reduced and from the environment side the SO_2 emission will be also reduced while the generated electric energy will be more than before.

EXPECTED RESULTS -EFFECTS OF RECOMMENDATION:

		Fuel	Electricity				Total cost	
		X t/year	Peak kW	Consumption MWh/year	Production * kWh/year	Production * Ft/year	* Ft/year	
Baseline - existing conditions		21,15	5900		19500	47840		
After recommended action		20,73	6000		20000	49440		
Net reduction	increasing of el.en.gen.	0,42	100		500	1600	6018	(a)

COST - BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	0,3	
Equipment procurement	0,3	
Equipment installation	3,0	
Equipment commissioning	0,19	
TOTAL INSTALLED COST (MFt)	3,79	(b)

Estimated increase in annual (non-energy) operations and maintenance cost	-	(c)

PAYBACK PERIOD:

$$\frac{b: 3,79}{6,018 - 0} = 0,63 \text{ years}$$

$* 10^3$

RECOMMENDED IMPLEMENTATION SCHEDULE:	3rd quarter of 1994

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name: Komlói Fűtőerőmű Kft
Address: 7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh

Report date: 25. 01. 1994.

BASELINE - EXISTING CONDITIONS

Boiler No. 4. with superheater for coal-firing	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^3Ft/year	Total Energy Cost x Ft/year	x.10^3
BASE CASE	844068			800	6553	19500	47840	220703	

SUMMARY OF RECOMMENDED EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^3Ft/year	Total Energy Cost Ft/year	Action Project Cost Ft	Action Payback Period (years)
1.	Extension of superheater	827170			800	6553	20000	49440	216285	3,79	0,63
	surface at TH boiler Nr 4										
TOTAL SAVINGS		16880					500	1600	4418		
SAVINGS AS PERCENTAGE OF BASE CASE		2,0									

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2

Plant name: Komlói Fűtőerőmű Kft
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

ACTION NO. AND BRIEF DESCRIPTION: 2. Hotwater pump replace

AREA OF THE PLANT AFFECTED: Heat distributing center

FINDINGS CONCERNING EXISTING CONDITIONS:
In the heat distr. center there are 3 pumps supplying the hotwater to consumers, one of them is continually operated, one is so called hot reserv pump while the third one is out of operation. Pumps and electric motors are old type, with low efficiency equipped with common shaft seals. Pumps efficiency 55-60 % P_{mot} = 250 kW

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:
New chesterton pump installation with 74 % eff. and el. motor with P = 200 kW, makes possible better operation and lower el. energy consumption.
The same flow rate and dyn. pres. head (600 m3/h, 64 m) the energy consumption at the new pump is only 144,6 kW one can spare 100 kWh/h energy (compare to 250 kW el. motor).
The chesterton pump has also a good shaft seal making possible ideal operational conditions, low maintenance cost.
Origin: E-motor, coupling and baseplate from Europe 18600 USD
Pump from the States 23923 USD Total Sum: 42523 USD

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

		Electricity		Fuels, heat and steam:			Total cost Th.HuF /year	3,2 Ft/kWh
		Peak kW	Energy MWh/year					
Baseline – existing conditions	(6 months)	250	1095				3504,0	
After recommended action		144,0	630,7				2018,3	
Net reduction		106,0	464,3				1485,7	(a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Th.HuF Cost	Notes
Engineering design	–	
Equipment procurement	4252,3	
Equipment installation	100,0	
Equipment commisssioning	20,0	
TOTAL INSTALLED COST	4372,3	(b)
Estimated increase in annual (non–energy) operations and maintenance cost	-300,0	(c)

PAYBACK PERIOD:

$$\frac{b: 4372,3}{a: 1485,7 - c: -300,0} = 2,45 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE: 4th quarter of 1994

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ACTION PLAN – SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hegler Bailly

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

BASELINE – EXISTING CONDITIONS

Hot water pump with low efficiency	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF/year
BASE CASE				250	1095000	3504,0

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF/year	Action Project Cost	Action Payback Period (years)
2.	Hotwater pump replace				144,0	630700	2018,3	4372,3	2,45
TOTAL SAVINGS							1485,7		
SAVINGS AS PERCENTAGE OF BASE CASE							42,4		

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 3

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

ACTION NO. AND BRIEF DESCRIPTION: 3. Burner reconstruction

AREA OF THE PLANT AFFECTED: Boiler No. 4.

FINDINGS CONCERNING EXISTING CONDITIONS:

Boiler No. 4 is equipped with 4 pcs corner oilburners working low efficiency and the flame situation makes possible variable heat transfer and for this reason it is hard to held a good, constant steamgeneration at the different loading

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

1. Eliminate corner burners
2. Demolition of refractory wall
3. Modify the refractory wall at boiler bottom
4. Bottom burner building in
5. Modify of fueloil supply
6. Electrical mounting
7. Instrument and control panel mounting

Boiler efficiency increasing 2,0 % (81,2 to 85,2), soot no reduced from 6 to 3, and stack tempr. from 248 °C to 220 °C.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year	t/y			MiHuF /year
Baseline – existing conditions			1547			161,46
After recommended action			1474			154,00
Net reduction			73			7,46 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Mi.HuF Cost	Notes
Engineering design	2,1	
Equipment procurement	23,0	
Equipment installation	4,65	
Equipment commissioning	1,31	
TOTAL INSTALLED COST	31,06 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost		(c)

PAYBACK PERIOD:

$$\frac{b: 31,06}{a: 7,46 - c: 0} = 4,16 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE: 2nd quarter 1995

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for US AID and RCG/Hegler Bailly

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994.

BASELINE – EXISTING CONDITIONS

Boiler No. 4 with corner burners	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost MiHuF /year
BASE CASE	621000					161,46

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost MiHuF /year	Action Project Cost MiHuF	Action Payback Period (years)
3.	Burner reconstruction at boiler No. 4.	592667					154,00	31,06	4,16
TOTAL SAVINGS		28233					7,46		
SAVINGS AS PERCENTAGE OF BASE CASE		4,56					4,56		

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 4

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

ACTION NO. AND BRIEF DESCRIPTION: 4. Application of chesterton seals for hotwater pumps

AREA OF THE PLANT AFFECTED: Heat-distributing center

FINDINGS CONCERNING EXISTING CONDITIONS:

The hotwater pumps are equipped by common shaft seals and for that reason the el. energy consumption is relativly high.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Instead of old type shaft seal on the pumps one has change to Chesterton type seals
Pump No. 2.: 1.) 221 Complete seal, shaft diameter 88,9 mm 3 pcs
Others: 2.) 155 Complete seal, shaft dia. 40,0 mm 6 pcs
3.) 155 Complete seal, shaft dia. 35,0 mm 2 pcs

Decreasing of the electric energy consumption 10 %
Operation time: 4380 Hrs/y

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

		Electricity		Fuels, heat and steam:			Total cost
		Peak kW	Energy MWh/year				Th.HuF /year
Baseline – existing conditions	Pump No. 2.	250	1095,0				3504,0
After recommended action		225	985,5				3153,6
Net reduction		25	109,5				350,4 (a)

COST–BENEFIT ANALYSIS: Th.HuF

PROJECT COST ESTIMATE:		Cost	Notes
Engineering design		-	
Equipment procurement	1 pc 221 comp. seal	1500,0	
Equipment installation		30,0	
Equipment commissioning		2,0	
TOTAL INSTALLED COST		1532,0 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost		-60,0 (c)	

PAYBACK PERIOD:

$$\frac{b: 1532,0}{a: 350,4 - c: -60} = 3,73 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE: 3rd quarter of 1994

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ACTION PLAN – SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994

BASELINE – EXISTING CONDITIONS

Hotwater pump with old shaft seals	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF/year
BASE CASE				250	1095000	3504,0

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF/year	Action Project Cost Th.HuF	Action Payback Period (years)
4.	Application of Chesterton seal for hotwater pump No. 2.				225	985500	3153,0	1532,0	3,73
TOTAL SAVINGS					25	109500	350,4		
SAVINGS AS PERCENTAGE OF BASE CASE					10 %				

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

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ACTION NO. 7

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.

Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994.

ACTION NO. AND BRIEF DESCRIPTION: 7. Steam consumption measuring

AREA OF THE PLANT AFFECTED: boiler house

FINDINGS CONCERNING EXISTING CONDITIONS:

In the stam generation system there are four different boilers with old type measuring devices, to have a good operating system is necessary to replace the measuring instruments.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Install up-to-date meriam instrument accutube flow sensors in the outlet pipes of steam boilers gathered data for the central computer on this way the steam generators and distributing system would be operated with higher efficiency.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year	t/y			Mi.HuF /year	
Baseline – existing conditions			21150			220,7	
After recommended action			20832			217,2	
Net reduction 1,5 %			318			3,5	(a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	MiHuF Cost	Notes
Engineering design	1,0	
Equipment procurement	4,8	
Equipment installation	1,5	
Equipment commisssioning	0,5	
TOTAL INSTALLED COST	8,8	(b)
Estimated increase in annual (non–energy) operations and maintenance cost		(c)

PAYBACK PERIOD:

$$\frac{b: 8,8}{a: 3,5 - c:} = 2,51 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name: Komlói Fűtőerőmű Kft.
Address: H-7300 Komló, Bem u. 24.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 25. 01. 1994.

BASELINE - EXISTING CONDITIONS

Steam flow measuring with old type instruments	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^6Ft/year	Total Energy Cost M1. Ft/year
BASE CASE	880068							220,7

SUMMARY OF RECOMMENDED EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Electric Energy Production MWh/year	Electric Energy Sales 10^6Ft/year	Total Energy Cost Ft/year	Action Project Cost M	Action Payback Period (years)
7.	Installation of accutube										
	flow sensors with data										
	transformers	837346							217,2		
TOTAL SAVINGS		42722							3,5		
SAVINGS AS PERCENTAGE OF BASE CASE		1,5							1,5		

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Mohasci Farostlemezgyar Rt.

by

Miklos Gellert

Gellert Innovative Bureau of Engineering

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise	FIBREBOARD FACTORY INC. MOHÁCS HUNGARY
Address	Budapesti országút
	H-7700 MOHÁCS , P.O. BOX. 129 HUNGARY
Telephone	+ 36 (69) 311922
Fax	+ 36 (69) 322742
Contact Person	Dezsö SZÁNTÓ
Title	general manager

2. Energy auditor information

Dates - audit started: February 09, 1994 audit completed: April 5,1995

Energy audit company	GELLÉRT INNOVATIVE BUREAU OF ENGINEERING D.P.
Energy audit team leader	Miklós GELLÉRT C.E.M
Address	Barackos u. 24.
	H-7635 PÉCS
	HUNGARY
Telephone	+36 (72) 319661
Fax	+ 36 (72) 319661

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

I.

1, Energy audit, analysis of the situation preparation of action plans
2, Reduction of energy costs
3, Increase of energy efficiency
4, To encourage the participation of MOFA in international projects
5, To create and to propose
- strategic energy projects/ plans
- operational projects/ plans
- immediate measures
6, To offer information and to propagate new processes and equipment's for energy saving and energy cost reduction
7, To reveal and to encourage the possibilities for financing energy projects

II AREA:

1, heat energy production
- Supervision of boilers
- Combustion analysis
- Examination of isolation of boilers and pipeline
- Examination of Technologies
- Study of Buildings
- Study of the possibilities of Heat Recovery
- Supervision of the metering system
- Demand limiting control
- Apply new technologies of defibrators and at cogeneration

2, electricity
- electric peak demand management
- start-stop optimization and demand limiting control
- ASD
- electricity bills supervision
- creation of optimal contract
- additional automatizations
- supervision of the metering system
- energy management
- replace motor Match load
- Apply new technologies of defibrators and at cogeneration

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III. Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

With technology improvement energy savings are at defibrators and cogeneration and at ASD which is typical field of the third party financing. This is excellent possibility for capital outlay investment.

IV. New experience - in the energy auditor's opinion, what were the most significant lessons learned during the energy audit:

- project management
- tendering process,
- examination of transport possibilities
- information about American market in this field
- to contact American suppliers
- Realization in practice of third party financing

4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units:

Year:	1990	1991	1992	1993	1994	UNITS
Production						
Raw fiberboard	49530	42070	35670	34300	41250	m3
Lacked fiberboard	3270000	2266000	2471200	2431100	2261200	m2
Laminated fiberboard	1165400	1140300	958800	1151600	1019000	m2
Energy:						
SUMMA	**715910**	**631451**	**532287**	**466123**	**530848**	**GJ**
diesel fuel oil: 116	83 59	61 74	t			
	4872	3486	2478	2562	310	GJ
natural gas:	11463000	10449000	10045000	11896000	11117000	Nm3
	370112	336249	326857	390321	369289	GJ
coal:	17639	15781	3546	999 5889	t	
	24797	213880	136226	14141	83647	GJ
electricity:	27179	22551	19807	17572	20604	MWh
	97844	81184	71306	63259	74174	GJ
steam:	213470	192301	156003	151321	159640	t
	500856	458379	363962	353288	272670	GJ

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Energy/Production index:

THERMAL	1990	1991	1992	1993	1994	UNITS
Raw fiberboard	7.364	8.0077	7.146	6.8506	6.4584	GJ/m3
Lacked fiberboard						
Laminated Fiberboard	0.031	0.030	0.041	0.369	0.0328	GJ/m2

ELECTRICAL	1990	1991	1992	1993	1994	UNITS
Raw fiberboard	380.9	391.2	398.6	368.8	381.9	kWh
Lacked fiberboard	1.519	1.389	1.275	1.185	1.219	kWh/m2
Laminated fiberboard	0.785	0.844	0.926	0.711	0.592	kWh/m2

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5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	1994	UNITS
SUMMA:	**205457000**	**258662000**	**220417000**	**200229000**	**222701000**	**HuF**
diesel fuel oil:	1915000	1840000	2469000	3925000	4679000	HuF
natural gas:	78737000	103594000	93166000	111802000	108159000	HuF
coal:	46410000	50163000	31411000	3529000	20412000	HuF
electricity:	77206000	101578000	91510000	79523000	87848000	HuF
steam:	_____	_____	_____	_____	_____	

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding:

Analysis of value
Demand limiting control
Process control by own improvement

7. Detailed forms - required

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

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Electric energy consumption - 12 month audit period

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. Narrative

Provide any other information which would be useful to USAID and RCG/Hagler Bailly:

Dear David Keith

I send you enclosed the energy audit reports of the Mohács Fiberboard Company.
I was in Mohács on March 30, 1995 and spoke to Dezső SZÁNTÓ, general manager, about the possibility of the 2 nd step. He fully agrees with and manifests enormous affinity.
A considerable energy price increase is to be expected due to the privatization of energy industry and energy supplier (distributor) companies and the updating of tariffs. According to my estimations the price of electricity will increase in the case of the MOFA from 5-6 Ft/kWh to 8,4 Ft/kWh or more.
In my opinion the peak demand period will be expanded from the present 3 hour afternoon period in summer and the 4.5 hour- afternoon period in winter to the morning period as well taking into consideration the load diagram at country level.
I think electricity peak demand period is going to be 7- 9 hours after the updating of tariffs.
I estimate the price of gas energy 21.50 Ft/m3 in 1997 instead of the present 12.50 Ft/m3.
Considering the above in case of the MOFA we have to solve energy issues at two levels:
1, at strategic level
2, at operational level

1. The most important task

In order to increase competitiveness, the biggest cost and energy saving can be achieved by the modernization of defibration system of technology line 2 and 5.
On operational level the quickest solution is presented in MOFA-1 ASD and MOFA-2- ASD-2 action plans meaning additional modernization and automatization by the installment of ASD and PLC.
Two machines of both technology lines should be equipped according to the action plans. The solution suggested in MOFA 1-ASD action plan and realized by USAID support (Allen Bradley ASD and HONEYWELL equipment) functions very well at technology line 2. It judtified the presuppositions.

At operational level:

The next task would be MOFA 7 TRM, the modernization of the press at technology line 4. with a micro- processed PLC. Johnson Control and ... gave proposals for this project.
The rest of MOFA' s priority list is according to MOFA 3 VAL. action plan.
Projects of MOFA 4 STE have been realized by MOFA's own development (that is an intelligent heat capacity and energy measurement system for factory use and for cost division).
The inaccuracy of the measurement system is still prevailing,

MOFA- 5-Gas Analyzer

The efficiency of the coal boilers increased from 77,6 to 82,3 as a result of the usage of the combustion gas analyzer.

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They are truly satisfied with the BACHARAH MODEL 3000. Experts in the boiler and boilermen use it regularly.

MOFA- 6- EM- Energy Management

MOFA Solved it with own improvement and realization.

A system of signal device has been developed. Data are micro- processed. The processing software is own improvement.

MOFA- 9- EPW

They try to solve it by their own effort.

The hardware has been realized. The softwer is under improvement similarly to MOFA- 6- EM. Softwer under development.

MOFA- 10- IW

MOFA has begun to realize the program by own effort with DANFOSS flow meters (3 pieces) at technology line 4 and the water intake at the water works.

The data collector is own improvement.

At strategic level:

Acknowledged by the general manager, Mr. Szántó the solution would be 1- 1 machine at technology lines 2 and 5 instead of 15 defibrators and rafinators. Type of equipment: .....

I sent the catalogue to RCG/Hagler Bailly, Inc. Steam consumption would be minimal. According to experts' opinion an almost self contained process could be elaborated. What is more electricity kW peak demand and kWh energy consumption would drop significantly.

The estimated cost of the purchase of defibration is 3000000 USD at each technology line.

In my opinion it is a typical third party financement possibility. It is to be realized for 1997 when Hungarian energy prices reach the world price level.

A strategic lever another important possibility is cogeneration based on gas- but only when electricity and heat need are minimalized as a result of energy savings measures.

This solution (under planning)would significantly reduce the effects of tariff modification (expansion of the peak demand period for morning as well).

Briefly about electric engines:

under 1 kW	190 pieces
1- 10 kW	395 pieces
10- 50 kW	172 pieces
50- 100 kW	30 pieces
100-500 kW	29 pieces

These numbers are self- evident. During the audit period we had influence primarily on electric capacity managemen nt, Electricity contract was modified significantly as a result of our collaboration.

In my opinion ASDs have a major role at the defibrators listed in the action plans especially at the pumps assuring water supply and at ventilators.

Further data concerning the above are to be found in the audit reports.

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IMPLEMENTED

- *New individual electric energy contract.*
- *Building the monitoring system, survening electric key consumers.*
- *Monitoring system for controlling steam production and consumption and giving up costs.*
- *Applying of smoke gasanalyser.*
- *Installing of additional automatization and drive control, and It's operation at defibrator.*
- *Establishment of new steam measuring places.*
- *Proposals for making measurings more precise.*
- *Introduction of stimulating system in order to decrease energy consumption.*
- *The computer - registration of engines is accomplished (for maintenance, for changing the engine).*
- *Deckeasing of industrial water consumption.*
- *Extension-training for the middle management in marketing, computering and management skills.*
- *Rationalizing on the sterndistributing network.*
- *The possibility of shadowing the energy loadings, the processes and quality of production with a computer system for chief and middle - level management.*
- *Awakaning to consciousness at all levels in order to promote thinking in costs.*
- *The auditing helped the strategic view to assert besides the operative way of thinking. (Possibilites and financing of cogenerations, of modernization of technological lines.)*

Increasing the energy - efficiency of MOFA and Decreasing it's cost is essential in respect of improving the competitiveness and efficiency of the enterprise.
The market acknowledges the considerate increase energy prices only moderately is the price of the products.
The management of MOFA is interested in improving efficiency and decreasing the costs, but it's financial possibilities are limited.
The energy consuming of MOFA has 2 basic fields strategically and on an operative level: consuming and producing thermal energy, and consuming electric energy.
The MOFA ASD-1 program, primarily the additional automatization and drive control reducing the power needed by steam energy and the steam energy consumption, realized with the aid support of USAID and the program MOFA 5 GASANAL reducing smokegas waste was already proven to be good, and gave reasonable help.
MOFA would like to accomplish the MOFA-2-ASD-2 program-additional automatization and drive control at 5 technological lines and MOFA 7 TRM automatization at 4 technological lines- as the II. step of the USAID program. This is a milestone at increasing energy efficiency.
An the period out of the heating season, when producing certain products and at the simultaneous operation of technological lines 2, 5, 3, 4 when synchronizing the starts. These will be possibility that 2 gas boilers would provide the steam production, and the possibility of disconnecting the 3.boiler, operating with coal, will also be given.
The further continuation of the program is possible with repeating the MOFA 1 ASD 1 program at the other machine of the 2. technological line, and repeating the MOFA -2 ASD 2 program at the other machine of the 5 technological line. This way with the operation of a defibrator supplied with 4 additional automatization and drive control the steam production of 2 boilers is enough during the summer operation, provided synchronized operation.
It has a positive effect on the electric energy consumption and on the efficiency economy too.
The analysation of the effects of the optimalized thermal and electric energy system, of the changes in the energy prices, the privatization of the energetical industry bring up the competence of the survey on the economy of linked thermal and electric energy production.
Another important strategic task of in creasing the energy efficiency of MOFA and the one with the quickest return by own efforts is decreasing the peak demand on electric energy, and synchronizing the operation of the works and the tariff system of the electric energy, based on measures.
As a result of the auditing reasonable changes have taken place in the point of view. The financial point of view has strengthened besides the product-orientated point of view.
The middle managing class realized that the production of the same product differs a lot be the zoneperiods, with costs differing according to times of the day. Based on this the production was rephased, and the control of the energy consumption of the 'clue-consumers' was organized. The power demand was decreased in peak time and in day time. With respect of the results of the auditing and measurements an individual contract was signed with the southern-Transdanubian Electricity Supplying Company.
The modernization of the system measuring and registrating the electric energy and steam consumption, and the computerized collecting and processing of data is still going on, with their own efforts.
Based on these data a stimulating system who introduced. The reduction of industrial water consumption was also realized by their own efforts.
Depending on the financial possibilities the continuous realization of the systematized proposals explored by auditing is planned. My opinion is that the management of MOFA is an excellent partner to realize the USAID model project, having highly qualified experts and a positive approach.

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapest road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

BASELINE - EXISTING CONDITIONS

		Fuels Thermal Consumption GJ/year	Heat Thermal Consumption GJ/year	Steam Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Consump. GJ/year	Total Energy Cost $/year
BASE CASE 1993		404462		357865	6300	17572000	466123	2002290

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS: (63269 GJ/year)

Action No.	Action Description	Area of Plant Effect	Fuels Thermal Consumption GJ/year	Heat Thermal Consumption GJ/year	Steam Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Consump. GJ/year	Total Energy Cost $ /year	Action Project Cost $	Action Payback Period (years)
94-H-MOFA-7-TRM	THERMAL CONTROL SYSTEM PREASURIIZER /UPDATING OF CONTROLING, AT THE PRESS OF PRODUCTION LINE 4 WITH TEMPERATURE CONTROL. OPTIMAL USE OF WASTEHEAT	4			2334		240000		20700	11069	0.53
94-H-MOFA-1-ASD1	STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION DEFIBRATOR AT PRODUCTON LINE IN 2 IN MOFA	2			7807				32020	23598	0.74
94-H-MOFA-5-GASANAL	COMBUSTION GAS ANALYSER BOILER-HOUSE	6	1303						3164	2950	0.93
94-H-MOFA-9-EPW	MONITORING OF THE POWER CONSUMPTION OF THE KEY CUSTOMER UNITS MANAGEMENT OF ELECTRIC POWER SUPPLY	9				DAY 700 PEAK 1100	351630		16004	14044	0.94
94-H-MOFA-4-STEAM METERS	INTELLIGENT HEAT CAPACITY AND ENERGY MEASUREMENT SYSTEM HEATING CENTER IN MOFA	8	4345						10548	10057	0.95
94-H-MOFA-6-PA	PAINTING THE BOARDS WITH A ROLLER MACHINE MODERNISATION OF THE TECHNOLOGY PRODUCTION LINE 3 IN MOFA SURFANCE REFINING BLOCK	3					400000		67245	85664	1.27
94-H-MOFA-2-ASD2	STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION DEFIBRATOR AT PRODUCTON LINE IN 5 IN MOFA	5			7354				30162	42714	1.42
94-H-MOFA-8-EM	INSTALLATION OF AN INFORMATION SYSTEM INTRODUCTION OF SUPPORTING ENERGY EFFICIENCY MEASURES MOFA ENERGY MANAGEMENT	8	4661						19070	29022	1.52
94-H-MOFA-3-VALVE	REPLACEMENT OF THE CONTROL VALVE, MODERNISTING THE CONTROL SYSTEM PRODUCTION LINE 5 IN MOFA	5			1469				5967	11788	1.97
94-H-MOFA-10-IW	REDUCTION OF TECHNOLOGICAL WATER CONSUMPTION METERING OF WATER CONSUMPTION AT EACH TECHNOLOGY LINE. /SEWAGE - WATER ISSUE TAKEN INTO CONSIDERATION	10							4003	16196	4.05
TOTAL SAVINGS			10309		18954	1100	991630		208001		
SAVINGS AS PERCENTAGE OF BASE CASE			0.025		0.053	0.175	0.056		0.104		

Report date: Aug 16, 1995

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
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Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

Action No.	Action Description	Area of Plant Effect	Fuels Thermal Consumption GJ/year	Heat Thermal Consumption GJ/year	Steam Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Consump. GJ/year	Total Energy Cost $ /year	Action Project Cost $	Action Payback Period (years)
94-H-MOFA-1-ASD1*	STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION OTHER DEFIBRATOR AT PRODUCTON LINE IN 2 IN MOFA	2			7807				32020	23598	0.74
94-H-MOFA-2-ASD2*	STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION OTHER DEFIBRATOR AT PRODUCTON LINE IN 6 IN MOFA	6			7364				30162	42714	1.42
11-94-H-MOFA	ELECTRIC MOTOR CONTROL, REPLACE MOTOR W/SIZE TO MATCH LOAD										
12-94-H-MOFA	ON/OFF OR/AND DEMAND LIMITING CONTROL										
13-94-H-MOFA	INSTALL VARIABLE FREQUENCY DRIVE ON PUMPS AND FANS										
14-94-H-MOFA	DRIVE CONTROLL OF CENTRIFUGAL PUMPS										
15-94-H-MOFA	UP-DATING THE HEAT DISTRIBUTION SYSTEM										
16-94-H-MOFA	MAINTENANCE COMPUTERIZATION										
17-94-H-MOFA	HEAT EXCHANGER AT COMBUSTION GAS - ECONOMIZER - (GAS BOILERS)										
18-94-H-MOFA	COGENERATION										
19-94-H-MOFA	MINIMUM MATERIAL USE WITH CONSTANT THICKNESS CONTROL / METERING										
20-94-H-MOFA	INTRODUCTION OF NEW TECHNOLOGIES UV LACK INSTEAD OF INFRA LACK										
21-94-H-MOFA	LIGHTING SEQUENCING										
22-94-H-MOFA	UPDATING OF OUTDOOR LIGHTING, WITH OCCUPANCY SENSOR AND PROGRAMMED SWITCH ON/OFF										
23-94-H-MOFA	TEMPERARURE CONTROL OF TECHNOLOGICAL PROCESS, HEAT WASTE UNCOVEREING (INFRA THERMO METER)										
24-94-H-MOFA	HEATING CONTROL OF HOT WATER BOILERS										
25-94-H-MOFA	OPTIMALIZATION OF THE HEATING SYSTEM										
26-94-H-MOFA	PERMANENT OXIGENE CONTENT OF FEED WATER, REDUCTION OF STEAM WASTE										
27-94-H-MOFA	REDUCTION OF VACANT RUN AT ELECTRIC ENGINES (CHIPPING)										

Report date: Aug 15, 1995

Gellert

ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC, MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24, H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

28-94-H-MOFA	REDUCTION OF VACANT RUN AT ELECTRIC ENGINES (CHIPS FOR FIBERING)										
29-94-H-MOFA	ELECTRICITY PEAK DEMAND REDUCTION (OPERATIONAL RESTRICTIONS AT DEFIBRATORS AND RAFINATORS IN PEAK HOURS)										
30-94-H-MOFA	ELECTRICITY PEAK DEMAND REDUCTION, ENERGY USE REDUCTION (COOLING WATER PUMP AT PRODUCTION LINE 4)										
31-94-H-MOFA	OPTIMALIZATION OF BOILER OPARATION, EFFICIENCY LISTING, OPTIMAL LOAD										
32-94-H-MOFA	REDUCTION OF HEAT WASTE (WITH THE PARTIAL UPDATING OF INSULATION OF HAUSE PIPELINES)										
33-94-H-MOFA	UPDATING OF HEATING WITH THE HEATING APPLICATION OF A GAS INFRA RADIATOR AT UPDODUCTION LINE 2 AND LINE 5)										
34-94-H-MOFA	EFFICIENCY LISTING OF RAFINATORS, CONTROL OF THEIR TECHNICAL STATE										
35-94-H-MOFA	INTRODUCTION OF PERSONAL INCENTIVES FOR ENERGY SAVING										
36-94-H-MOFA	MODERNIZATION OF BOILER-HOUSE, GAS-BURNERS, OPERATORS										
37-94-H-MOFA	ELECTRICITY PEAK DEMAND REDUCTION /OPERATIONAL RESTRICTIONS FOR CHIPPING MACHINES IS PEAK PERIOD/										
38-94-H-MOFA	MARKETING TRAINING FOR TOP AND MIDDLE MANAGERS										
39-94-H-MOFA	SOFTWARE APPLICATION IN ENERGY MANAGEMENT AND CONTROLING TOP AND MIDDLE MANAGERS										
40-94-H-MOFA	OPTIMALIZATION OF BOILER OPERATION, EFFICIENCY LISTING, OPTIMAL LOAD										
41-94-H-MOFA	THE EFFICIENCY LISTING OF DEFIBRATORS ACCORDING TO SPECIFIC ENERGY USE										
42-94-H-MOFA	REDUCTION OF STEAM ENERGY CONSUMPTION /OPTIMALIZATION OF THE STEAM PRESSURE AT DEFIBRATORS ACCORDING TO TYPE/										
43-94-H-MOFA	THE PROGRAMMING OF RAW MATERIAL PRODUCTION IN ORDER TO USE STORAGE BUNKERS AND CONTAINER CAPACITY /ELECTRIC PEAK DEMAND										
44-94-H-MOFA	APPLICATION OF FIBER - FRACTIONING AFTER DEFIBRATION										
45-94-H-MOFA	REDUCTION THE BOILER LOSSES INSULATION UPGRADE AT HLG										
46-94-H-MOFA	REDUCTION THE BOILER LOSSES INSULATION UPGRADE AT WAGNER-BIRO										
47-94-H-MOFA	UPGRADE CONDENSATE SYSTEM										

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ACTION PLAN - SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC, MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

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48-94-H-MOFA	REDUCTION OF HEAT WASTE WITH THE PARTIAL UPDATING OF THE INSULATE VALVES AND OTHER SPECIAL FITTING										
49-94-H-MOFA	INSULATE HOT WATER TANKS										

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

Prepared for USAID and RCG/Hagler Bailly

ACTION NO 94-H-MOFA-1-ASD1

MOFA1AS1

Plant name: FIBREBOARD FACTORY INC. MOHÁCS HUNGARY

Address: H-7701 Mohács, P.O.Box 129 HUNGARY Phone:+36 (69) 311922 Fax: +36 (69) 322742

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-1-ASD1
STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION

AREA OF PLANT EFFECTED DEFIBRATOR AT RODUCTION LINE 2 IN MOFA

FINDINGS CONCERNING EXISTING CONDITIONS

Two or three defibrators on Production Line 2 are continously defibrating the chips for the fibreboard production simultaneously. The Asplund Defibrator pulping system consits of screw feeder, preheater, defibering unit and discharge arrangement. The chips are fed into the preheater by means of continuous screw feder forming a chip plug wich seals effectively against the steam pressure in the preheater. The chip plug breaks up entering the preheater in which the heating time can be varied in view of row material, capacity and product required. Still under steam pressure, the chips are fed from the preheater into the defibering unit by conveyor screw. In the defibering unit- the Defibrator- the fiber separation takes place between the refining discs. The pulp produced is discharged by steam pressure throught an diaphragm.
The defibraters machines are in good condition. The controllers of the mechanical drive went wrong
New the screw feeder works with constant RPM. The level controller of the preheater controls the RPM of the lower conveyor screw
This control is not perfect. It does not assure the optimal loading for the process. The operators chose manual control and as a result in most cases they cannot provide optimal loading so the steam consumption is too high.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

The optimal feedig of defibrator's preheater can be assured with the ASD control of the upper screw, (Type: ASD BUL 1336-8060-EJG-R4PN1) and with the existing built in level control extended with an additional UDC 5000 Process Controller unit (type No.: DC5082-1-0F12-2-00-0).
The material goes from the preheater to the defibrator discs on the lower screw.In the future the control of the ASD of the lower screw will be given by the defibrator's main engine registrator according to the signals. This solution assures the optimal loading and maximal filling of the discs. As a result the steam consumpton will be decreased, because just a small amount of the steam can escape from the system. Steam consumption is expected to decrease from 1.8 to 1.0 -0.8 t/hour.
This ASD is going to be the main machine. The working time will be increased from 3100 - 3500 hours to 4000 hours.
As the result of the better efficiency and the automatic control the number of the defibrators will decrease to 2.
(Type of the small ASD: 6005 9,6 A 6,3 kVA 380 VAC A (IP20). The manufacturer of the controller: Allen -Bradley a Rockwell International Company. The manufacturer of the Controller: Honeywell. Both products are made in the USA.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy				
	KW	Mwh/year			tonna	US $/year
Baseline - existing conditions					7464	71471
After recomended action					4120	39451
Net reduction					3344	32020

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	800		
Equipment procurement	20998		
Equipment installation	1200		
Equipment commissioning	600		
TOTAL INSTALLED COST	23598	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 23598}{a: \quad 32020 - \quad c:} = 0.74 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-2-ASD2

Prepared for USAID and RCG/Hagler Bailly

MOFA-2-ASD-2

Plant name:	FIBREBOARD FACTORY INC. MOHÁCS HUNGARY		
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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		

ACTION No. AND BRIEF DESCRIPTION: 94-H-MOFA-ASD2

STEAM ENERGY REDUCTION WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION

AREA OF PLANT EFFECTED: DEFIBRATOR AT PRODUCTION LINE 5 IN MOFA

FINDINGS CONCERNING EXISTING CONDITIONS

Two or three defibrators on Production Line 5 are continously defibrating the chips for the fibreboard production simultaneously. The Asplund Defibrator pulping system consits of screw feeder, preheater, defibering unit and discharge arrangement. The chips are fed into the preheater by means of continuous screw feder forming a chip plug wich seals effectively against the steam pressure in the preheater. The chip plug breaks up entering the preheater in which the heating time can be varied in view of row material, capacity and product required. Still under steam pressure, the chips are fed from the preheater into the defibering unit by conveyor screw. In the defibering unit- the Defibrator- the fiber separation takes place between the refining discs. The pulp produced is discharged by steam pressure throught an diaphragm.
The defibrators machines are in good condition. The controllers of the mechanical drive went wrong. Currently The screw feeder works with constant RPM. The level controller of the preheater controls the RPM of the lower conveyor screw. This control is not perfect. It does not assure the optimal loading for the process. The operators chose manual control and as a result in most cases they cannot provide optimal loading so the steam consumption is too high.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

The optimal feedig of defibrator's preheater can be assured with the ASD control of the upper screw, (Type: ASD BUL 1336-B075P-EJHT-EPS-PN1-R41-75BMI-75PM) and with the existing built in level control extended with an additic UDC 5000 Process Controller unit (type No.: DC5062-1-0F12-2-00-0) or PC6003-U-0AP-50-0-OR.
The material goes from the preheater to the defibrator discs on the lower screw.In the future the control of the ASD of the lower screw will be given by the defibrator's main engine registrator according to the signals. This solution assures the optimal loading and maximal filling of the discs. As a result the steam consumption will be decreased, because just a small amount of the steam can escape from the system. Steam consumption is expected to decrease from 2,25 to 1,2 - 1,0 t/hour.
This ASD is going to be the main machine. The working time will be increased from 1860 hours to 3000 hours.
As the result of the better efficiency and the automatic control the number of the defibrators will decrease to 2.
(Type of the small ASD: B005 9,6 A 6,3 kVA 380 VAC A (IP20). The manufacturer of the controller: Allen-Bradley a Rockwell International Company. The manufacturer of the Controller: Honeywell. Both products are made in the USA.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels	Heat	Steam tonna	Total cost US $/year
Baseline - existing conditions					6750	64634
After recomended action					3600	34472
Net reduction					3150	30162

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	800		
Equipment procurement	40114		
Equipment installation	1200		
Equipment commissioning	600		
TOTAL INSTALLED COST	42714	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD b: 42714 / a: 30162 - c: = 1,42 years

Gellert

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-3-VALVE

Prepared for USAID and RCG/Hagler Bailly

MOFA3VAL

Plant name: FIBREBOARD FACTORY INC. MOHÁCS HUNGARY

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-3

Replacement of the control valve, modernising the control system

AREA OF PLANT EFFECTED PRODUCTION LINE 5 IN MOFA

FINDINGS CONCERNING EXISTING CONDITIONS The operation of the heat flow press of the 5th factory is provided by a heatacumulator set up for over 20 years ago. The important NA 125 KVS 25 regulating valve made by Honeywell is used up The regulating circle didn't work properly even before that, the oparators often used the manual manner instead, so the heatacumulator does not work optimally.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY Using Honeywell series 2000 din 150 PN40 KVS 250 or Johnson controls PSVDB 125/250 GA 40-NORMALLY OPEN 28P regulating valve and building HONEYWELL PC 6003-U-ODP-500000 PROCESS CONTROLLER IN. This can provide optimal and antomatic production both technologically and energetically.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels	Heat Steam tonna	Total cost US $/year
Baseline - existing conditions				25011	239492
After recomended action				24386	233505
Net reduction				625	5987

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	800	
Equipment procurement	9198	
Equipment installation	1200	
Equipment commissioning	600	
TOTAL INSTALLED COST	11798	(b)

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 11798}{a: \quad 5987 - \quad c:} = 1,97 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA4-Steam Meters

Prepared for USAID and RCG/Hagler Bailly

MOFA4STE

Plant name: FIBREBOARD FACTORY INC. MOHÁCS HUNGARY

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-4-STEAM METERS

INTELLIGENT HEAT CAPACITY AND ENERGY MEASUREMENT SYSTEM

AREA OF PLANT EFFECTED HEATING CENTER IN MOFA

FINDINGS CONCERNING EXISTING CONDITIONS

The measuring system at the steam grid between units at the central factory of MOFA realised by plans dated 1984, serving mainly technological purposes has been overwied. In order to provide more reliable and accurate measuring of the energy transported the sources of the errors were analysed. The original installation of the equipment was done properly. When comparing the current operation and the original desing data, it is clear that the uncertainity of the measuring is not greater than 2.5 - 3 % under the designed conditions.The current pressure, temperature and quanity data is significantly different from that of designed. Under the current operational circumstances the radical error is between 1 - 22%.

As the preassure is fluctualing, there are some units for example defibrators where the quantity of the steam (mass flow) is changing between 20 and 90 %.The error of the system is increasing significantly when the mass flow is dropping below 50% of the limit of the measuring system. The current measuring system is not suitable for measuring the thermal capacity and transported thermal energy. The accuracy is 4 - 8% in the range of 50 - 100% and 10 - 25% in the range of 20 -50 % of the limits.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

As a result, it is proposed to install an intelligent mass flow and thermal capacity measurement system at the key customers. The primer elemet of the proposed measuring system is a pipe with orifice plates as was before.

The arythmetic equipment for measuring the mass flow and the thermal capacity must be a microcomputer which is able to solve the mass flow and thermodynamic equations continously, provide high resolution digital display of the measured and calculated data and transfer in a modem format. The proposed instrument and measuring algorythm complies to ISO 5167, ISO 6976 and DIN 1952 recommendations. The targeted accuracy is 3 - 17% in the range of 20 – 100% of the measuring limits using the recalibrated existing PT 100 type thermal sensors, measuring circuits with PT correction and an intelligent autonom microcomputer -Flow Computer-(Hungary). It is possible to increase the accuracy by changing from the existing 0.6 accuracy class transmitters and using analogue device of 0.25 accuracy class or a Smart transmitter of 0.1 accuracy class. Accurate measurements provide relevant information for energy management and energy conservation. The energy consumption data can be compared to the production data on line in order to achieve efficient operation.

/Honeywell USA/ STD924-A1A-00000-MB,POD2 ST3000 series 900 SMART differential pressure transmitter (3piece)

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy	gas+coal			
	KW	Mwh/year	GJ			US $/year
Baseline - existing conditions			434462			1054769
After recomended action			430117			1044221
Net reduction			4345			10548

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	800		
Equipment procurement	5584		
Equipment installation	300		
Equipment commissioning	3373		
TOTAL INSTALLED COST	10057	(b)	
Estimated increase in annual (non-energy) operations and maintenance cost		(c)	

PAYBACK PERIOD

$$\frac{b: \quad 10057}{a: \quad 10548 - \quad c:} = 0{,}95 \text{ years}$$

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-5-GASANAL

Prepared for USAID and RCG/Hagler Bailly

MOFA-5GAN

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-5-GAS ANALYZER

Combustion gas analyser

AREA OF PLANT EFFECTED Boiler-house

FINDINGS CONCERNING EXISTING CONDITIONS

There are two boilers in the area of the factory ran by gas /18.3MW, 18.5MW/ and two ones ran by coal /15.7MW, 15.7MW/ at the plant simultaneausly working two or three. There is no waseges analyser in the factory.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

We recommend using a portable BACHARAH MODEL 300 COMBUSTION ANALYZER or other meter wquivalent of this. There is no need for NO2 and SO2 analysis with a wiew to energetics.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy	gas+coal			
	KW	Mwh/year	GJ			US $/year
Baseline - existing conditions			434462			1054769
After recomended action			433159			1051605
Net reduction			1303			3164

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	0		
Equipment procurement	2650		
Equipment installation	0		
Equipment commissioning	300		
TOTAL INSTALLED COST	2950	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 2950}{a: \quad 3161 - \quad c:} = 0{,}93 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-6-EM

Prepared for USAID and RCG/Hagler Bailly

MOFA6EM

Plant name:	FIBREBOARD FACTORY INC. MOHÁCS HUNGARY		
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	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		

ACTION No. AND BRIEF DESCRIPTION

94-H-MOFA-6
Installation of an information system
Introduction of supporting energy efficiency measures

AREA OF PLANT EFFECTED

MOFA energy management

FINDINGS CONCERNING EXISTING CONDITIONS

System of the energy management. The account of the energy system is done by electric measuring instruments set up in every 10-20-30 year. The technical level and the expenditures of the instruments were on the level of the day. The survey data were read off and registered manually, and were summarized and specified monthly and annually. These bach-measuring files are unsuitable to prevent or moderate the quick rising of energy prices and to put effect on production. The data processing of the electric and gas energy drawings and the account metering is done by a microprocessor.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

An hardware side there is a need for an electric, intelligent data processor to the established computered system. On those places wich are far from the computer system the data processing is independent. This forms the basie of energy management which is an integral part of information management. Completed with the production data, this assures effective contribution in controlling, reduction on the electricity in peak (kw) and energy (MWh) gas, heat, steam, water intake, and in moderating the per unit costs. As a result of the on-line connection gives wiew of the prodution in the real-line. On the software side: exploration of the relations with modern statistic and mathematic manners and giving synoptical daily reports and on these basis interventions, reckonings and motivations can be done. We recommend using five intelligent dataprocessor made in Hungary on the basis of the enclosed specification. For the dataprocessor we recommend the "spss for windows base system tables, professional statistics categories," or the equivalent EMCO PROCESSES CONTROL UTILITIES softwares made in the USA.
Quality process management beginns with accurate flow mea surement.
Controlled energy cost-swains in production.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Total	Electricity		Fuels	Heat	Steam	Total cost
		Peak	Energy				
	GJ	KW	Mwh/year				US $/year
Baseline - existing conditions	466123						1907821
After recomended action	461462						1888743
Net reduction	4661						19078

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	9000	
Equipment procurement	6779	
Equipment installation	2443	
Equipment commissioning	10800	
TOTAL INSTALLED COST	29022 (b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 29022}{a: \quad 19078 - \quad c:} = 1{,}52 \text{ years}$$

Gellert

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RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-7-TRM

Prepared for USAID and RCG/Hagler Bailly

MOFA7TRM

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Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-7-MODERNISATION OF THE THERMAL CONTROL SYSTEM

Thermal control system

AREA OF PLANT EFFECTED Preasurizer

FINDINGS CONCERNING EXISTING CONDITIONS

The work of the factory is producing 1151630m2/1993y laminated plate. The heat power of the press is 7.8MW.
The regulation and the controlling of the press is used up, and it did not work properly even before as the regulation was planned for the energy prices of the 60 ties.
For the cooling of the press the factory uses the water of the Danube arriving to the area of the factory.
A great amount of heat escapes from the system in every cooling cycle.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

We recommend the modernizing of the regulation with processcontroller made in the USA or with using PLC.
The task is to put into practice a pressregulation that can realize a given pressing temperature grofile and timing.
This assures through five regulating valves that a maximum heat will stay in the system. There should operate require number of pumps according to the cycle.
During the auditing we find that in the present operating circumstances the working time of one 55KW pump can be decreased with 6000 hours per year.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	Steam	Total cost
	Peak	Energy				
	KW	Mwh/year			tonna	US $/year
Baseline - existing conditions		450			20010	212699
After recomended action		210			19010	191909
Net reduction		240			1000	20790

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	4717		
Equipment procurement	3774		
Equipment installation	1698		
Equipment commissioning	900		
TOTAL INSTALLED COST	11089	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 11089}{a: \quad 20790 - \quad c:} = 0{,}53 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-8-PA

Prepared for USAID and RCG/Hagler Bailly

MOFA8PA

Plant name: FIBREBOARD FACTORY INC. MOHÁCS HUNGARY

Address: H-7701 Mohács, P.O.Box 129 HUNGARY Phone:+36 (69) 311922 Fax: +36 (69) 322742

Dezső SZÁNTÓ general manager

Auditor's name GELLÉRT INNOVATIVE BUREAU OF ENGINEERING D.P.

Barackos út 24 H-7635 Pécs HUNGARY Phone:+36 (72) 319661 Fax: +36 (69) 319661

Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-8-PA

Painting the boards with a roller machine Modernisation of the technology

AREA OF PLANT EFFECTED PRODUCTION LINE 3 IN MOFA surfance refining block.

FINDINGS CONCERNING EXISTING CONDITIONS

The above mentioned firm produces 2.5 million m2 of enamelled fibre boards per year. The main operations and machines used are

- priming with roller kite spread machine
- coring enamel spreading with pouring 60-70g/m2 machine 100g/m2

The stiffening of both layers will be done in electric fuelled infra tunnel specific energy consumption 1.2kWh/m2

There is a need for Hinner enalled and cheaper boards on the market. The Hinner cavering in the present procedure cannot be realised therefor they need a roller lack spreader machine, wich is according to one's wich could cover 40-50g/m2. With this rollered procedure the enamel is more densed, so its solving material content is less. Stiffening dense and thin layer needs less electric energy so productivity can be improved. Roller enamed spreader producers and transporters are - Börde DALS 1800 information price of 1992

- Mymmen ULC 1800

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

The new product is supposed to give the 40% of the output which is one million m2. The recommended procedure has three main effect as saving electric energy and on important amount of material and a positive effect on the /protection of/ the enviroment. The minimum width of the roller of the machine is 1750mm.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Material	Electricity		Fuels	Heat	Steam	Total cost
		Peak	Energy				
	US $/year	KW	Mwh/year				US $/year
Baseline - existing conditions	589622		3000				717547
After recomended action	471698		2600				583056
Net reduction	117924		400				134490
							67245

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	2500	
Equipment procurement	56600	
Equipment installation	23584	
Equipment commissioning	3000	
TOTAL INSTALLED COST	85684	(b)

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 85684}{a: \quad 67245 - \quad c:} = 1{,}27 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA9EPW

Prepared for USAID and RCG/Hagler Bailly

MOFA9EPW

Plant name: FIBREBOARD FACTORY INC. MOHÁCS HUNGARY

Address: H-7701 Mohács, P.O.Box 129 HUNGARY Phone:+36 (69) 311922 Fax: +36 (69) 322742

Dezső SZÁNTÓ general manager

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Baracksos út 24 H-7635 Pécs HUNGARY Phone:+36 (72) 319661 Fax: +36 (69) 319661

Miklós GELLÉRT C.E.M. managing director

Report date April 1994

ACTION No. AND BRIEF DESCRIPTION 94-H-MOFA-9-POWER

Monitoring of the power consumption of the key customer units

AREA OF PLANT EFFECTED Management of electric power supply

FINDINGS CONCERNING EXISTING CONDITIONS

The measurement of the energy consumption of the consumers is done by daily registering according to the measuring system diverging from the electric factory on different potential. The in-built capacity of the more then 20-year old system is 11,2MW. The continnous observation is worked up only at the main measure instrument. Possibility of intervention is will the manner required by the disspatcher.

Data processing is done manually in every month. Evaluation concerning mostly to distribution of overhead cost and fact finding.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

There would be a 10 Channel Analog and 7 Bit Digital Impuut Data Acquisition and Storage Intrument in use made by László Bode Hungaran enginneer wich gathers the information by key-consumes with local signaling and date processing by computer system. It can be programmed for continnous intervention, scheduling and limiting vacant run. This system is integral part of the willing energy management.

Bath the energy management and the datta processing uses the sme comuter system and software, the SPSS QI ANALYST and SPSS FOR WINDOWS BASE SYSTEM analyst programs

It is available for the management with graphical representation and sunoptical tables.

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity Peak KW	Electricity Energy Mwh/year	Fuels	Heat	Steam	Total cost US $/year
Baseline - existing conditions		17591522				750217
After recomended action		17239692				735213
Net reduction		351830				15004

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost	Notes
Engineering design	2830	
Equipment procurement	6884	
Equipment installation	2830	
Equipment commissioning	1500	
TOTAL INSTALLED COST	14044	(b)

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 14044}{a: \quad 15004 - \quad c:} = 0{,}94 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

RECOMMENDED ACTION - ENERGY EFFICIENCY OPPORTUNITY

ACTION NO 94-H-MOFA-10-IW

Prepared for USAID and RCG/Hagler Bailly

MOFA10IW

Plant name:	FIBREBOARD FACTORY INC. MOHÁCS HUNGARY		
Address:	H-7701 Mohács, P.O.Box. 129 HUNGARY	Phone:+36 (69) 311922	Fax: +36 (69) 322742
	Dezső SZÁNTÓ general manager		
Auditor's name	GELLÉRT INNOVATIVE BUREAU OF ENGINEERING D.P.		
	Barackos út 24 H-7635 Pécs HUNGARY	Phone:+36 (72) 319661	Fax: +36 (69) 319661
	Miklós GELLÉRT C.E.M. managing director		
Report date	April 1994		
ACTION No. AND BRIEF DESCRIPTION	94-H-MOFA-10		
	EVALUATION OF INDUSTRIAL WATER INTAKE		
AREA OF PLANT EFFECTED	Water intake		

FINDINGS CONCERNING EXISTING CONDITIONS

The water intake of the factory is 1,13 million m3 and the intake is hostly unmeasured. The intake of the sections are not measured. The intake of the water-softner is measured. The reduction of the water intake is is reasonable because of energy, cost and its effects on the enviroment.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY

We recommend ONICON F 1200 INSERTION FLOW METERS MODES made in the USA at the main forkings which can be easily set up and fits in the management system. EMCO FLOW is also suitable.(5 piece)

Data acquistition and storage instrument ade by Laszlo Bode Hungarian engineer (5 piece)

EXPECTED RESULTS - EFFECT OF RECOMMENDATION

	Electricity		Fuels	Heat	i. water	Total cost
	Peak	Energy				
	KW	Mwh/year			m3	US $/year
Baseline - existing conditions					1130374	80063
After recomended action					1073855	76060
Net reduction					56519	4003

COST BENEFIT ANALYSYS

PROJECT COST ESTIMATE	Cost		Notes
Engineering design	1800		
Equipment procurement	12383		
Equipment installation	1415		
Equipment commissioning	600		
TOTAL INSTALLED COST	16198	(b)	

Estimated increase in annual (non-energy) operations and maintenance cost (c)

PAYBACK PERIOD

$$\frac{b: \quad 16198}{a: \quad 4003 - \quad c:} = 4{,}05 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Gellert

270

ELECTRIC ENERGY CONSUMPTION - 12 MONTH AUDIT PERIOD
Prepared for USAID and Hagler Bailly

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24, H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Electricity Contract terms:

Electricity Supply company's name:	Dél - Dunántúli Áramszolgáltató Rt.
Contract maximum demand (kW):	6300 kW
Minimum charge (cost):	
Other:	

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERIOD 1994

Meter Reading Mo/Day/yr	Energy Active Day-time	Night kWh	Peak	Total Energy Active kWh	Max Demand Day-time kW	Peak	Auxiliary Demand Day-time kW	Peak	Demand Cost HUF	Electricity price HUF	Rebate Enar Reactive HUF	Two way Supply Cost HUF	Total Cost HUF	Cost per unit HUF/kWh	Product Index kWh
Jan	768777	402700	507273	1678750	4200	3600	0	0	0	5790615	-289531	63000	5564084	3.31	
Feb	933082	763309	401829	2098220	4200	3600	1800	2400	3420000	6668234	-504412	63000	9646822	4.60	
Mar	820356	584524	207280	1612160	4200	3500	0	0	2124500	4972986	-354874	63000	6805612	4.22	
Apr	1190146	858866	305648	2354660	4200	3300	1600	2300	3229000	7283348	-524617	63000	10030731	4.26	
May	624295	448606	159919	1232820	4200	3200	0	0	2009000	3803587	-290629	63000	5584958	4.53	
Jun	782765	589055	204620	1576440	4200	3200	0	0	2009000	4428276	-321864	63000	6178412	3.92	
Jul	929325	665146	228719	1821190	4200	3200	0	0	2009000	5602512	-380576	63000	7293936	4.01	
Aug	62506	37468	12536	112510	1000	800	0	0	493000	346988	100799	15000	955787	8.50	
Sep	1362831	1028785	368674	2760290	4000	3200	1300	1800	2905500	8511472	-570849	60000	10906123	3.95	
Oct	619381	496904	271215	1387500	4000	3200	0	0	1972000	4424464	-319823	60000	6136631	4.42	
Nov	813114	641264	304382	1758740	4000	2950	0	0	1875750	5539436	-370759	60000	7104427	4.04	
Dec	960041	813831	417488	2191460	4000	2950	1400	2150	2982500	6947063	-495478	60000	9474085	4.32	
Total:	9866619	7330558	3387563	20584740					25009250	64298971	-4322613	696000	85681608	4.16	

Peak demand during audit period (kW):

Report date: Aug 16, 1995

MOFELEC3.XLSMunka1

BOILER CHARACTERISTICS
Prepared for USAID and Hegler Betty

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

Boiler characteristics:

Number/name	8850/1984 HLG 2023-240	2771/1972 Wagner-Biró 2500	3561/1961 RK1	3562/1961 RK2	999/1955 BW 3	2261/1956 BW2	2260/1956 BW1
Manufacturer	Láng	Wégner					
Type / firetube/watertube /							
Type / saturated/superheated /							
Capacity / tons/hour /	20	20	20	20	9	9	9
Year installed	1984	1972	1961	1961	1955	1956	1956
Year last major overhaul							
Operational? / yes/no /	yes	yes	yes	yes	no	no	no
Steam pressure bar	21.1	21.1	29	29	14	16	16
Steam temperature grad C	212	212	212	212			
Stack temperature, after economizer	234	214		209			
Stack gas analysis: dissolved solids PPM							
Efficiency %	91	91		81			

Report date: 1995.09.12

Gellert

ENERGY BALANCE - ELECTRICAL
Prepared for USAID and Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address. Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

Item No.	Equipment or Process Description	Connected Load kW	Maximum Load kW	Average Load kW	Load at Peak Billing Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year
	CHOPPING						
	Chopping					703755	2928299
	Lighting					105737	440118
	Port					109470	455658
	BASE FACTORY						
	Lighting of process line I - II					349121	1453176
	Lighting of process line V					172258	717004
	II process line					5121222	21316498
	V process line					8176419	34033404
	LACQUER						
	Lighting					80499	335068
	Caloric center						
	Lacquer works III process line					2747985	11436213
	LAMINATION						
	Lighting						
	Caloric center					142170	591766
	Process line IV					319121	1328304
	BRIQUETTING					44706	186084
	OTHER USE						
	Self consumption of boyler center					1666665	6938550
	Water clearfying plant and other					414775	1726448
	Lighting /open space/					53700	223553
	Lighting /office/					85574	356079
	Lighting /open space factory/					134276	558917
	Kitchen					9670	40250
	Maintaince					22695	94476
	Processing plant					121599	506142
TOTAL PEAK DEMAND					5400		
TOTAL ENERGY CONSUMPTION AND COST (equals total billed consumption)						20584740	85681808

Auditor name: Miklós GELLÉRT C.E.M.
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661
Report date: April 4, 1995

Gellert

MOFAEBE.XLSMunka1

STEAM GENERATION AND DISTRIBUTION- 12 MONTH PERIOD
Prepare for USAID and RCG / Hingler Batty

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Adress: Budapesti road, H-7700 MOHÁCS HUNGARY

	STEAM DISTRIBUTION 1994																	STEAM GENERATION 1994		
	2. TECHNOLOGY LINE RAW FBRBRD.			6. TECHNOLOGY LINE			LACKING	LAMINATING		POWER STATION	HEATING	SELLING "KELTETŐ"	SELLING "MISSTRESS"	OIL STORAGE	TOTAL	LOSS	TOTAL	STEAM...	STEAM GENERATION	STEAM GENERATION
	PRESS	DEFIBRATOR	TOTAL	PRESS	DEFIBRATOR	TOTAL		SOCIAL	TECHNOLOGY	SELF CONSUMPTION							STEAM CONSUMPTION			HEAT CONTENT
	tonna	tonna	tonna	tonna	tonna	tonna	tonna	tonna	tonna	tonna	tonna	tonna	t	t	tonna	tonna	tonna	tonna	tonna	GJ
JANUARY	1826.0	1424.0	3250.0	3610.7	2603.8	6114.5	350.0	420.1	1571.4	1208.3	1956.0	280	6	1	15197	350	16547.3	635.3	14912	34476.0
FEBRUARY	2848.7	2287.6	5136.3	4831.8	3312.4	8144.2	320.0	400.0	1337.1	1678.2	1373.0	264	6	1	18700	460	19169.8	712.8	18447	42981.5
MARCH	1803.1	1503.3	3306.4	2973.8	2267.0	5240.8	300.0	347.6	1396.3	1305.4	1121.0	200	6	1	13264	350	13614.4	478.4	13136	30606.9
APRIL	3233.5	2548.0	5781.5	5807.0	4420.0	10227.0	200.0	244.5	1380.0	1555.0	360.0	136	1	1	19925	300	20225.0	827.0	19398	45197.0
MAY	1734.2	1440.0	3174.2	2181.3	1477.0	3658.3	209.5	0.0	1276.2	858.8	63.7	98	1	0	9379.7	220	9599.7	100.7	9499	22132.7
JUNE	1643.6	1549.0	3192.6	3481.1	2500.0	5981.1	100.0	32.0	638.0	813.0	0.0	62	5	0	10864	200	11063.7	460.7	10603	24705.0
JULY	1932.7	1322.0	3254.7	4376.2	2933.0	7309.2	30.0	0.0	1291.0	770.0	0.0	26	1	0	12721	200	12920.9	697.9	12323	28712.6
AUGUST	8.7	0.5	9.2	9.3	0.5	9.8	12.6	0.0	7.0	197.4	0.0	10	0	0	286	50	336.0	0.0	336	672.0
SEPTEMBER	4082.4	2864.0	6946.4	6089.0	3754.0	9843.0	80.0	92.8	1409.9	1578.0	8.1	79	7	0	20084	300	20384.2	921.2	19463	45349.0
OCTOBER	3192.0	2394.0	5586.0	850.0	571.0	1421.0	300.0	358.0	1518.0	1203.0	739.0	26	6	0	11197	300	11497.0	410.0	11087	25833.0
NOVEMBER	1788.0	1338.0	3126.0	3475.0	2248.0	5723.0	350.0	385.0	2256.0	1260.0	1062.0	39	8	0	14249	300	14549.0	671.0	13978	32662.0
DECEMBER	3071.4	2208.0	5279.4	6019.0	3337.0	8356.0	420.0	542.5	962.5	1632.4	716.6	136	9	0	18093	500	19593.4	723.4	17870	41637.0
TOTAL	27164.3	20878.4	48042.7	42604.2	29423.7	72027.9	2672.1	2822.4	16043.4	14069.6	7398.4	1354	56	4	163960	3530	168490.4	6438.4	161052	374863.7

Auditor name: Miklós GELLERT C.E.M
Adress: Barcsolce road, 24, H-7635 PÉCS HUNGARY
Phone/Fax: + 36-72-318661
Report date: April 4, 1995

Gellert

MOFA 94-95 szerződéstervezet
MOFA
MOHÁCS
Év:1993-1994

TARIFFANALYSATION FOR SIGNING INDIVIDUAL CONTRACTS ON ELECTRIC ENERGY LOADING. THE POSSIBILITY OF POWER REDUCTION AT PEAK TIME AND DURING DAYTIME, IT'S POWER EFFECTS AND COST EFFECTS.

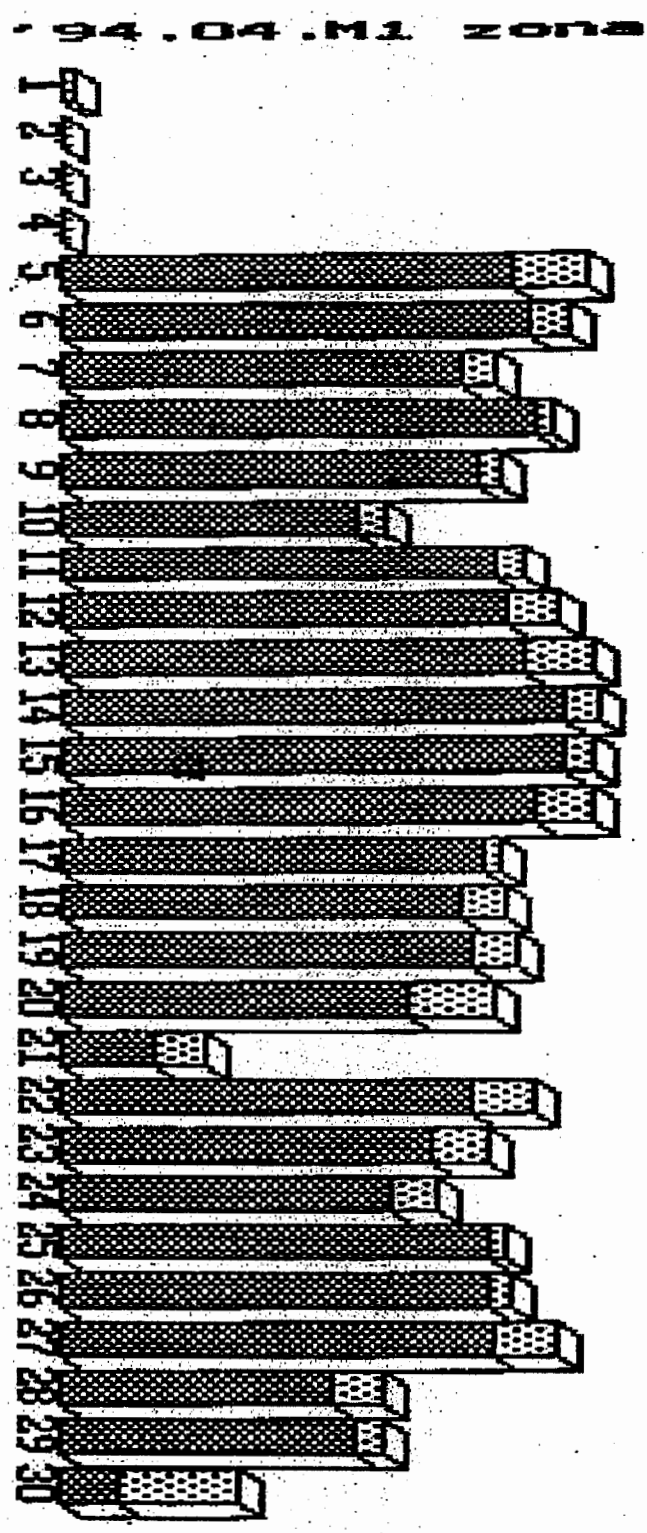
1994.08.10 10:13 MOFAZ1BB.WK1

	94 SZEP	94 OKT	94 NOV	94 DEC	94 ÖSSZ	95 JAN	95 FEB	95 MÁRC	95 ÁPR	95 MÁJ	95 JUN	95 JUL	95 AUG	94/95 sz.Öss	95 SZEPT	95 OKT	95 NOV	95 DEC	95 ÖSSZ
N fogy:	933082	820456	1190146	470923	8410532	788418	933082	820456	1190146	824295	782768	782785	110000	9410532	933082	820456	1190146	470923	8410532
É.fogy:	783306	584824	886866	393568	7192845	783306	783306	584824	886866	446409	649055	589055	90000	7192845	783306	584824	886866	393568	7192845
Cs. fogy:	401826	207280	306846	219219	2979163	331271	401826	207280	306846	189919	201826	204820	30000	2979163	401826	207280	306846	219219	2979163
ÖSSZ FOGY:	2098220	1612260	2384060	1083810	18534540	1723750	2098220	1612260	2384060	1232820	1576440	1576440	230000	18534540	2098220	1612260	2384060	1083810	18534540
Tel.n.	5300	3958	5300	3120	3830	3120	5300	3959	5300	3247	3628	3628	950	3901	5300	3959	5300	3120	3901
Tel.cs.	4750	3200	4750	3113	3277	3113	4750	2750	4750	2758	2750	2750	750	3348	4250	3200	4750	2750	3278
Lek.l.n.	4000	4000	4000	4000	3569	4000	4000	4000	4000	4000	4000	4000	1000	3760	4000	4000	4000	4000	3760
Lek.l.cs.	2750	3200	3200	3200	2827	3200	3200	2750	2750	2750	2750	2750	800	2778	2750	3200	3200	2750	2738
Ind.hd. felár	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
kap.kap.felár t	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operatív l.n	1300	0	1300		527	0	1300	0	1300	0	0	0		433	1300	0	1300		433
Operatív lcs	2000	0	1550		750	0	1550	0	2000	0	0	0		592	1850	0	1550		650
Áramdíj n	2945862	2671896	4185511	1848230	30477358	2654456	3203787	2871896	4185511	2868032	2730677	2730677	385000	32977935	3206787	2671896	4185511	1848230	32657800
Áramdíj é.	1789776	1400836	2190108	1003433	17200095	1629910	1946137	1400836	2190108	1143946	1602090	1602090	229500	16412580	1946137	1400836	2190108	1003433	16356250
Áramdíj cs.	1658805	1057128	1658805	1118017	14291926	1648462	2040326	1057128	1658805	815687	1043862	1043862	153000	15033000	2040326	1057128	1658805	1118017	16193731
Ösz.áramdíj	6668234	5419280	7914424	3770100	62372376	5973848	7261652	5419280	7914424	4144584	5285328	5285328	767500	65823524	7261652	5419280	7914424	3770100	66410641
Tdj.n.	340000	600000	800000	800000	6784908	800000	800000	800000	800000	800000	800000	800000	200000	8860000	800000	800000	800000	800000	9000000
Tdj.cs.	1058750	1344000	1344000	1344000	14464750	1344000	1344000	1188000	1188000	1188000	1155000	1155000	330000	13880750	1188000	1344000	1344000	1155000	13897000
Cos fi tg	-423349	-378163	-502921	-268704	-4281953	-405877	-470277	-388713	-492471	-304076	-362016	-362016	-85975	-4132660	-480627	-378163	-502921	-268234	-4480988
Pótdj.n.n	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pótdj.cs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tőke.n.d	60000	60000	60000	60000	680000	60000	60000	60000	60000	60000	60000	60000	15000	675000	60000	60000	60000	60000	675000
Operatív n.d	240000	0	260000	0	1200000	0	260000	0	260000	0	0	0	0	1020000	260000	0	260000	0	1040000
Operatív csd	770000	0	651000	0	3230500	0	651000	0	840000	0	0	0	0	2812000	630000	0	651000	0	2772000
Számlaösszeg	9114135	7248907	10626503	5078398	86868875	7771071	9906275	7066547	10539953	5884888	6938313	6938313	1263328	88828114	9706725	7245097	10626503	5409848	89241183
Ár.forg.szá.	914014	724810	1062650	507840	8668287	777107	990627	706656	1053996	589459	693831	693831	126333	8882811	970672	724510	1062650	540985	8924015
FIZETENDŐ	10028149	7973807	11688153	5586238	95218832	8548838	10896902	7772102	11593948	6474348	7632144	7632144	1389660	97710826	10676397	7969607	11688153	5949730	98165198
Fajl.Fdíjnk	4,36	4,45	4,67	5,24	4,43	4,60	4,72	4,36	4,47	4,78	4,40	4,40	5,46	4,84	4,63	4,49	4,47	5,07	4,68
Fajl.Fdíjnk	4,10	4,32	4,22	5,07	4,22	4,41	4,57	4,32	4,22	4,04	4,37	4,37	5,19	4,37	4,47	4,32	4,22	5,07	4,41
Fajl.F.díjnk	2,23	2,42	2,42	2,42	2,28	2,42	2,42	2,42	2,42	2,42	2,42	2,42	2,42	2,40	2,42	2,42	2,42	2,42	2,42
Fajl.F.díjnk	8,79	11,06	11,04	10,87	10,20	8,70	9,56	10,14	11,05	11,71	10,21	10,21	16,40	10,18	8,07	11,00	11,05	8,85	10,13
Teh.tő n	100%	99%	100%	78%	87%	78%	100%	99%	100%	91%	91%	91%	99%	93%	100%	99%	100%	78%	93%
Teh.tő cs	100%	100%	100%	87%	93%	97%	100%	100%	100%	100%	100%	100%	91%	99%	100%	100%	100%	100%	100%
Teh.tő l.n	49%	83%	71%	38%	59%	58%	60%	65%	62%	42%	54%	83%	30%	54%	49%	63%	71%	38%	54%
Teh.tő l.cs	53%	82%	80%	35%	56%	57%	67%	62%	60%	40%	55%	83%	32%	52%	63%	62%	60%	35%	52%
Teh.tő l.e	94%	48%	48%	48%	68%	74%	87%	84%	71%	63%	82%	80%	40%	67%	103%	48%	48%	57%	68%
F.erőny n%	44%	61%	61%	43%	46%	46%	44%	61%	61%	61%	60%	50%	48%	45%	44%	61%	61%	43%	45%
F.erőny é%	36%	36%	36%	30%	37%	37%	36%	36%	30%	36%	37%	37%	39%	37%	36%	36%	36%	30%	31%
F.erőny c%	19%	13%	13%	20%	16%	19%	10%	13%	13%	13%	13%	13%	19%	16%	18%	13%	13%	20%	16%
csúcs időtartam	3,08	4,50	4,50	4,50	3,36	4,50	4,50	3,00	3,00	3,00	3,00	3,00	3,00	3,63	3,00	4,50	4,50	4,50	3,63
	16.00-21.00	16.30-21.00	16.30-21.00	16.30-21.00		16.30-21.00	16.30-21.00	16.00-21.00	16.00-21.00	19.00-22.00	19.00-22.00	19.00-22.00	19.00-22.00		10.00-22.00	16.30-21.00	16.30-21.00	16.30-21.00	
nappali kiöl.	12,00	10,50	10,50	10,50	10,50	10,50	10,50	12,00	12,00	12,00	12,00	12,00	12,00	11,38	12,00	10,50	10,50	10,50	11,38
	7.00-16.00	6.00-16.30	6.00-16.30	6.00-16.30		6.00-16.30	6.00-16.30	6.00-16.00	6.00-16.00	7.00-16.00	7.00-16.00	7.00-16.00	7.00-16.00		7.00-16.00	6.00-16.30	6.00-16.30	6.00-16.30	
éjszaka kiöl	0,00	9,00	9,00	9,00	8,31	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00	9,00
Alb	10	10	10	10		10	10	10	10	10	10	10	10		10	10	10	10	
Tőke.n.d	15	15	15	15		15	15	15	15	15	15	15	15		15	15	15	15	
áramd.cs	4,70	5,10	5,10	5,10		5,10	5,10	5,10	5,10	5,10	5,10	5,10	5,10		5,10	5,10	5,10	5,10	
áramd.nap	3,20	3,50	3,50	3,50		3,50	3,50	3,50	3,50	3,50	3,50	3,50	3,50		3,50	3,50	3,50	3,50	
áramd.é.	2,35	2,55	2,55	2,55		2,55	2,55	2,55	2,55	2,55	2,55	2,55	2,55		2,55	2,55	2,55	2,55	
lek.díj n.	195,00	200,00	200,00	200,00		200,00	200,00	200,00	200,00	200,00	200,00	200,00	200,00		200,00	200,00	200,00	200,00	
lek.díj cs.	385,00	420,00	420,00	420,00		420,00	420,00	420,00	420,00	420,00	420,00	420,00	420,00		420,00	420,00	420,00	420,00	
napok	30	31	30	31	365	31	28	31	30	31	30	31	31	365	30	31	30	31	365

Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: [illegible]nati road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-7[illegible] 561



'94.04.M1 zonal	at1 [kW]	amax. [kW]
1	538	646
2	166	193
3	209	246
4	314	435
5	4425	5073
6	4584	4920
7	3960	4273
8	4628	4783
9	4111	4328
10	3085	3347
11	4284	4512
12	4391	4846
13	4534	5140
14	4874	5160
15	4851	5108
16	4618	5109
17	4179	4308
18	3990	4388
19	4073	4480
20	3548	4255
21	1325	1755
22	4091	4616
23	3744	4206
24	3398	3757
25	4220	4360
26	4231	4409
27	4260	4825
28	2854	3324
29	3060	3311
30	1014	2080

MONTHLY POWER LOADING OF ELECTRIC ENERGY IN DAYTIME ZONE-PERIOD.
AVERAGE AND MAXIMUM

Gellert

Prepared for USAID and RCG/Hagler Bailly

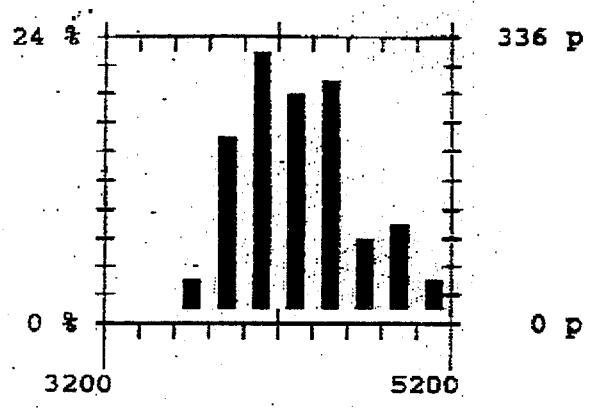
Plant Name: "MOFA" Fiberboard Factory INC. MOHÁCS
Address: Budapesti road. H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLERT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Baradics road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

IO

PQ ELOSZLÁSOK	Dt:04.07 Cs	Á1:0.9336 Á2:0.9336	Ár:3Z6	3F	VILCOMP
Egész nap	Hatásos kW	3Flek.[kW]- N:5000 C:5000 É:5000			

A zóna időtartama: 1440 perc



Sáv 200	t[p]	%
3200 - 3400	0	0
3400 - 3600	0	0
3600 - 3800	30	2
3800 - 4000	225	16
4000 - 4200	345	24
4200 - 4400	285	20
4400 - 4600	315	22
4600 - 4800	90	6
4800 - 5000	120	8
5000 - 5200	30	2
3200 - 5200	1440	100

½h-s MAXIMUMOK	
NAPP.	IDŐP.
5079	11: 0
CSÚCS	IDŐP.
4332	19:15
ÉJSZ.	IDŐP.
4519	0: 0

A zóna átlagteljesitménye :4313

Mérés helye: MOFA FOMERO
Megjegyzés : SZOMBAT

Mérő cég : GELLÉRT INNOVÁCIÓS IRODA
Mérte : GELLERT

IO

SHADOWING OF ELECTRIC ENERGY LOAD

-WHOLE DAY (FIRST MEASURER)

Gellert

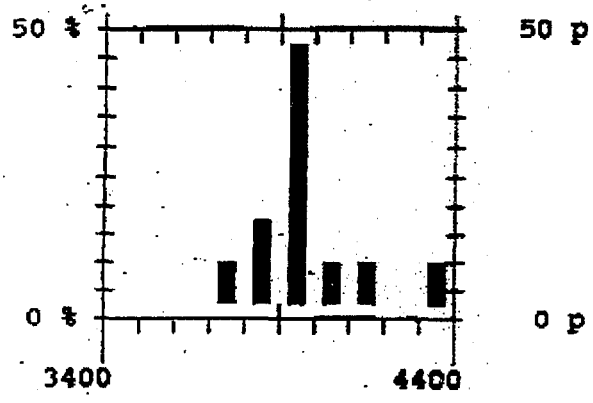
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road. H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLERT INNOVATIVE BUREAU OF ENGINEERING
Address: Baracksos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

IO

PQ ELOSZLÁSOK	Dt:04.07 Cs	Å1:0.9336 Å2:0.9336	Ár:3Z6	3F	VILCOMP
Csúcs	Hatásos kW	3Flek.[kW]- N:5000 C:5000 É:5000			
A zóna időtartama: 180 perc					



Sáv	100	t[p]	%
3400 - 3500		0	0
3500 - 3600		0	0
3600 - 3700		0	0
3700 - 3800		15	8
3800 - 3900		30	17
3900 - 4000		90	50
4000 - 4100		15	8
4100 - 4200		15	8
4200 - 4300		0	0
4300 - 4400		15	8
3400 - 4400		180	100

¼h-s MAXIMUMOK	
NAPP.	IDŐP.
5079	11: 0
CSÚCS	IDŐP.
4332	19:15
ÉJSZ.	IDŐP.
4519	0: 0

A zóna átlagteljesítménye :3986

Mérés helye: MOFA FOMERO
Megjegyzés : SZOMBAT

Mérő cég : GELLÉRT INNOVÁCIÓS IRODA
Mérte : GELLERT

IOIO

SHADOWING OF ELECTRIC ENERGY LOAD
-AT PEAK TIME (FIRST MEASURER)

Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Gellert

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Baranice road, 24, H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

IO

PQ NAPI ÖSSZ.	Dt:04.07 Cs	Å1:0.9336 Å2:0.9336	Ár:3Z6	3F	VILCOMP

½h-s max.	Pm-kW	IDÖP.	kvarL	kvarC	3Flek.	3FPm/lk	W/Wlk	+10	-10	Kie	Uhiba
NAPPALI :	5079	11:00	0.0	0.0	5000 kW	102 %	90 %	0	240	0 db	
CSúCSIDEI :	4332	19:15	0.0	0.0	5000 kW	87 %	80 %	0	60	0 db	
ÉJSZAKAI :	4519	00:00	0.0	0.0	5000 kW	90 %	84 %	0	180	0 db	

3 p max.	kW	IDÖP.	kvarL	kvarC	P1 p/%	P2 p/%	P3 p/%	Kim. p/%
NAPPALI :	5153	11:09	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0
CSúCSIDEI :	4407	19:18	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0
ÉJSZAKAI :	4631	00:03	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0

MUNKA (W)	kWh	kvarhL	kvarhC	cosφ	Alapd.	Áramd.	φár%	Összes	Ft/kWh
NAPPALI :	53837	0.00	0.00	1.00	30833	253034	-5	269674	5.01
CSúCSIDEI :	11959	0.00	0.00	1.00	64167	38270	-5	97315	8.14
ÉJSZAKAI :	37721	0.00	0.00	1.00	0	90531	-5	86004	2.28
N + CS :	65796	0.00	0.00	1.00	95000	291304	-5	366989	5.58
ÖSSZES :	103518	0.00	0.00	1.00	95000	381835	-5	452993	4.38
							Tm:	476835	4.61

Mérés helye: MOFA FOMERO
Megjegyzés : SZOMBAT

Mérő cég : GELLÉRT INNOVÁCIÓS IRODA
Mérte : GELLERT

IO

SUMMARIZING CHART FOR ANALYZING COST EFFECTS, IN RESPECT OF POWER, ENERGY CONSUMPTION, UTILIZATION, COS Ø AND ZONE PERIODS

Gellert

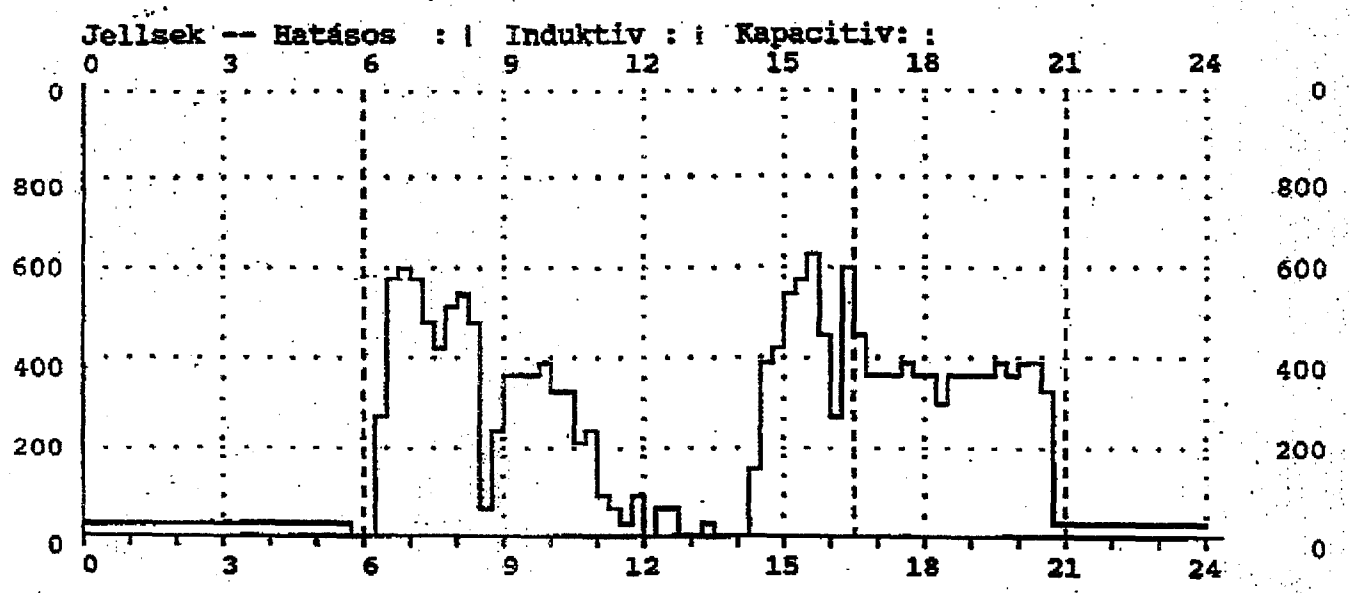
Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Baranicza road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

IO

PQ IDDIAGRAM	Dt:10.04 Ke	1:1.5000 2:1.5000	Fn:APRIT006	VILCOMP
Hely : MOFA aprito Megj.: tfszár	Er cg: GELLRT INNOVCIÓS IRODA Mrte : Gellrt s Kecsks	r:3%6 3F		



DAILY LOAD CURVE OF ELECTRIC POWER (CHOPPING UNIT)

Gellert

Prepared for USAID and RCG/Hagler Bailly

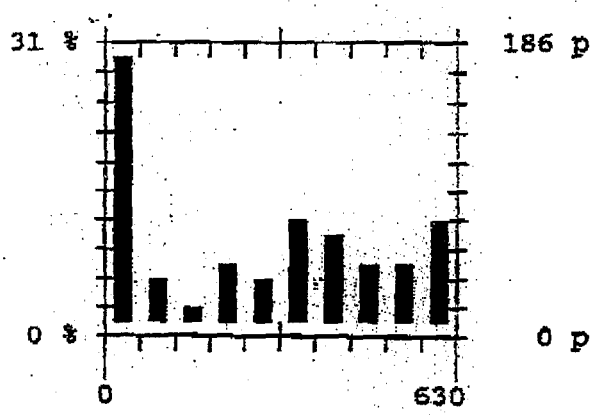
Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapest road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

0‡

PQ ELOSZLÁSOK	Dt:10.04 Ke	Å1:1.5000 Å2:1.5000	Ár:326	3F	VILCOMP
Nappali	Hatásos kW	3Flek.[kW]- N:600 C:600 É:600			

A zóna időtartama: 630 perc



Sáv	63	t[p]	%
0 -	63	195	31
63 -	126	30	5
126 -	189	15	2
189 -	252	45	7
252 -	315	30	5
315 -	378	75	12
378 -	441	60	10
441 -	504	45	7
504 -	567	45	7
567 -	630	75	12
0 -	630	615	98

½h-s MAXIMUMOK	
NAPP.	IDŐP.
630	15:30
CSÚCS	IDŐP.
450	16:30
ÉJSZ.	IDŐP.
30.0	0: 0

A zóna átlagteljesitménye : 280

Mérés helye: MOFA aprito
Megjegyzés : tfszám

Mérő cég : GELLÉRT INNOVÁCIÓS IRODA
Mérte : Gellért és Kecskés

0‡

ELECTRIC ENERGY POWER LOAD, POWER DISTRIBUTION AND FREQUENCY (CHOPPING UNIT)

Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

IO

PQ NAPI ÖSSZ.	Dt:10.04 Ke	Å1:1.5000 Å2:1.5000	Ár:3Z6	3F	VILCOMP

½h-s max.	Pm-kW	IDÖP.	kvarL	kvarC	3Flek.	3FPm/lk	W/Wlk	+10	-10	Kie	Uhiba
NAPPALI :	630	15:30	0.0	0.0	600 kW	105 %	46 %	0	210	0 db	
CSÚCSIDEI :	450	16:30	0.0	0.0	600 kW	75 %	57 %	0	90	0 db	
ÉJSZAKAI :	30.0	00:00	0.0	0.0	600 kW	5 %	4 %	0	180	0 db	

3 p max.	kW	IDÖP.	kvarL	kvarC	P1 p/%	P2 p/%	P3 p/%	Kim. p/%
NAPPALI :	690	06:45	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0
CSÚCSIDEI :	540	16:36	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0
ÉJSZAKAI :	60.0	21:12	0.0	0.0	0/ 0	0/ 0	0/ 0	0/ 0

MUNKA (W)	kWh	kvarhL	kvarhC	cosφ	Alapd.	Áramd.	φár%	Összes	Ft/kWh
NAPPALI :	2922	0.00	0.00	1.00	3581	13733	-5	16448	5.63
CSÚCSIDEI :	1545	0.00	0.00	1.00	7452	4944	-5	11776	7.62
ÉJSZAKAI :	203	0.00	0.00	1.00	0	486	-5	462	2.28
N + CS :	4467	0.00	0.00	1.00	11032	18677	-5	28224	6.32
ÖSSZES :	4670	0.00	0.00	1.00	11032	19163	-5	28686	6.14
							Tm:	30196	6.47

Mérés helye: MOFA
Megjegyzés : lk

Mérő cég : GELLÉRT INNOVÁCIÓS IRODA
Mérte : Gellért és Kecskés

IO

SUMMARIZING CHART FOR ANALYZING COST EFFECTS, IN RESPECT OF POWER, ENERGY CONSUMPTION, UTILIZATION, COS Ø AND ZONE PERIODS (CHOPPING UNIT)

Gellert

Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Baranyai road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

2.82

F1 Help	F2 Open	F3 Create	F4 Save	F5 Browse	F6 Utility	F7 Move	F8 Set

Files

GOZMENNY

Record 19965/26108

DATUM	IDO	HLG	WB	RK1	DEFIK	PRES2	PRES5	PRES4
09/14/94	1735	7.0	16.6	12.6	13.6	7.7	9.5	5.3
09/14/94	1736	8.1	16.3	13.1	13.6	7.7	11.1	5.1
09/14/94	1737	9.0	16.1	13.5	13.6	7.4	12.9	4.7
09/14/94	1738	9.4	15.8	13.8	13.8	7.2	13.8	4.3
09/14/94	1739	9.3	15.3	14.1	13.9	6.8	14.1	3.9
09/14/94	1740	8.8	14.9	14.1	14.0	6.6	14.0	3.5
09/14/94	1741	8.3	14.9	14.3	14.0	6.8	13.8	3.1
09/14/94	1742	7.8	15.1	14.3	13.9	7.1	13.4	2.7
09/14/94	1743	7.5	15.2	14.2	14.1	7.3	13.0	2.4
09/14/94	1744	7.1	15.6	14.0	14.0	7.6	12.6	2.1
09/14/94	1745	6.8	15.4	13.9	14.0	7.7	12.3	1.8

SHADOWING OF STEAM PRODUCTION AND CONSUMPTION. THE POSSIBILITY OF REDEEMING BOILERS

F1 Help	F2 Open	F3 Create	F4 Save	F5 Browse	F6 Utility	F7 Move	F8 Set

Files

GOZMENNY

Record 20257/26108

DATUM	IDO	HLG	WB	RK1	DEFIK	PRES2	PRES5	PRES4
09/14/94	2220	11.6	8.6	13.5	13.5	7.4	9.8	4.5
09/14/94	2221	12.5	9.7	14.3	13.7	7.0	11.6	5.8
09/14/94	2222	12.1	11.0	14.8	13.5	6.5	12.9	6.1
09/14/94	2223	10.6	13.0	15.1	13.3	6.2	13.5	6.1
09/14/94	2224	9.3	15.2	15.0	13.9	6.1	13.6	6.0
09/14/94	2225	8.3	17.1	14.6	13.9	6.3	13.4	5.9
09/14/94	2226	7.5	18.5	14.2	13.7	6.5	13.2	5.9
09/14/94	2227	7.3	18.9	14.1	13.8	6.9	12.8	5.7
09/14/94	2228	7.6	18.3	14.0	13.6	7.2	12.5	5.6
09/14/94	2229	7.7	17.7	14.0	13.6	7.3	12.3	5.5
09/14/94	2230	7.7	17.4	14.1	13.7	7.4	12.0	5.2

Gellert

ENERGY EFFICIENCY OPPORTUNITY

STEAM ENERGY REDUCTION
WITH THE HELP OF ASD AND ADDITIONAL AUTOMATIZATION
DEFIBRATOR 6 AT PRODUCTION LINE II. IN MOFA

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barokos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36-72-319-661

RAFFINATOR AT PRODUCTION LINE II. IN MOFA

	1. raffinator			2.raffinator			3. raffinator			Havi összes		
	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW
Jan	158	24 130	152	4	430	107	390	122 830	314	552	147 390	267
Feb	116	15 430	133	6	1 020	170	335	102 330	305	457	118 780	259
Mar	155	19 090	123	74	18 820	254	419	99 760	238	648	137 670	212
Apr	203	24 480	120	0	0		0	0		203	24 480	120
May	136	18 190	133	0	0		327	91 420	279	463	109 610	236
Jun	0	0	#####	0	0	####	0	0	####	0	0	####
Jul	0	0	#####	0	0	####	0	0	####	0	0	####
Aug	0	0	#####	0	0	####	0	0	####	0	0	####
Sep	0	0	#####	0	0	####	0	0	####	0	0	####
Oct	0	0	#####	0	0	####	0	0	####	0	0	####
Nov	0	0	#####	0	0	####	0	0	####	0	0	####
Dec	0	0	#####	0	0	####	0	0	####	0	0	####
Total	768	101 320	131	84	20 270	241	1 471	416 340	283	2 323	537 960	231
Participate												
operation h.		33%			4%			63%			100%	
energy		19%			4%			77%			100%	
performance		57%			104%			123%			100%=	231

DEFIBRATOR AT PRODUCTION LINE II. IN MOFA

	2. defibrator			3. defibrator			4.defibrator			5. defibrator			6. defibrator			Havi összes		
	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW	operation h.	kWh	kW
Jan	0	0		301	49 430	164	188	36 460	193	0	0		440	104 321	237	929	190 211	204
Feb	0	0		126	18 910	150	293	62 750	214	59	12 190	206	280	66 606	238	728	160 456	220
Mar	0	0		203	36 900	181	290	58 730	195	85	15 670	183	602	153 416	254	1 180	262 616	222
Apr	0	0		346	66 410	192	5	590	131	218	46 470	213	483	115 810	239	1 051	229 280	218
May	0	0		170	31 720	186	38	7 810	205	157	32 760	208	263	70 226	267	628	142 506	226
Jun	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Jul	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Aug	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Sep	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Oct	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Nov	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Dec	0	0	#####	0	0	####	0	0	####	0	0	####	0	0	#####	0	0	###
Total	0	0		1 148	203 370	177	814	164 340	202	519	106 960	206	2 038	510 381	250	4 516	985 071	218
Participate																		
operation h.	0%			25%			18%			11%			45%			100%		
energy		0%			21%			17%			11%			52%			100%	
performance			0%			81%			93%			94%			115%		100% =	218

SOURCE: MOFA / NAGY

SETTING OF OPTIMAL PLANT OPERATION AT COAL-FED BOILERS WITH MEASURING EQUIPMENTS GIVEN BY USAID AS DONATION

Tokaj. Berch

Balinhai ...

BACHARACH MODEL 300
COMBUSTION ANALYZER
ID: 10 31
DATE: 1994.09.16
TIME: RH-1
FUEL: COAL GAS
PRIMRY TEMP(C): 20
STACK TEMP(C): 214
% OXYGEN: 13.5
% EXCESS AIR: 182
% CARBON - DIOXIDE: 7.3
PPM CARBON - MONOXIDE: 0
% EFFICIENCY: 82.3
% STACK LOSS: 17.7
TEST PERFORMED BY: 15 t/h
COMMENTS ....

BACHARACH MODEL 300
COMBUSTION ANALYZER
ID: 10 27
DATE: 1994.09.16
TIME: RH-1
FUEL: COAL GAS
PRIMRY TEMP(C): 20
STACK TEMP(C): 211
% OXYGEN: 13.8
% EXCESS AIR: 194
% CARBON - DIOXIDE: 7.0
PPM CARBON - MONOXIDE: 0
% EFFICIENCY: 82.0
% STACK LOSS: 18.0
TEST PERFORMED BY: 14 t/h
COMMENTS ....

BACHARACH MODEL 300
COMBUSTION ANALYZER
ID: 10 21
DATE: 1994.09.16
TIME: RH-1
FUEL: COAL GAS
PRIMRY TEMP(C): 20
STACK TEMP(C): 211
% OXYGEN: 14.4
% EXCESS AIR: 221
% CARBON - DIOXIDE: 6.4
PPM CARBON - MONOXIDE: 0
% EFFICIENCY: 80.6
% STACK LOSS: 19.4
TEST PERFORMED BY: 14 t/h
COMMENTS ....

BACHARACH MODEL 300
COMBUSTION ANALYZER
ID: 10 22
DATE: 1994.09.16
TIME: RH-1
FUEL: COAL GAS
PRIMRY TEMP(C): 20
STACK TEMP(C): 219
% OXYGEN: 14.9
% EXCESS AIR: 248
% CARBON - DIOXIDE: 5.9
PPM CARBON - MONOXIDE: 1
% EFFICIENCY: 78.2
% STACK LOSS: 21.8
TEST PERFORMED BY: 14 t/h
COMMENTS ....

BACHARACH MODEL 300
COMBUSTION ANALYZER
ID: 10 15
DATE: 1994.09.16
TIME: DK1
FUEL: COAL GAS
PRIMRY TEMP(C): 20
STACK TEMP(C): 213
% OXYGEN: 15.3
% EXCESS AIR: 272
% CARBON - DIOXIDE: 5.5
PPM CARBON - MONOXIDE: 35
% EFFICIENCY: 77.6
% STACK LOSS: 22.4
TEST PERFORMED BY: 12 t/h
COMMENTS ....

Gellert

BACHARACH MODEL 300
****
COMBUSTION ANALYZER

ID:	12 50	12 00	12 48	12 45	12 42	12 37	12 10
DATE:	1994.03.22	1994.03.22	1994.03.22	1994.03.22	1994.03.22	1994.03.22	1994.03.22
TIME:	RK-1	RK-1	RK-1	RK-1	RK-1	RK-1	RK-1
FUEL:	COAL GAS	COAL GAS	COAL GAS	COAL GAS	COAL GAS	COAL GAS	COAL GAS
PRIMRY TEMP(C):	23	23	23	23	23	23	23
STACK TEMP(C):	195	213	184	187	182	189	286
% OXYGEN:	13.0	15.2	13.1	13.2	13.7	13.7	15.3
% EXCESS AIR:	164	266	167	171	198	198	272
% CARBON - DIOXIDE:	7.0	5.6	7.7	7.6	7.1	7.1	5.5
PPM CARBON - MONOXIDE:	28	94	28	23	26	26	170
% EFFICIENCY:	86.1	78.3	86.8	85.6	85.2	84.7	78.8
% STACK LOSS:	13.9	21.7	14.8	14.4	14.8	15.3	21.2
TEST PERFORMED BY:	Ly Fl	Ly Fl	Ly Fl	Ly Fl	Ly Fl	Ly Fl	Ly Fl
COMMENTS							

SETTING OF OPTIMAL PLANT OPERATION AT COAL-FED BOILERS WITH MEASURING EQUIPMENTS GIVEN BY USAID AS DONATION

Prepared for USAID and RCG/Hagler Bailly

Plant Name: "MOFA" Fibreboard Factory INC. MOHÁCS
Address: Budapesti road, H-7700 MOHÁCS HUNGARY

Auditor name: Miklós GELLÉRT C.E.M.
GELLÉRT INNOVATIVE BUREAU OF ENGINEERING
Address: Barackos road, 24. H-7635 PÉCS HUNGARY
Phone/Fax: +36 72-319-681

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Nitrokemia Rt.

by

Mihaly Szaniszlo, CEM

Rendszertechnika Fejleszto Kft

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise	NITROKÉMIA RT
Address	8184 Fűzfőgyártelep
	Pf.: 45
Telephone	/88/ 352-011
Fax	/88/ 351-240
Contact Person	Halas György
Title	chief engineer
Telephone	/88/ 352-011

2. Energy auditor information

Dates - audit started: 1994.jan.14. audit completed: 1994.aug.31.

Energy audit company	Rendszertechnika Fejlesztő KFT
Energy audit team leader	Dr.Szaniszló Mihály CEM
Address	1088 Budapest
	Vas u. 15/b. III/40. Hungary
Telephone	/36-1/ 138-1638, /36-1/ 117-3370
Fax	/36-1/ 117-3370

RENDSZERTECHNIKA
FEJLESZTŐ KFT
1088 Budapest, Vas u. 15/B III/40.

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

1. Steam generation, distribution
2. Steam consumption
3. Electric energy generation, distribution
4. Electric energy consumption

Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

The most important field of energy rationalization at Nitrokémia is the stream- and electrical energy, as these produce around 80-90 % of the energy costs.

Install Additional Steam Metering to Aid in Cost Accounting and Energy Management

The only metering that occurs is at the highest levels - the 6 -bar and 20-bar steam headers which supply the 5 plants and the other costumers.

We also saw many steam lines which had degraded or missing insulation, especially in the lines going to heat the village houses and shops.

New experience - in the energy auditor's opinion, what were the most significant lessons learned during the energy audit:

We feel, that at the planning of the energy production and distribution the consumption was not the main point of view, so the recent pipelines are much bigger, than needed.

Nitrokémia complex is very large. There is no doubt that there are zones within the plant where the distribution losses for heating and compressed air systems far exceed the load at the end of the pipeline.

New experiense:
- komplex energy audit method
- DSM
- new instruments /Rustrak, infrakamera/

4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units (also list the type of units per year, i.e. tons/year, kWh/year etc.):

Year:	1990	1991	1992	1993	UNITS
Production:					
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Energy:					
heavy fuel oil:	0	2.300	0	0	GJ/év
diesel fuel oil:	_____	_____	_____	_____	_____
natural gas:	2.300.000	2.000.000	2.050.000	2.020.000	GJ/év
coal:	_____	_____	_____	_____	_____
electricity:	414.000	353.000	386.000	356.000	GJ/év
steam:	1.980.000	1.800.000	1.770.000	1.850.000	GJ/év
other (describe):					
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Energy/Production index:					
thermal	_____	_____	_____	_____	_____
electrical	_____	_____	_____	_____	_____

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5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	UNITS
heavy fuel oil:					
diesel fuel oil:					
natural gas:					
coal:					
electricity:	310	340	370	350	10^6 forint
steam:					
other (describe):					

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding ---

- the replacement of transformers with small-loss ones
- setting up of systemic unique and groupes phase-corrector capacitors
- appropriate network developments
- between 1985 and 1987 they set up a computerized control system for the energy distribution, which has been working ever since
- change of public lighting lamps
- boiler renewal

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7. Detailed forms - required

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

Electric energy consumption - 12 month audit period

Electric energy generation - 12 month audit period (if plant has generator)

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. Narrative

Provide any other information which would be useful to USAID and RCG/Hagler Bailly --

Ripple-control system is already used at the following Hungarian industrial establishments: Dunai Kőolajipari Vállalat, Szekszárdi Húsipari Vállalat and all the common electric suppliers.

At the chlor factory we also think, that the time has come for the replacement of the shortcutting sectioners of the electrolization tubes, as the recent ones are worn out. It would be worthwhile to examine all the possible classical and modern solutions for minimizing the losses.

A similar computerized production control as at the electrical part would surely be necessary here, from the steam consumption, through the steam network to the boilers.

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ELECTRIC ENERGY GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name:
Address:

Auditor's name:

Report date:

Generator characteristics: 01.550/200/2 tip. 3000

Name/number	2 db			
Manufacturer	GANZ			
Capacity (kW):	6000 kVA			
Year installed:	1958/1963			
Year last major overhaul:	1977/1977			
Drive type (steam, gas, diesel)	gőz			
If steam – Condensing/extraction/backpressure	ellennyomásos			
Operational? (yes/no)	igen			

GENERATION DATA FOR 12–MONTH AUDIT PERIOD:

	SELF–GENERATION BY PLANT				SOLD TO OTHERS:				PURCHASED FROM OTHERS				NOTES
Meter Reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Unusual Operating conditions
Jan/__/__	4.357.900	3.720.000											
Feb/__/__	3.911.900	3.810.000											
Mar/__/__	4.133.700	3.900.000											
Apr/__/__	3.012.300	3.400.000											
May/__/__	1.672.100	2.900.000											
Jun/__/__	1.360.400	2.700.000											
Jul/__/__	1.157.100	2.700.000											
Aug/__/__	941.400	2.630.000											
Sep/__/__	1.972.500	2.600.000											
Oct/__/__	2.516.400	3.100.000											
Nov/__/__	2.804.300	3.430.000											
Dec/__/__	3.115.000	3.850.000											
TOTAL													

STEAM GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name:
Address:

Auditor's name:

Report date:

Boiler characteristics: 4 db besugárzott tűzterű meredekcsöves

Name/number	LMF/4 db	2		
Manufacturer				
Type (firetube/watertube)	kisvízterű	nagyvízterű		
Type (saturated/superheated)	túlhevített terű	steamblock		
Capacity (tons/hour)	30/35 t/h	20		
Year installed:	60/62/64/65	1971		
Year last major overhaul:	1990/1992/most			
Operational? (yes/no)	tél 4 / nyár 2	tartalék		
Steam pressure:	44 bar	14		
Steam temperature:	430 °C	200		
Stack temperature, after economizer:				
Stack gas analysis: percent O2				
Combustion efficiency:				
Blowdown analysis: dissolved solids PPM				

STEAM GENERATION DATA FOR 12–MONTH AUDIT PERIOD:

	STEAM GENERATION BY PLANT				IMPORTS	STEAM SALES AND DISTRIBUTION TO CONSUMERS:							NOTES
Meter Reading Mo/day/yr	Fuel Consumption ~~Gal~~	Steam Generation tons	Steam Generation[1] GJ	Monthly Efficiency %	Steam Purchased GJ	Papírgyár GJ	GJ	GJ	GJ	GJ	GJ	Losses & Unaccounted GJ	Unusual Operating conditions
Jan/__/__	6,4	78.000											
Feb/__/__	6,2	75.000											
Mar/__/__	6,0	73.000											
Apr/__/__	4,6	55.000				7000 – 10000 t							
May/__/__	2,8	34.000											
Jun/__/__	2,3	28.000											
Jul/__/__	1,9	23.000											
Aug/__/__	1,8	21.000											
Sep/__/__	2,9	35.000											
Oct/__/__	3,8	46.000											
Nov/__/__	5,8	70.000											
Dec/__/__	5,9	72.000											
TOTAL	/Mm³/												

ACTION PLAN – SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name:
Address:

Auditor's name:

Report date:

BASELINE – EXISTING CONDITIONS

	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year
BASE CASE						

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS: Net reduction

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year	Action Project Cost	Action Payback Period (years)
1.	steam metering /6-bar, 9-point/			3000 GJ				1,2 mFt	0,9
2.	infrakamera			4000 GJ				1,6 mFt	0,6
3.	200 kVAr capacitor			1,68 mFt				0,6 mFt	0,36
4.	steam metering /20-bar, 6-bar/			6000 GJ				2,5 mFt	1,46
TOTAL SAVINGS				13000 GJ 1,68 mFt					
SAVINGS AS PERCENTAGE OF BASE CASE									

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 1

Plant name: NITROKÉMIA RT
Address:

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: Instrumentation, 9-point steam metering

AREA OF THE PLANT AFFECTED: Balatonfűzfő, NITROKÉMIA RT, 6-bar steam network

FINDINGS CONCERNING EXISTING CONDITIONS:

There are not steam metering at costumers now.
The produced steam are measured in tons.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Steam meters have to employ at the highest level 6-bar steam header for improvement of energy management. This would create the ability to delegate accountability for energy conservation to costumers.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year	Steam			/year	
Baseline – existing conditions			1,850,000 GJ			758.5	mFt
After recommended action			1,847,000 GJ			757.3	mFt
Net reduction			3,000 GJ			1.2	mFt (a)

COST-BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	30,000.–	
Equipment procurement	950,000.–	
Equipment installation	100,000.–	
Equipment commisssioning	20,000.–	
TOTAL INSTALLED COST	1,100,000.– (b)	
Estimated increase in annual (non-energy) operations and maintenance cost	15,000.– (c)	

PAYBACK PERIOD:

$$\frac{b: 1,100,000.-}{a: 1,200,000.- \quad c: 15,000.-} = 0.9 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

Quotations, instrumentation, measurement, new tariff.

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2

Plant name:
Address:

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: Infrared camera and thermodetector

AREA OF THE PLANT AFFECTED: Isolation of the steam network

FINDINGS CONCERNING EXISTING CONDITIONS:

The factory is located on a very big area so the steam has to be supplied through long pipe sections. The isolation is abused, there are damages at many places. The material being used is not modern, the efficiency of the insulation system is not more satisfactory.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

It seems to be useful to purchase an infrared camera and a thermodetector in order to identify the leakage in the network and to estimate the losses. The most critical sections have to be identified and the replacement of the insulation has to be started at this locations.

Using the infrared camera the temperature of the electrical connection in the cells for the electrolysis can be measured in order to find the connection having a too high electrical resistance. The maintenance and the replacement of the connectors can be optimized using this method.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				/year	
Baseline – existing conditions			1.850.000 GJ			758.5	mFt
After recommended action			1.846.000 GJ			756.9	mFt
Net reduction			4.000 GJ			1.6	mFt(a)

COST-BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design		
Equipment procurement		
Equipment installation		
Equipment commissioning		
TOTAL INSTALLED COST	900.000,–(b)	
Estimated increase in annual (non-energy) operations and maintenance cost	120.000,–(c)	

PAYBACK PERIOD:

$$\frac{b: 900.000,-}{a: 1.600.000,- \quad c: 120.000,-} = 0.61 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 3

Plant name:
Address:

Auditor's name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: Correction of the power factor on the 0,4 kV network

AREA OF THE PLANT AFFECTED: Concerning the supply area of the transformer TR31

FINDINGS CONCERNING EXISTING CONDITIONS:

The transformer TR31 has to carry the highest load although there is no capacitor bank installed at all. The actual power factor is equal to 0.85 and in this way an extra fee of 6% has to be paid for the utility.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Installing a 200 kVAr capacitor bank a power factor of 0.95 can be achived. In this case the utility offers a 3 % bonus /instead of 6 % extra fee /.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				/year	
Baseline – existing conditions	500	4464				19.87	mFt
After recommended action	500	4464				18.19	mFt
Net reduction	–	–				1.68	mFt (a)

COST – BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design		
Equipment procurement		
Equipment installation		
Equipment commissioning		
TOTAL INSTALLED COST	600.000,– (b)	

Estimated increase in annual (non-energy) operations and maintenance cost 20.000,– (c)

PAYBACK PERIOD:

$$\frac{b: 600.000}{a: 1.680.000,- \quad c: 20.000,-} = 0.36 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 4

Plant name:
Address:

Auditor s name:

Report date:

ACTION NO. AND BRIEF DESCRIPTION: Instrumentation for produced steam metering

AREA OF THE PLANT AFFECTED: Central boiler house, 3 pcs 40-bar and 2 pcs 6-bar boiler

FINDINGS CONCERNING EXISTING CONDITIONS:

The actual heatflow at the inlet and outlet of the pipe sections /supply point and consumers connection/ is not measured at all. The billing is based on an estimated heat consumption using the volumetrical data of the building. The losses along the pipeline are not identified yet.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Performing an accurate measurement the losses can be decreased and the more accurate billing could contribute to a more efficient energy usage at the consumers.

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				/year	
Baseline – existing conditions			1.850.000 GJ			758.5	mFt
After recommended action			1.844.000 GJ			756.0	mFt
Net reduction			6.000 GJ			2.5	mF (a)

COST – BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design		
Equipment procurement		
Equipment installation	100.000,–	
Equipment commisssioning		
TOTAL INSTALLED COST	3.600.000,– (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	30.000,– (c)	

PAYBACK PERIOD:

$$\frac{b: 3.600.000,-}{a: 2.500.000,- \quad c: 30.000,-} = 1.46 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

REGIONAL EASTERN EUROPE ENERGY EFFICIENCY PROJECT -- HUNGARY

FINAL ENERGY AUDIT REPORT

for work at

Richter Gedeon Rt.

by

Gyorgy Viragh, CEM

Kontravill, Inc.

for

Hagler Bailly Consulting, Inc.

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ENERGY AUDIT REPORT
Prepared for
USAID and RCG/Hagler Bailly

1. Plant information

Name of Enterprise: CHEMICAL WORKS OF GEDEON RICHTER

Address: HUNGARY
H-1103 BUDAPEST
GYÖMRŐI ÚT 19-21.

Telephone:

Fax:

Contact Person: ATTILA, TOMCSÁNYI

Title: Head of En. Division

Telephone:

2. Energy auditor information

Dates - audit started: 11. 04. 1994. audit completed: 11. 05. 1994.

Energy audit company: KONTRAVILL

Energy audit team leader: György, Sz. Tóth Ph.D.C.E.M.

Address: 1154 Budapest, Domaháza u. 28.
Hungary

Telephone: (36-1) 271-9553

Fax: (36-1) 271-9553

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3. Energy audit information

Energy audit focus - describe the major tasks, or areas of the plant, which were investigated during the energy audit:

Gas fired steam generating plant

Cooling system

Air compressor system

Water treatment

Electric power supply

Energy efficiency - in the energy auditor's opinion, what were the most significant findings of the energy audit:

Energy loss on condens water system

and on ATLAS COPCO system

New experience - in the energy auditor's opinion, what were the most significant lessons learned during the energy audit:

There are consumers without measurement

and the existing measuring points

aren't connected with central data

collection basis

4. Energy savings

List the energy efficiency measures ALREADY IMPLEMENTED, during the course of the audit (if any):

Description of measure	Fuel saved	Savings/units	Payback
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years
_____	_____	_____/year	_____years

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4. Historical production and energy consumption

1. Summarize the recent production and energy consumption at the plant in physical units (also list the type of units per year, i.e. tons/year, kWh/year etc.):

Year:	1990	1991	1992	1993	UNITS
Production:					
Product value	13717	13058	10743	15500	10^6 HUF
Energy:					
heavy fuel oil:	-	-	-	-	-
diesel fuel oil:	-	-	-	-	-
natural gas:	9201	6682	7829	8761	10^3 m^3
	98856	114499	113882	116205	10^3 Ft
coal:	-	-	-	-	-
electricity:	47210	40955	36632	40724	MWh
	177879	193485	181789	189108	10^3 Ft
steam:	157	162	124	127	10^3 t
	98091	144861	125951	155960	10^3 Ft
other (describe):					
Total gas + steam	196947	259360	239833	272168	10^3 Ft/y
Electr.	177879	193485	181789	189108	10^3 Ft/y
Energy/Production index:					
thermal	1,43	1,98	2,23	1,75	Ft/Ft
electrical	1,29	1,48	1,69	1,22	"

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5. Historical energy costs

Summarize the recent energy cost at the plant, for the base year of the audit and following years, in terms of money per year:

Year:	1990	1991	1992	1993	UNITS
heavy fuel oil:					
diesel fuel oil:					
natural gas:	98856	114499	113882	116205	10^3 Ft/y
coal:					
electricity:	177879	193485	181789	189108	10^3 Ft/y
steam:	98091	144861	125951	155963	10^3 Ft/y
other (describe):					

6. Previous actions

Describe any other projects which resulted in improved energy efficiency that have already been implemented (or are already funded and in-progress), but which were not identified in the energy audit. Describe the project, the source of the idea, the approximate cost of implementing the project, and the source of funding ---

Installation of some 7000 steam traps,

Installation of over 200 electrical sub-meters,

Installation of 26 steam sub-meters,

Replacement to high-efficiency fluorescent lighting,

Complete seal replacement.

7. Detailed forms - required

Complete and attach the following forms:

Fuel, steam, or heat energy consumption - 12 month audit period
(complete for each major fuel type for areas studied)

Steam generation - 12 month audit period (if plant has boiler)

Energy balance - fuel, steam or heat

Electric energy consumption - 12 month audit period

Electric energy generation - 12 month audit period (if plant has generator)

Energy balance - electrical

Action plan - summary of energy efficiency project opportunities

Recommended action - energy efficiency opportunity
(complete one for each recommended action)
(attach additional details if required to justify project)

8. Narrative

Provide any other information which would be useful to USAID and RCG/Hagler Bailly --

_____

_____

_____

_____

_____

FUEL, STEAM OR HEAT ENERGY CONSUMPTION – 12 MONTH AUDIT PERIOD
ENERGY TYPE: NATURAL GAS
Prepared for USAID and RCG/Hagler Bailly

Plant name: R.G. CHEMICAL FACTORY
Address: H-1103 Budapest, Gyömrői út 19-21.

Heat value H = 33,8 MJ/m^3

Auditor's name: Dr. Sz. Tóth - Virágh, G.

Demand charge 287 Ft/MJ/Hr

Report date: 11. 05. 1994.

Supply contract terms:

Fuel or heat supply company's name	GÁZMŰVEK
Contract maximum demand:	18,9 x 10^6 m^3
Minimum charge (cost):	0,236 Ft/MJ
Other:	

CONSUMPTION OR BILLING DATA FOR 12-MONTH AUDIT PERIOD
FOR: (NAME OF ENERGY FORM):

Meter Reading Mo/day/yr	Physical Consumption units = m^3 N	Thermal Consumption GJ	Total Cost 10^3 Ft	Monthly Heating Degree-Days HDD	Heating Index GJ/HDD	Product Index GJ per:	Notes on plant conditions and changes
Jan/31/93	1476171	49895	16751	289	172.6		
Feb/28/93	1509748	51029	17216	280	182.2		
Mar/31/93	1217246	41070	14354	93	441.6		
Apr/30/93	609350	20486	8413	24	853.6		
May/31/93	422055	14350	5893	-	-		
Jun/30/93	644975	22576	9272	-	-		
Jul/31/93	231116	7768	5550	-	-		
Aug/31/93	-	-	3740	-	-		
Sep/30/93	-	-	3740	-	-		
Oct/31/93	386771	13146	5399	42	313.0		
Nov/30/93	1172559	39867	16372	330	120.8		
Dec/31/93	681644	23146	9505	307	75.4		
TOTAL	8371455	282955	116205	1365	174.5		

Note: Heating degree-days based on reference temperature of 12 C

STEAM GENERATION – 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: R.G. CHEMICAL FACTORY
Address: H-1103 Budapest, Gyömrői út 19-21
Auditor's name: Dr. Sz. Tóth - Virágh, Gy.
Report date: 11. 05. 1994.

Boiler characteristics

		1.	2.	3.	
Name/number		1.	2.	3.	
Manufacturer		Duisburg SK.	Duisburg SK.	Duisburg SK.	
Type (firetube/watertube)		Firetube	Firetube	Firetube	
Type (saturated/superheated)		Superheated	Superheated	Superheated	
Capacity (tons/hour)		26,0	26,0	26,0	
Year installed		1970	1974	1986	
Year last major overhaul					
Operational? (yes/no)					
Steam pressure	bar	13	13	13	
Steam temperature	°C	220	220	220	
Stack temperature, after economizer	°C	160	160	160	
Stack gas analysis: percent O2		3,0	3,0	3,0	
Combustion efficiency:	%	85,0	85,0	86,0	
Blowdown analysis: dissolved solids PPM		1500	1500	1500	

x 4,5 bar
xx 11,0 bar
Steam generation 88207 tons
Steam purchased 127000 tons

STEAM GENERATION DATA FOR 12-MONTH AUDIT PERIOD:

	STEAM GENERATION BY PLANT				IMPORTS	STEAM SALES AND DISTRIBUTION TO CONSUMERS						NOTES	
Meter Reading Mo/day/yr	Fuel Consumption GJ	Steam Generation tons	Steam Generation GJ	Monthly Efficiency %	Steam Purchased X GJ	St.purch XX GJ	Purch. total GJ	GJ	GJ	GJ	GJ	Losses & Unaccounted GJ	Unusual Operating conditions
Jan/3193		15684	44991		4999	25886	30885						
Feb/2893		15986	46044		5335	22226	27561						
Mar/3193		12875	36997		4483	22828	27311						
Apr/3093		6381	18397		3325	22405	25730						
May/3193		4512	12886		5755	13750	19505						
Jun/3093		7080	20273		3344	7395	10739						
Jul/3193		2442	6975		5503	18116	23619						
Aug/3193		–	–		4944	21956	26900						
Sep/3093		–	–		5231	31164	36395						
Oct/3193		3984	11477		6195	23831	30026						
Nov/3093		12161	35265		8310	28164	36474						
Dec/3193		7102	20497		11014	30158	41172						
TOTAL	296680	88207	253802	85,5	68438	267879	336317						

ELECTRIC ENERGY CONSUMPTION -- 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Bailly

Plant name: R.G. CHEMICAL FACTORY
Address: H-1103 Budapest, Gyömrői út 19-21.

Auditor's name: Dr. Sz. Tóth - Virágh, Gy.

Report date: 11. 05. 1994.

Electricity contract terms:

Electricity supply company's name	BUDAPESTI ELMŰ RT.
Contract maximum demand (kW):	8000/7000 day/night
Minimum charge (cost):	4,51 Ft/kWh
Other:	T 2 tarifa

CONSUMPTION AND BILLING DATA FOR 12-MONTH AUDIT PERIOD:

Meter Reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Power Factor cos 0	Load Factor	Total Cost	Product. Index kWh per:	Notes on plant conditions and changes
Jan/31/93	2562600	411000	6800		0,974	0.506	13043888		
Feb/28/93	3019500	321200	6700		0,988	0.670	13497572		
Mar/31/93	3527300	326200	6800		0,988	0.697	14701929		
Apr/30/93	2761800	349600	6800		0,991	0.564	13457888		
May/31/93	3205100	346900	7100		0,988	0.607	14043086		
Jun/30/93	3529200	369100	7400		0,988	0.662	15023490		
Jul/31/93	3197400	315400	7100		0,989	0.605	14472664		
Aug/31/93	2552000	341000	7000		0,981	0.490	12490865		
Sep/30/93	3539800	391400	7100		0,987	0.692	15529228		
Oct/31/93	3251800	324400	7200		0,989	0.607	14671774		
Nov/30/93	3621700	349800	7300		0,99	0.689	15807877		
Dec/31/93	3072500	307600	7200		0,989	0.573	14097447		
TOTAL	37840700	4153600				0.613	170837708	0,011	

Peak demand during audit period (kW): 7310

ELECTRIC ENERGY GENERATION - 12 MONTH AUDIT PERIOD
Prepared for USAID and RCG/Hagler Baily

Plant name:
Address: R. G. Chemical Factory

Auditor's name: "Not applicable"

Report date:

Generator characteristics:

Name/number				
Manufacturer				
Capacity (kW):				
Year installed:				
Year last major overhaul:				
Drive type (steam, gas, diesel)				
If steam – Condensing/extraction/backpressure				
Operational? (yes/no)				

GENERATION DATA FOR 12-MONTH AUDIT PERIOD:

	SELF-GENERATION BY PLANT				SOLD TO OTHERS:				PURCHASED FROM OTHERS				NOTES
Meter Reading Mo/day/yr	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Energy Active kWh	Energy Reactive kVARh	Max Demand kW	Max Demand kVA	Unusual Operating conditions
Jan/__/__													
Feb/__/__													
Mar/__/__													
Apr/__/__													
May/__/__													
Jun/__/__													
Jul/__/__													
Aug/__/__													
Sep/__/__													
Oct/__/__													
Nov/__/__													
Dec/__/__													
TOTAL													

ENERGY BALANCE – ELECTRICAL
Prepared for USAID and RCG/Hagler Bailly

Plant name:
Address: R. G. Chemical Factory "Not applicable"

Auditor's name:

Report date:

Item No.	Equipment or Process Description	Connected Load kW	Maximum Load kW	Average Load kW	Load at Peak Billing Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost $/year
TOTAL PEAK DEMAND (equals maximum billing demand)							
TOTAL ELECTRIC ENERGY CONSUMPTION AND COST (equals total billed consumption)							

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 1

Plant name: Richter Gedeon Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994.

ACTION NO. AND BRIEF DESCRIPTION: 1. Lighting efficiency project

AREA OF THE PLANT AFFECTED: Technological building chem. VI.

FINDINGS CONCERNING EXISTING CONDITIONS:

In the building Chemi. VI. there are 67 old lamps with low lighting efficiency and high electric energy consumption.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

To change the old lamps onto new fluorescent lamps each 2 x 36 W with electronical ballast, type el5242

Producer: TUNGSRAM - Schréder Lighting Equipment Co. Ltd.
Hungarian - American Joint-Stock company

Work days 300/year
Lighting operating hours 16 Hrs/day
Total operating hours 4800 Hrs/y

offer attached

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

		Electricity		Fuels, heat and steam:			Total cost	
		Peak kW	Energy MWh/year				HuF /year	
Baseline – existing conditions	4,64 HuF/kWh	33,5	160,8				746112	
After recommended action		4,83	23,15				105440	
Net reduction							638672	(a)

COST–BENEFIT ANALYSIS: Th.HuF

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	500	
Equipment procurement	2445,5	
Equipment installation	13,4	
Equipment commisssioning	–	
TOTAL INSTALLED COST	2508,9 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	-5,9 (c)	

PAYBACK PERIOD:

$$\frac{b: 2508,9}{a: 638672 - c: -5,9} = 3,9 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

3rd quarter of 1994

ACTION PLA[illegible]UMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

Plant name: Richter Gedeon Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994

BASELINE – EXISTING CONDITIONS

67 pcs old lamps 500 W/pc	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Mi Ft /year
BASE CASE				33,5	160800	746112,0

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost HuF /year	Action Project Cost Mi HuF	Action Payback Period (years)
1.	Provide the chem. VI building with new and high efficiency el5242 type lamps				4,83	23150	107440	2508,9	3,9
TOTAL SAVINGS							638.672		
SAVINGS AS PERCENTAGE OF BASE CASE							85,6		

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 2

Plant name: Richter Gedeon Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994

ACTION NO. AND BRIEF DESCRIPTION: 2. obtaining automatic portable fluegas analyser

AREA OF THE PLANT AFFECTED: steamboiler house

FINDINGS CONCERNING EXISTING CONDITIONS:

R. G. uses a fluegas analyser borrowed from Hungarian Scientific Academy

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Getting a new portable fluegas analyser R. G. can spare the borrowing cost, and they can use frequently for boiler control and setting better efficiency

offer attached

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				HuF /year	
Baseline – existing conditions						250.000	
After recommended action							
Net reduction						250.000	(a)

COST – BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Th.HuF Cost	Notes
Engineering design	-	design no necessary
Equipment procurement	661,57	
Equipment installation	-	no installation cost
Equipment commisssioning	-	no commiss. cost
TOTAL INSTALLED COST	661,57	(b)
Estimated increase in annual (non-energy) operations and maintenance cost		(c)

PAYBACK PERIOD:

$$\frac{b: 661,57}{a: 250,0 - c: 0} = 2,64 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

3rd quarter of 1994.

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RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 3

Plant name: R. G. Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994.

ACTION NO. AND BRIEF DESCRIPTION: 3. Steam consumption measuring

AREA OF THE PLANT AFFECTED: boiler house

FINDINGS CONCERNING EXISTING CONDITIONS:

In the boiler house there are 3 boilers supplying steam to a distributor, most of consumers have up-to-date measuring device except boilers.

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Supposing that 4 pcs complete steam measuring instrument will be installed (3 pcs for boilers and 1 pc for selfconsumption) the boiler operation could be more automatical and the energy distributing system would be higher efficient. There are 29 measuring points on the distributing system only the boilerhouse hasn't equipped by meriam instrument (USA) produced accutube flow sensors, getting these instruments the whole steam system will be ready to operate by computer system, and the heat distributing system will up-to-date and more efficient. (Boiler efficiency increasing from 85,5 % to 86,4 %),

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost
	Peak kW	Energy MWh/year	GJ/y		GJ/y	Th.HuF /year
Baseline – existing conditions Self generation			296680		253802	116205
After recommended action			293713		253802	115043
Net reduction			2967			1162 (a)

COST–BENEFIT ANALYSIS:

PROJECT COST ESTIMATE:	Th.HuF Cost	Notes
Engineering design	-	Design is ready
Equipment procurement	4800,0	
Equipment installation	100,0	
Equipment commisssioning	20,0	
TOTAL INSTALLED COST	4920,0 (b)	
Estimated increase in annual (non–energy) operations and maintenance cost	1200,0 (c)	Operator's cost reduction

PAYBACK PERIOD:

$$\frac{b\ 4920,0}{a\ 1162,0 - c\ 1200,0} = 2,08 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

4th quarter of 1994

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ACTION PLAN – SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hegler Bailly

Plant name: R. G. Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994

BASELINE – EXISTING CONDITIONS

	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF /year
BASE CASE	296680					

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost Th.HuF /year	Action Project Cost Th.HuF	Action Payback Period (years)
3.	Meriam Instrument accutube flow sensors installation in boiler house	293713					115043	4920,0	2,08
TOTAL SAVINGS									
SAVINGS AS PERCENTAGE OF BASE CASE									

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

RECOMMENDED ACTION – ENERGY EFFICIENCY OPPORTUNITY
Prepared for USAD and RCG/Hagler Bailly

ACTION NO. 4

Plant name: R. G. Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virégh
Report date: 11. 05. 1994.

ACTION NO. AND BRIEF DESCRIPTION: 4. Application of chesterton seals for waterpumps

AREA OF THE PLANT AFFECTED: Boiler house

FINDINGS CONCERNING EXISTING CONDITIONS:

Present there are used normal shaft seals on feedwater pumps and because of frequently tightening high energy loss appears on the shaft

RECOMMENDED ACTION TO IMPROVE EFFICIENCY:

Instead of old type shaft seals one has to use Chesterton 155 complete seal 316 SS type, by this increases the efficiency, decreases the electric energy consumption with 10 %. Furthermore decreases the maintenance work and by the long life seals the operational costs will be reduced.

Offer attached

EXPECTED RESULTS – EFFECT OF RECOMMENDATION:

	Electricity		Fuels, heat and steam:			Total cost	
	Peak kW	Energy MWh/year				Th.HuF /year	
Baseline – existing conditions	74,0	296,0				1373,4	
After recommended action	66,0	264,0				1224,9	
Net reduction						148,5	(a)

COST – BENEFIT ANALYSIS: Th.HuF

PROJECT COST ESTIMATE:	Cost	Notes
Engineering design	-	no design
Equipment procurement	394,32	for 4 pcs seal
Equipment installation	30,0	mounting
Equipment commissioning	2.0	testing and adjustment
TOTAL INSTALLED COST	426,32	(b)
Estimated increase in annual (non-energy) operations and maintenance cost	-60,0	(c)

PAYBACK PERIOD:

$$\frac{b: 426,32}{a: 148,5 - c: -60,0} = 2,04 \text{ years}$$

RECOMMENDED IMPLEMENTATION SCHEDULE:

3rd quarter of 1994

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ACTION PL[illegible] SUMMARY OF ENERGY EFFICIENCY PROJECT OPPORTUNITIES
Prepared for USAID and RCG/Hagler Bailly

[illegible]NO. 4.

Plant name: R. G. Chemical Factory
Address: H-1103 Budapest, Gyömrői út 19-21.
Auditor's name: Dr. Sz. Tóth - Virágh
Report date: 11. 05. 1994.

BASELINE - EXISTING CONDITIONS

There are 4 pumps with old type seals 2 pumps are running with P = 37,0 kW	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year
BASE CASE				74,0	296000	1373440

SUMMARY OF RECOMMENDED ENERGY EFFICIENCY ACTIONS:

Action No.	Action Description	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Thermal Consumption GJ/year	Electric Peak Demand kW	Electric Energy Consumption kWh/year	Total Energy Cost /year	Action Project Cost	Action Payback Period (years)
4.	Feedwater pump equiping with Chesterton type shaft seal: 155 compl. seal 316 SS				66,0	264000	1224960	394320	2,04
TOTAL SAVINGS						32000	148480		
SAVINGS AS PERCENTAGE OF BASE CASE						10,8			

Note: Assumes that the actions are taken in order of best payback period first, in order to take into account the interaction between the various measures.

P. 12

ENERGY EFFICIENCY

MARKET DEVELOPMENT

Sponsored by:

United States Agency for International Development

Presented by:

Association of Energy Engineers

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ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY
Sponsored by the US Agency for International Development (USAID)
and the Association of Energy Engineers (AEE)

PROGRAM REVIEW MEETING - HUNGARY
November 14, 1996

Location: Gellért Hotel
Attendees: Certified Energy Managers; Plants participating in USAID industrial energy efficiency projects; Representatives of the Ministry of Industry and Trade; USAID and its contractors.
Objective: To discuss and review energy efficiency activities, results and future directions of: (1) support to the development of local energy service companies; (2) establishment of Hungarian Chapters of the Association of Energy Engineers; and (3) energy efficiency project demonstrations.

0830-0900	Registration	
0900-0915	Introduction and Welcoming remarks	Dr. Tamás Jászay, AEE Hungary
0915-0930	AID Hungary - Country Program Description	Bruce Abrams, USAID Hungary
Review of Project Results		
1.	**Demonstration Projects at Industrial Plants**	**Moderator:** Hagler Bailly
0930-1045	Roundtable with managers from plants participating in demonstration projects **Topics:** Concrete results achieved by the plants with the help of the USAID Program Results and lessons learned Benefits of hiring ESCOs	
1045-1100	**Coffee Break**	
1100-1200	**Summarize Results of the Roundtable Discussion**	**Moderator:** Hagler Bailly
1200-1330	**Luncheon with Keynote Speaker** AEE Organization and Future Trends	Al Thumann, AEE
2.	**Support to Energy Service Companies (ESCOs)**	**Moderator:** Hagler Bailly
1330-1345	Introduction (Results of the ESCO Survey, Highlight of some Results and Trends)	Laurent Pommier
1345-1400	Open Discussion	
3.	**Establishment of AEE Chapter**	**Moderator:** Al Thumann
1400-1430	AEE Chapter Status Report	András Morenth, AEE Hungary
1430-1500	Open Discussion	
1500-1515	**Coffee Break**	
4.	**Financing Energy Efficiency - Future Directions**	**Moderator:** Hagler Bailly
1515-1530	Global and regional trends in energy efficiency financing	Laurent Pommier, Hagler Bailly
1530-1615	European Financing Mechanisms. Project Participants' Experiences and Perspectives. Group discussion	*lead by: Laurent Pommier*
5.	**Discussion of Energy Efficiency Issues and Future Cooperation**	**Moderator:** Ira Birnbaum, USAID WDC
1615-1630	Planned USAID technical assistance program	Larry Markel, Electrotek
1630-1700	Group Discussion	
2000	Dinner	Sponsored by Hagler Bailly

AZ ENERGIAHATÉKONYSÁGI PIAC FEJLŐDÉSE MAGYARORSZÁGON
Szponzorálja az Amerikai Egyesült Államok Nemzetközi Fejlesztési Hivatala (USAID)
és az Energiamérnökök Egyesülete (AEE)

PROGRAM ÉRTÉKELŐ TANÁCSKOZÁS
1996. november 14.

Helyszín: Gellért Szálló, Budapest
Résztvevők: Minősített Energia Menedzserek; Üzemek képviselői, akik részt vettek a USAID energia hatékonysági projektjeiben; az Ipari és Kereskedelmi Minisztérium képviselői; a USAID képviselői és szerződött partnerei.
Célkitűzés: Megvitatni és áttekinteni az energiahatékonysági tevékenység eredményeit és jovőbeni irányait, beleértve: (1) a helyi ESCO-knak nyújtott támogatást; (2) az Energiamérnökök Egyesülete Magyar Tagozatának létrehozását; (3) az energiahatékonysági demonstrációs projekteket.

0830-0900	Regisztráció	
0900-0915	Bevezető és üdvözlés	Dr. Jászay Tamás, elnök, AEE Magyar Tagozat
0915-0930	A USAID magyarországi programja	Bruce Abrams, USAID Hungary

A projekt eredményeinek áttekintése

1.	**Demonstrációs projektek ipari üzemekben**	**Moderator:** Hagler Bailly
0930-1045	Kerekasztal beszélgetés a demonstrációs projektekben részt vett üzemek vezetőivel. **Téma:** Konkrét eredmények, amiket az üzemek a USAID program segítségével értek el. Eredmények és tanulságok Energia konzulensek (ESCO-k) igénybevételének előnyei.	
1045-1100	**Kávészünet**	
1100-1200	**A kerekasztal konferencia eredményeinek összefoglalása**	**Moderator:** Hagler Bailly
1200-1330	**Ebéd egy kiemelt téma előadójával** Az AEE szervezete és jövőképe	Al Thumann, AEE Atlanta
2.	**Energiakonzulens cégek támogatása**	**Moderator:** Hagler Bailly
1330-1345	Bevezetés (A konzulens [ESCO] cégekkel kapcsolatos felmérés eredményei; néhány eredmény és tendencia kiemelése)	Laurent Pommier
1345-1400	Nyílt vita	
3.	**Az AEE Magyar Tagozat létrehozása**	**Moderator:** Al Thumann, AEE
1400-1430	Beszámoló az AEE Magyar Tagozatról	Morenth András, alelnök, AEE Magyar Tagozat
1430-1500	Nyílt vita	
1500-1515	**Kávészünet**	
4.	**Az energiahatékonyság finanszírozása - a jövő irányai**	**Moderator:** Hagler Bailly
1515-1530	Globális és regionális finanszírozási tendenciák	Laurent Pommier, Hagler Bailly
1530-1615	Európai finanszírozási mechanizmusok. Projekt résztvevők tapasztalatai és kilátásai. Csoport beszélgetés.	*vezeti: Laurent Pommier*
5.	**A jövőbeni együttműködés megvitatása**	**Moderator:** Ira Birnbaum, USAID WDC
1615-1630	A USAID tervezett műszaki támogatási programja	Larry Markel, Electrotek Concepts, Inc.
1630-1700	Csoport beszélgetés	
2000	Vacsora	Szponzorálja: Hagler Bailly

ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY
Sponsored by the US Agency for International Development (USAID)
and the Association of Energy Engineers (AEE)

OPEN CONFERENCE - HUNGARY
November 15, 1996

Location: Gellért Hotel

Attendees: Representatives from industrial and institutional enterprises nominated by the AEE members; Plants and vendors who participated in USAID Industrial Energy Efficiency Project and Emergency Energy Project; AEE members; Certified Energy Managers; Representatives from Government Ministries and agencies, utilities, and other assistance programs; USAID and its contractors.

Objective: To promote a market-oriented approach to energy efficiency

0800-0830	Registration		
0830-0845	Welcoming Remarks	Dr. Miklós Poós,	General Director, Ministry of Industry and Trade
0845-0900	AEE in Hungary	Dr. Tamás Jászay,	AEE Hungary

Results of Demonstration Projects — **Moderator:** Hagler Bailly

CEM presentations with Plant Energy Managers

	CEM	Plant
0900-0930	György Virágh, Kontravill Kft.	Richter Gedeon Rt., Komló Fűtőerőmű Rt.
0930-0945	Ed Corcoran, CENTECH Kft.	Dunapack Rt.
0945-1015	Dr. Albin Zsebik, JOMUTI Kft.	Dunaqua-therm Rt, DUNAFERR Energiaszolgáltató Kft.

1015-1030 **Coffee Break**

1030-1045 **Role of USAID in Hungary** — Tom Cornel, USAIDRep in Hungary

Continuation of CEM Presentations

1045-1115	Dr. Mihály Szaniszló, Rendszertechnika Kft.	NITROKÉMIA Rt., Észak-Magyarországi Vízművek Rt.
1115-1145	Miklós Gellért, Innovative Engineering Bureau	Mohácsi Farostlemezgyár Rt.(MOFA); Baranya Hospital
1145-1215	Open Discussion	

1215-1330 **Luncheon with Keynote Speaker** — Al Thumann, Executive Director, AEE
Developments in the Global Energy Efficiency Market
CONCURRENT PRESS CONFERENCE

AEE Chapter — **Moderator:** Al Thumann, AEE

1330-1345	Presentation of AEE	Al Thumann, AEE
1345-1400	AEE Chapter in Hungary	András Morenth, AEE Hungary
1400-1415	Open Discussion	

Financing Energy Efficiency Projects in Hungary — **Moderator:** Hagler Bailly

1415-1430	Global and regional trends in energy efficiency financing	Laurent Pommier, Hagler Bailly
1430-1515	European Financing Mechanisms,	*Invited: Ian Brown - H-EU Energy Center* *Mrs. Borbála Czakó, HEC* Czakó borbála *György Verő,* Verő György *Attila Bogdán, UNICBANK*

1515-1530 **Coffee Break**

Future Cooperative Assistance Programs — **Moderator:** Ira Birnbaum, USAID WDC

1530-1600	Current USAID Technical Assistance Program	Larry Markel, Electrotek Concepts, Inc.
1600-1700	Open Discussion	

1700-1715 **Concluding Remarks** — Ira Birnbaum, USAID WDC
Bruce Abrams, USAIDRep Office, Hungary
Dr. Tamás Jászay, AEE Hungary

1715-1830 **Conference Networking Meeting**

AZ ENERGIAHATÉKONYSÁGI PIAC FEJLŐDÉSE MAGYARORSZÁGON
Sponzorálja az Amerikai Egyesült Államok Nemzetközi Fejlesztési Hivatala (USAID)
és az Energetikai Mérnökö Egyesülete (AEE)

NYÍLT KONFERENCIA
1996 november 15.

Helyszín: Gellért Szálló

Meghívottak: Ipari vállalkozások és intézmények AEE tagok által meghívott képviselői; üzemek és beszállítók, akik részt vettek a USAID Ipari Energiahatékonysági Projektjében és a Szükségállapoti Energia Projektben; AEE tagok; minősített energia menedzserek (C.E.M.); kormányzati szervezetek, közművek és más támogatási programok képviselői; a USAID képviselői és szerződött partnerei.

Célkitűzés: Az energiahatékonyság piacorientált megközelítésének elősegítése

0800-0830	Regisztráció	
0830-0845	Üdvözlet és bevezetés	Dr. Poós Miklós főosztályvezető, IKM
0845-0900	Az AEE Magyarországon	Dr. Jászay Tamás, elnök AEE Magyar Tagozat
Demonstrációs projektek eredményei		**Moderátor:** Hagler Bailly
	Konzulensek beszámolói az érintett üzemek, intézmények képviselőivel együtt	
	C.E.M.	Üzem, intézmény
0900-0930	Virágh György, Kontravill	Richter Gedeon Rt, Komlói Fűtőerőmű Rt.
0930-0945	Ed Corcoran, CENTECH	Dunapack Rt.
0945-1015	Dr. Zsebik Albin, JOMUTI Kft.	Dunaqua-therm Rt., DUNAFERR Energiaszolgáltató Kft.
1015-1030	**Kávészünet**	
1030-1045	**A USAID szerepe Magyarországon**	Tom Cornel, a USAID képviselője Magyaroraszágon
	a konzulens beszámolók folytatása	
1045-1115	Dr. Szaniszló Mihály, Rendszertechnika Fejl. Kft.	NITROKÉMIA Rt., Északmagyarországi Vízművek Rt.
1115-1145	Gellért Miklós, Innovációs Mérnök Iroda, BT.	Mohácsi Farostlemez Gyár, Baranya megyei Kórház
1145-1215	Nyílt vita	
1215-1330	**Ebéd egy kiemelt téma előadójával**	
	A globális energiahatékonysági piac fejlődése	Al Thumann, Executive Director, AEE
	EZIDŐBEN SAJTÓKONFERENCIA A GOBELIN TEREMBEN	
Az AEE Magyar Tagozata		**Moderator:** Al Thumann, AEE
1330-1345	Az AEE bemutatása	Al Thumann, AEE
1345-1400	Az AEE Magyar Tagozata	Morenth András, alelnök
1400-1415	Nyílt vita	AEE Magyar Tagozat
Energiahatékonysági projektek finanszírozása Magyarországon		**Moderator:** Hagler Bailly
1415-1430	Globális és regionális finanszírozási tendenciák	Laurent Pommier, Hagler Bailly
1430-1515	Európai finanszírozási mechanizmusok	*Meghívottak: Ian Brown, Magyar-EU Energia Központ* *Czakó Borbála, IFC* *Verő György,* *Bogdán Attila, UNICBANK*
1515-1530	**Kávészünet**	
Jövőbeni kooperativ támogatási programok		**Moderátor:** Ira Birnbaum, USAID WDC
1530-1600	A jelenlegi USAID Műszaki Segítség Program	Larry Markel, Electrotek Concepts, Inc.
1600-1700	Nyílt vita	
1700-1715	**Záró megjegyzések**	Ira Birnbaum, USAID WDC Bruce Abrams USAID Hungary Dr. Jászay Tamás, AEE Hungary
1715-1830	**Kötetlen, kapcsolatépítő beszélgetés**	

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Budapest Conference on Energy Efficiency, 1996. List of responses to Invitation to the Meeting and Conference.
Please note: 1., Negative response is marked by **NO** and the whole line is shaded.
2., Attendance at the November 15 Open Conference is marked by **Y**, for both of the days is marked by **Y-2**
3., Numbers refer to the original list. Data are corrected upon the basis of responded ones.

74. **Y**		Selmeczi	András	energetikus Energy Manager	HUNGRANA Keményítő Kft.	H-2432 Szabadegyháza Ipartelep	(22)312-661	(22)328-920	MESZ; Fonth Zoltán helyett Substitutes for Mr. Z. Fonth
76. **Y**		Fülöp	István	gazdasági vezető	Sopronkőhida Fegyház / Börtön Sopronkőhida Penal Institution	H-9407 Sopronkőhida Pesti Barnabás utca 25.	(99)312-170	(99)312-170 /Ext.183	
88. **Y**		Gáthy	Róbertné	osztályvezető Department Head	Pénzügymin. Vállalkozási Oszt. Min.of Fin.,Dept. of Undertaking	H-1051 Budapest József nádor tér 2.	(1)118-2066	(1)118-2570	Ipari és Kereskedelmi Osztály Dept. for Industry and Trade
89. **Y**		Gelencsér	István	osztályvezető Department Head	Fővárosi Vízművek Rt. Capital City Water Works Plc				vízgazdálk. üzemv./fejlesztés Water Mngmt/Oper./Dev.mt
90. **Y-2**		Gellért	Miklós	ügyvezető igazgató Managing Director	Gellért Innovációs Mérnöki Iroda BT.	H-7635 Pécs, Barackos út 24.	(72)313-107	(72)313-107	C.E.M, az AEE Tagozat tagja Chapter Founding Member
91. **Y**	Dr.	Gémesi	György	elnök President	Magyar Önkorm. Szövetsége Hungarian Municipality Leage	H-2100 Gödöllő, Szabadság tér 1.	(28)320-120	(28)330-180	érdekképviselet Representation of Interest
94. **NO**		Gőbölös	Kálmán	energiaellátási o.v. En. Supply D. Head	Szekszárdi Húsipari Vállalat Szekszárd Meatworks	H-7100 Szekszárd Keselyűsi út 24.	(74)412-166	(74)416-418	MESZ
98. **NO**		Gönnert	Gábor	főosztályvezető Division Head	FŐTÁV Rt. Capital City DH Company Ltd.	H-1116 Budapest Kalotaszegi út 31.	(1)185-3385	(1)203-0543	távhő üzem / műszaki fejl. DH O&M/Techn. Devlpment
104. **Y-2**		Halas	György	főosztályvezető Division Head	NITROKÉMIA Rt.	H-8184 Fűzfő Gyártelep Pf.:45	(88)352-178	(88)351-240	műszaki fejlesztés Technical Development
105. **Y**		Halász	Ferenc	osztályvezető Department Head	Magyar Energia Hivatal (MEH) Hungarian Energy Office	H-1081 Budapest, Köztársaság tér 7.	(1)210-0348	(1)117-1330	Energiatakarékossági Osztály Dept.for Energy Conservation
109. **Y**		Hanzéli	György	főtanácsos Senior Counsellor	Mezőgazdasági Minisztérium Ministry for Agriculture	H-1055 Budapest Kossuth Lajos tér 11.			
112. **Y**	Mrs	Hegedűs	Ágnes	főosztályv.helyettes Dep.General Dir.	Magyar Nemzeti Bank National Bank of Hungary	H-1850 Budapest Szabadság tér 8/9.	(1)112-1428	(1)302-3711	nemzetközi programkoord. Intn'al Program Coordination
113. **Y**		Hegedűs	Ferenc	főenergetikus Chief Energy Mgr.	EGIS Gyógyszergyár Rt	H-1108 Budapest Keresztúri út 30.		(1)265-5523	
118. **Y**	Dr.	Hidegkuti	Gyula	műszaki igazgató Technical Director	APV Hungary Kft.	H-1222 Budapest, Háros utca 7.	(1)227-4496	(1)227-4501	hőcserélők, hőközpontok Heat Exchangers, Centers
123. **Y-2**	Dr.	Homonnay	Géza	ügyvezető igazgató Executive Director	GAMAX Kft.	H-1122 Budapest, Csaba utca 24/A.	(1)155-3016	(1)175-3134	Hagler Bailly Consulting, Inc. Contact to the AEE Chapter
124. **Y**		Honhalmi	József	főenergetikus Chief Energy Mgr.	MEZŐGÉP Rt.	H-5000 Szolnok Tószegi út 47.		(56)424-322	
132. **Y**	Mrs	Imrei	Józsefné	főenergetikus Chief Energy Mgr.	Budapest XV.ker Polgm.Hivatal Bp. XV District Mayor's Office	H-1153 Budapest Bocskai utca 1/3.	(1)169-1561	(1)306-3185	MESZ; Önk. Pénzügyi Oszt. Municipality Financial Dept.
133. **Y**		Geszti	Sándor	Commercial Specialist	US Embassy Commercial Section	H-1054 Budapest Szabadság tér 7.		(1)302-0089	Imrik Andrea helyett Substitutes for Mrs A.Imrik
136 **Y-2**	Dr.	Jászay	Tamás	egyetemi docens University Docent	BME Energetika Tanszék	H-1521 Budapest, Műegyetem rpt. 9	(1)463-2559	(1)463-3273	az AEE Tagozat elnöke Chapter President

RESPLIS2.DOC
October 24, 1996
1. kiegészítés 1996 október 28.
2. kiegészítés 1996. október 30.
3. kiegészítés 1996. november 7.
4. kiegészítés 1996. november 12.

Budapest Conference on Energy Efficiency, 1996. List of responses to Invitation to the Meeting and Conference.

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137. Y		Eisenbacher	György	főenergetikus Chief Energy Mgr.	Csepel Autógyár Kft. Csepel Automobil Factory	H-2311 Szigetszentmiklós Gyártelep, Pf.:17	(24)366-563	(24)366-277	Jávor Ernő helyett Replaces Ernő Jávor
139. Y		Juhász	Béla	ügyvezető igazgató Managing Director	Alföldi Téglaipari Kft. Lowlands Brick Factory, Ltd.	H-5400 Mezőtúr Földvári út 6.			
144. Y		Kálmán	György	igazgató Director	Tiszai Vegyi Kombinát Rt. Tisza Chemical Works Ltd.	H-3580 Tiszaújváros, Pf.:20	(49)321-714	(49)321-322	MESZ
145. Y	Mrs	Kapelnerné Szőnyei	Éva	főenergetikus, Chief Energy Mgr.	Népjóléti Minisztérium Ministry for Public Welfare	H-1051 Budapest Arany János u. 6-8.		(1)331-5572	NM Beruházás Min. of Welfare, Investmtent
149. Y		Kassai	Róbert	alelnök Vice President	IPOSZ National Association of SMEs	H-1054 Budapest, Kálmán utca 20.	(1)269-2948	(1)269-2947	kis-és középváll. érdekképvis. nationw. represent'n of SMEs
152. Y-2		Katona	Zoltán	doktorandus	BME Energetika Tanszék	H-1521 Budapest, Műegyetem rpt. 9.	(1)463-2632	(1)463-3273	AEE diák tag, Student Memb. Int.:katona@cta.enrg.bme.hu
155. Y-2		Keller	Péter	energiagazd. vezető Energy Branch Mgr	Landis & Gyr Magyarország Kft. Landis & Gyr Hungary Ltd.	H-1134 Budapest, Váci út 37.	(1)270-4000	(1)270-4005	az energia ágazat vezetője Head of Energy Conservation
160. Y		Kis	István	tanácsos	Magyar Nemzeti Bank National Bank of Hungary	H-1850 Budapest Szabadság tér 8/9		(1)302-3711	
161. NO		Kiss	Árpád	osztályvezető Department Head	Budapesti Elektromos Művek Rt. Budapest Electric Works, Ltd.	H-1132 Budapest Váci út 72-74.			
165. Y		Kiss	Olivér	főenergetikus Chief Energy Mgr.	Rába Vagon és Gépgyár Rába Wagon and Machine Fact.	H-9027 Győr Budai út 1.			
168. Y		Kissomlyói	György	irodavezető Office Head	Épületfenntartási Alapítvány Building Mngmt Foundation	H-1061 Budapest Paulay Ede u. 6.	(1)268-0574	(1)268-0575	épületgazdálk.; fontos partner Building Mngmt, pot. partner
169. Y	Mrs	Kocsi	Zsuzsanna	főmunkatárs Senior Assistant	Tiszai Vegyi Kombinát Rt. Tisza Chemical Works Ltd.	H-3580 Tiszaújváros, Pf.:20	(49)321-714	(49)321-322 (49)321-580	MESZ; Műszaki Szolgáltatási Igazgatóság
170. NO	Dr.	Kocsis	István	vezérigazgató General Manager	ÁPVRT State Priv.and Asset Mgment Co	H-1133 Budapest Pozsonyi út 56.			
172. NO		Komlósi	József	manager	DMS Hungary, Armstrong, Bacharach, UE Sytems Repres.	H-1027 Budapest Csalogány u.3/b.	(1)201-3328 (60)338-602		
174. Y		Körmendi	Gábor	főenergetikus Chief Energy Mgr.	Csepeli Csőgyár Rt. Csepel Tube Factory, Ltd.	H-1221 Budapest Gyepsor utca 1.		(1)276-7970	
176. Y		Kovács	Árpád	vill. főosztályvez. Head, Elect.Divis'n	MOL Rt. FLÜ DF	H-2443 Százhalombatta Pf.:1	(23)354-322	(23)354-191	hatékony villamos üzem Efficient Electric Operation
178. Y		Kovács	János	energetikus Energy Manager	MÁV Rt. Üzemigazgatósága Szeged	H-6701 Szeged, Tisza L. krt.28-30	(62)311-826	(62)314-696	MESZ
184. Y	Mrs Dr.	Czappné Varga	Ilona	forg. műsz. igh. Serv.Techn.Dp.Dir.	Debreceni Közlekedési Vállalat; Debrecen Transport Company	H-4024 Debrecen, Blaháné u.2	(52)315-216	(52)315-216	MESZ; Krista Géza helyett Subsitutes for Mr. G. Krista
191. Y		Láng	Géza	főenergetikus Chief Energy Mgr.	Nitrogénművek Rt. Nitrogen Works, Ltd.	H-8105 Várpalota			

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192. **Y**		László	György	cég képviselő Company Repres.	ABB Power Generation Kft.	H-1138 Budapest Váci út 154.	(1)269-8725	(1)269-8721	előreszigetelt csövek Preinsulated Pipelines
193. **Y-2**		László	Tamás	területi igazgató Area Director	Landis & Gyr Magyarország Kft. Landis & Gyr Hungary Ltd.	H-1134 Budapest, Bulcsú utca 21/b.	(1)149-9681 (30)523-948	(1)149-9681	energiamegtak. projektek Energy Efficiency Projects
195. **Y-2**		Lénárt	László	osztályvezető Department Head	É-m.o.-i Regionális Vízmű Rt North-Hung. Waterworks Co.	H-3701 Kazincbarcika Tardonai út 1.	(48)311-726	(48)313-728	Műszaki fejlesztés Technical Development
200. **Y**		Lontay	Zoltán	irodavezető Bureau Head	GEA/EGI, Contr. / Engineering Co. Ltd.	H-1027 Budapest, Bem rakp. 33-34.	(1)201-8652 (20)463-356	(1)201-9646	energiagazd. proj. szervezés En. Efficiency Project Mngmt
202. **Y**		Mádai	Sándor	osztályvezető Department Head	MOL Rt KTÁ Div. for Explor. and Production	H-6701 Szeged, Pf.:1333	(62)322-120	(62)322-120	
204. **Y**	Dr.	Magyar	Zoltán	energia menedzser Energy Manager	APV Hungary Kft	H-1222 Budapest, Háros utca 7.	(1)226-5598	(1)227-4501	
206. **Y-2**	Dr.	Majoros	Imre	ügyvezető igazgató Managing Director	IMPACK Kft	H-1092 Budapest, Ráday utca 60.	(1)217-4014	(1)217-4014	C.E.M.,az AEE Tagozat tagja Chapter Founding Member
208. **Y**		Marton	Ferenc	kulcsfogyasztó mg. key-consumer mng.	DÉDÁSZ Rt	H-7601 Pécs, Pf.:85	(72)441-022	(72)447-353	MESZ
209 **Y-2**		Marton	Tamás	végzett egy. hallg. Grad. Univ.Student		H-7634 Pécs, Liliom utca 27.	Budapesten: (1)112-5268		AEE diák tag, Student Memb. Int.net:trefl7@sparta.banki.hu
211. **Y**	Dr.	Martonosi	György	igazgató Director	Városgazdálkodási Rt. Municipal Management Co.	H-6900 Makó, Návay Lajos tér 5-7.	(62)412-788	(62)411-412	
212. **Y**		Máté	András	főenergetikus Chief Energy Mgr.	Kabai Cukorgyár Rt. Kaba Sugar Factory, Ltd.	H-4183 Kaba			
214. **Y**	Mrs	Mátyás	Péterné	főenergetikus Chief Energy Mgr.	Budapesti Közlekedési Vállalat Budapest Public Transport Co.	H-1980 Budapest, Pf.:11	(1)322-7859	(1)322-7859	MESZ
215. **Y**		Megyer	Tibor	főenergetikus Chief Energy Mgr.	Aranybulla Rt.	H-8000 Székesfehérvár Fehérvári út 44.		(22)315-395	
226. **Y-2**		Morenth	András	tanácsadó consultant		H-1122 Budapest, Tóth Lőrinc ut. 4.	(1)155-2784	(1)116-2691	az AEE Tagozat alelnöke Chapter President Elect
227 **Y-2**		Mudra	József		DUNAFERR Szolgáltató Kft. DUNAFERR Supply Co. Ltd.	H-2401 Dunaújváros Vasmű tér 1-3.	(25)381-186	(25)312-658	
233. **Y**		Nagy	György	tanácsadó Advisor	HESCO Hungary	H-1051 Budapest Sas utca 11.		(1)133-0387	KELEG Kft., SUD-EST Kft.
241. **Y**		Néda	László	üzemvezető Works Manager	VIDEOTON Holding Rt. Ipari Park Vállalat	H-8000 Székesfehérvár Pf.:253		(22)313-540	
245. **Y**		Németh	János	főenergetikus Chief Energy Mgr.	Simontornyai Bőrgyár Rt. Simontornya Tannery, Ltd.	H-7081 Simontornya Gyár utca 1-5.			
246. **NO**		Németh	Lajos	elnök Chairman	MESZ. Hungarian Federation of Energy Consumers	H-1055 Budapest Kossuth Lajos tér 6-8.	(1)138-4049	(1)266-6269	

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249. **Y-2**		Neszmélyi	György	elnök-igazgató Chairman and CEO	DUNAQUA-THERM Rt.	H-2400 Dunaújváros Építők útja 7.	(25)311-332	(25)313-623	távhőszolgáltatás DH distribution
254. **NO**		Olajos	Dezső	főigazgató Director in Chief	Műszaki Biztonsági Főfelügyelet Technical Safety Supervisorate	H-1012 Budapest, Attila utca 99.	(1)156-3802	(1)175-8802	
255. **Y**		Orbán	József	vezérigazgató General Manager	É-m.o.-i Regionális Vízmű Rt North-Hung. Waterworks Co.	H-3701 Kazincbarcika Tardonai út 1.	(48)311-726	(48)313-728	Vízgazdálkodás, fejlesztés Water Mngment, Developm.
265. **Y**		Papp	István	főenergetikus Chief Energy Mgr.	MOL Rt.	H-5000 Szolnok Ady Endre u. 20.			
266. **Y**		Parázs	Géza		Szegedi Közlekedési Kft. Szeged Public Transport Co. Ltd.	H-6720 Szeged, Zrínyi u. 4-6.	(62)313-211 Extn. 11		MESZ
269. **Y**		Pécs	János		Békés Megyei Vízművek Rt. Békés County Water Works Co.	H-5601 Békéscsaba, Pf.:96	(66)452-015	(66)441-589 (66)441-708	MESZ
272. **NO**	Dr.	Péterfia	Tamás	ügyvezető igazgató Executive Director	AVKKF Baranya Megyei Vállalkozási Központ	H-7623 Pécs Rákóczi u. 24.			AVKKF Baranya County Enterpreneurial Center
273. **Y**		Pétervári	László		Merlin Gerin VERTESZ Vill.Rt. M. G. V. Electrical Works	H-1509 Budapest Pf.:7	(1)203-0380	(1)203-0380	MESZ
277. **Y**		Pintér	Antal	kuratórium elnök Board Chairman	Német Szénsegély Alapítvány German Coal Aid Fund	H-1880 Budapest Pf.:74 POB 74	(1)201-4215	(1)118-0257	kedvezményes forgó hitelalap Pref. Revolving Credit Fund
279. **Y**		Pisák	István		Miskolc Városi Közlekedési Rt	H-3502 Miskolc 2 Pf.:226	(46)349-211 Extn. 146	(46)348-201	MESZ
283. **Y-2**	Dr.	Poós	Miklós	főosztályvezető General Director	IKM Ministry of Industry and Trade	H-1051 Budapest, Vigadó utca 6.	(1)118-4655	(1)118-0257	Energia koordináció Energy Coordination
286. **NO**		Porpáczy	Dezső	alelnök, ügyv.ig. VP, Exec. Director	MESZ Hungarian Federation of Energy Consumers	H-1055 Budapest Kossuth Lajos tér 6-8.	(1)153-3333	(1)153-4069	
289. **Y**		Radnay	József	főelőadó senior assistant	Büntetésvégrehajtás Orsz. Psága Nat'l Headqu.s Penal Authority	H-1361 Budapest 501 Pf.:15			en.gazd. 36 BV intézményben En. Mngmt in 36 Penal Inst'n
290. **Y**	Dr.	Rádonyi	László	tanszékvezető Department Head	BME Energetika Tanszék BTU Department for Energy	H-1521 Budapest Műegyetem rpt. 9.	(1)463-2203	(1)463-3273	
291. **Y**		Rakonczai	Róbert	műszaki vezető technical director	Váci Távhő Kft. Vác District Heating Co., Ltd.	H-2800 Vác Zrínyi út 9.		(27)311-426	
293. **Y**		Rév	Zoltán	főmérnök Chief Engineer	Szent Rókus Kórház Saint Roch Hospital	H-1085 Budapest Gyulai Pál utca 2.		(1)226-2768	
296. **Y**	Dr.	Salamon	Gábor	befekt. tanácsadó Investment Advisor	XIII. ker. Önkormányzat XIII. District Municipality	H-1132 Budapest, Váci út 16. II./8.	(30)421-761	(1)302-2891	projektelők., a XIII. ker.ben Project Prep., in XIII District
299. **NO**	Dr.	Sándor	Péter	energetikus Energy Manager	DUNAFERR En.szolgáltató Kft. DUNAFERR En.Supply Co. Ltd	H-2401 Dunaújváros Vasmű tér 1-3.	(25)381-186	(25)312-658	MESZ; felkért előadó Project Client, Speaker
308. **Y-2**		Sitku	György	doktorandus	BME Rendszertechnika Tanszék Dept. of System Engineering	H-1056 Budapest, Havas utca 3.	(1)117-2682		AEE diák tag Chapter Student Member

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309. Y		Kámán	Géza	irodavezető Office Leader.	Csepel Autógyár Kft. Csepel Automobil Factory Ltd.	H-2313 Szigetszentmiklós Gyártelep, Pf.:17	(24)366-563	(24)366-277	Sólyom István helyett Replaces István Sólyom
310. Y	Dr.	Sólyom	János	irodavezető Office Leader	Tüzeléstechnikai K+F Vállalat R&D in Firing Technics, Co.Ltd.	H-3515 Miskolc Egyetemváros			
311. Y-2		Soós	László	projekt munkatárs Project Specialist	Magyar Termelékenységi Kp. Hungarian Efficiency Center	H-1024 Budapest, Margit krt. 31-33.	(1)343-1945	(1)251-4088	CEM.,az AEE Tagozat titkára Chapter Secretary
314. Y		Stocker	Miklós	műszaki ovh.;Dep. Techn. Dept. Head	Baranya Megyei Kórház Baranya County Hospital	H-7621 Pécs Rákóczi út 2.			
317. Y-2	Dr.	Sz. Tóth	György	energ. tanácsadó Energy Advisor		H-1013 Budapest, Pauler utca 5.	(1)175-9897		C.E.M.,az AEE Tagozat tagja Chapter Member
325. NO	Dr.	Szabó	Pál		HUNGALU Magy. Alum.ip. Rt. Hung. Aluminium Industrial Co.	H-1024 Budapest, Margit körút 85.	(1)156-2937	(1)175-6494	MESZ
329. Y		Szala	Pál	osztályvezető Department Head	É-m.o.-i Regionális Vízmű Rt North-Hung. Waterworks Co.	H-3701 Kazincbarcika Tardonai út 1.	(48)310-811	(48)310-015	Vízgazd., hatékony üzemvitel Water Mngmt, Eff. Operation
332. Y	Mrs	Szalkó	Tiborné	főenergetikus Chief Energy Mgr.	MÁV Rt. Üzletigazgatósága Miskolc	H-3501 Miskolc Szemere utca 26.	(46)358-419	(46)358-460	MESZ
333. Y		Szalóki	András	elnök Chairman	Energia Klub Energy Club	H-1117 Budapest Móricz Zs. körtér 15	(1)181-3393	(1)181-3393	NGO
334. Y-2	Dr.	Szaniszló	Mihály	ügyvezető igazgató Managing Director	Rendszertechnika Fejlesztő Kft. Dvmt of System Engineering Ltd	H-1088 Budapest, Vas utca 15/b.	(1)117-3370	(1)117-3370	C.E.M.,az AEE Tagozat tagja Chapter Member
339.		Szemes	Béla		MATÁV Rt. Hungarian Telecom Corporation	H-1541 Budapest	(1)202-5168		MESZ
346. Y		Szőcs	Mihály	főmérnök Chief Engineer	SZETÁV Szeged DH Company	H-6723 Szeged Csongor tér 1.		(62)475-084	
347. Y		Szőnyi	László.	cég képviselő Project Engineer	APV Hungary Kft.	H-1222 Budapest, Háros utca 7.	(1)227-4469	(1)227-4501	
348. Y	Mrs	Szövényi	Eszter	főtanácsos Senior Counsellor	KTM Ministry for Environment	H-1011 Budapest, Fő utca 44-50.	(1)201-3764	(1)201-2846	Nemzetközi együttműködés International Cooperation
352. Y		Taksz	Károly	főovez.helyettes Dep.Director Gen.	Pénzügymin. Vállalk. Főosztály Ministry of Finance	H-1051 Budapest József nádor tér 2.	(1)118-6405	(1)327-2744	
356. Y-2		Tisztaval	Ferenc		Budapesti Vegyi Művek Budapest Chemical Works	H-1097 Budapest, Illatos út 19-23.	(1)280-6912	(1)280-6834	
360. Y		Torma	Csaba	ügyvezető helyettes Deputy Executive	Kondika Kft.	H-1089 Budapest Bláthy Ottó utca 27.	(1)114-4404	(1)113-8404	MESZ
376. Y		Nagy	Péter	főenergetikus City Chief En. Mgr.	Polgármesteri Hivatal The Mayor's Office	H-4401 Nyíregyháza Kossuth tér 1.	(42)414-155	(42)414-155	Ürge László főmérnök helyett Substitutes for László Ürge
377. Y		Vad	Elek	kiszolgálási o.v. Service Dept. Head	MOL Rt.	H-5000 Szolnok Ady Endre u. 26.		(56)420-206	

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385. **Y-2**		Varga	László	főenergetikus; chief energy manager	DUNAPACK Csomagolópapír-gyár; Packing Paper Works	H-1215 Budapest, Duna utca 42.	(1)276-3756 (1)277-1133	(1)276-3756	MESZ; előadó speaker
398. **Y**	Mrs	Tompa	Valéria	üzletfejlesztési vez. Business. Dev.Head	TUNGSRAM Rt	H-1044 Budapest, Váci út 77.	(1)169-3444	(1)169-2768 (1)169-2764	Wohl Péter helyett Substitutes for Peter Wohl
400. **Y**	Dr.	Zettner	Tamás	egyet.tanár / elnök Univ.Prof/President	ETE; Scientific Association of Energy Economy	H-1055 Budapest Kossuth Lajos tér 6-8.	(1)153-2751	(1)153-3894	
404. **Y-2**	Dr.	Zsebik	Albin	tanszékvezető; Department Head ügyvezető igazgató Managing Director	BME Rendszertechnika Tanszék Dept.for Contr. and System.Eng. JOMUTI Kft.	H-1111 Budapest, Műegyetem rpt 3. H-1172 Budapest, Almásháza u. 55.	(1)463-2981 (1)257-7369	(1)463-3271 (1)258-2963	C.E.M.,az AEE Tagozat tagja Chapter Member Internet:zsebik@rit.bme.hu
407. **Y**		Zsótér	Mihály	főenergetikus Chief Energy Mgr.	Mezőhegyes Állami Ménesbirtok Mezőhegyes State Stud-Farm Co	H-5830 Mezőhegyes Kozma F. út 30.			

ÚJ MEGHÍVOTTAK, KÉSŐBB JELENTKEZTEK - NEW NAMES

202.	Mrs	Bajkovné			MOL Rt KTÁ	H-6701 Szeged, Pf.:1333	(62)322-120	(62)322-120	
Y		Bandits	György						A fax Atlantából érkezett Fax was transmitted from US
Y	Mrs	Benczur	Zsuzsanna		ÁPV Rt	H-1133 Budapest Pozsonyi út 56.			
Y		Bohocky	Ferenc		IKM	H-1051 Budapest Vigadó utca 6.			
Y		Elek	János		OMFB	H-1052 Budapest Szervita tér 8.			
Y		Gémesi	Csaba		HUNGAROTON				
Y		Hertelendy	Miklós		MÉLYÉPTERV				
165. **Y**		Józsa	Lajos	ipari szolgálat vez. Lead, Industr.Service	Rába Vagon és Gépgyár Rába Wagon and Machine Fact.	H-9027 Győr Budai út 1.			
Y		Kecskés	Attila	főenergetikus Chief Energy Mngr	Mohácsi Farostlemezgyár Rt.	H-7700 Mohács Budapesti országút			
Y		Kollár	Lajos		QUINT SERVICE Kft				
249. **Y**		Köller	Péter		DUNAQUA-THERM Rt	H-2400 Dunaújváros Építők útja 7.	(25)311-332	(25)313-623	Neszmélyi György javasolta György Neszmély proposed
Y		Nagy	László		ÉDASZ Rt.				

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Y		Résch	Pál		MEH	H-1085 Budapest Köztársaság tér 7.			
89. Y		Rusai	László	üzemfenntartás o.v. Oper. Dept. Head,	Fővárosi Vízművek Rt. Capital City Water Works Plc	H-1134 Budapest, Váci út 23-27.	(1)169-8242	(1)169-7478	Gelencsér István javasolta István Gelencsér proposed
Y		Szántó	Mihály		DUNAFERR Rt.				
Y		Szőlősi	Kálmán		GEA/EGI Rt.	H-1027 Budapest Bem rakpart 33.			
	Dr.	Tersztyánszky	Tibor	főtanácsos Senior Counsellor	Magyar Energia Hivatal Hungarian Energy Office	H-1085 Budapest, Köztársaság tér 7.			
Y		Tóth	Csaba		MOL Rt. KTÁ	H-6701 Szeged, Pf.:1333	(62)322-120	(62)322-120	
Y		Váradi	Tamás						
Y		Weöres	Lászlóné		OTP Rt. (Bank Center)	H-1054 Budapest, Szabadság tész 7.			

AMERIKAI RÉSZTVEVŐK - AMERICAN PARTICIPANTS

Title	Last name	First name	Institution/Company	
Mr.	Birnbaum	Ira	USAID WDC	
Mr.	Cornel	Tom	USAID Rep to Hungary	
Mr.	Abrams	Bruce	USAIDRep Office/Budapest	
Mr.	Thumann	Al	AEE	
Mrs	Stroup	Barbara	AEE	
Mr.	David	Keith	Hagler Bailly Consulting, Inc.	
Mr.	Pommier	Laurent	Hagler Bailly Consulting, Inc.	
Mr.	Markel	Lawrence	ELECTROTEK Concepts, Inc.	

VÁLLALATOK - COMPANIES

Alfa Laval	Not yet confirmed
APV	CONFIRMED
Armstrong	Not yet confirmed
Cheminst	Not yet confirmed
Denver Inst.	Not yet confirmed
FLUKE	CONFIRMED
Honeywell	Not yet confirmed

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IMPERIAL ELECTRIC	CONFIRMED
JOHNSON CONTROLS	CONFIRMED
LAND COMBUSTION	CONFIRMED
LANDIS & GYR	CONFIRMED
OWENS CORNING	CONFIRMED

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Energy Efficiency and its Financing in Hungary

Introduction and Welcoming Remarks

Dr. Miklós Poós
Director for Energy Co-ordination
Ministry of Industry and Trade

I am honoured and delighted to welcome you on behalf of the Hungarian Ministry of Industry and Trade to this „Energy Efficiency Market Development in Hungary Conference", in this beautiful 1100 years old country. I am very happy that you have been able to establish such stimulating programme for today, and I thank all the distinguished speakers and moderators in advance for their activities.

In Hungary, the energy - included the energy price, and the privatisation - is one of the most important political issues a typical front page story. This situation is caused by two factors: Firstly the high proportion of the energy bill in the family budget, because we have one-fifth or one-sixth income with the similar energy prices as in the well developed countries, secondly the Hungarian way of privatisation of the energy sector is unique in the world, there is only a slight similarity with some Latin-American countries. For this reason, energy is a highlighted topic in social and governmental level too.

The Government in accordance with its National Energy Policy, among others, recognises a potential break-out point from this income-price pitfall. The only one realistic possibility is the energy conservation and efficiency increasing. For this reason the Government created and accepted a National Energy Conservation and Energy Efficiency Increasing Programme in 1994, and also an Action Plan for its implementation, last year. The energy efficiency situation in Hungary is as follows:

Energy use in Hungary is significantly less efficient today as compared with well developed countries. This is because, among other reasons, the economy was sheltered from the rapid oil price rises that have occurred from the 1970's onwards, which led to major improvements in energy efficiency in most free market economies. Low energy prices and the over-emphasis on heavy industry led to high energy consumption per unit of economic output (energy intensity), while at the same time the low productivity of the economy and the low standard of living was reflected in a lower per capita consumption of energy than in OECD countries.

For comparison in 1992 primary energy consumption was 2.49 toe per capita in Hungary, while it was 3.26 toe in Austria and 7.96 toe per capita in the United States. However, energy intensity - energy consumption per unit of output - is considerably higher in Hungary than in the OECD countries. In 1993 primary energy intensity per $1000 US of GDP was 0.73, compared to 0.40 in OECD countries.

The Hungarian energy sector, in line with other sectors of the economy, has been significantly affected by the transition process. Overall energy demand has declined from 23.7 Mtoe in 1989 to 16.9 Mtoe in 1993. Also, the structure of demand has undergone important changes. Industrial energy consumption has declined from 9.76 Mtoe in 1989 to 5.3 Mtoe in 1993, a reduction of 36%, while during the same period residential and service sector energy use decreased from 8.2 Mtoe to 8.0 Mtoe, a reduction of only 2.5%. Energy use in agriculture also

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fell significantly, decreasing from 1.3 Mtoe in 1989 to 0.58 Mtoe in 1994, a reduction of 55%.

These facts underline the importance of the energy efficiency sub-policy in Hungary, but the Energy Efficiency Programme implementation is impossible without a well-functioning financing background, which covers the different demands and areas. To build-up this complex system is a continuous, never ending activity and challenge. We have some existing financial tools, we have some near and medium future plans. These are the next:

1.) "German Coal Aid Fund" Loan System (existing)
A preferential (half of the normal rate) loan system was established in 1991 from a German state grant. Starting capital was: 10 MUSD. Maximum unit loan is: 300 thousand USD. Number of undersigned and implemented contracts is: 263. Total accumulated amount of loans is: 27 MUSD. Approved energy savings are: cca.100 toe.

2.) PHARE Revolving Fund (from the end of 1996)
A co-financing scheme with PHARE and IFI (International Financing Institutions, e.g. World Bank, EIB, EBRD, etc.) sources, with a blending concept. The PHARE part is of zero interest rate, the IFI money is under normal commercial conditions. The starting PHARE capital is: 5 MECU (in 1996). Target groups: private SMEs, municipality institutions and companies, public institutions.
2 banks : 2.5 MECU each..

3.) EBRD Energy Efficiency Loan (some part in operation, some under preparation)
A 5 MUSD loan to an energy equipment manufacturing company (Prometheus Ltd) to initiate its ESCO activity.
Preparation of bankable projects with EBRD financed technical assistance. Implementation with normal EBRD loans.

4.) GEF-IFC Financial Scheme (from early next year)
A 5 MUSD financial support to Hungary was accepted by GEF (Global Environmental Facility), the financing mechanism of which is arranged through the IFC (International Financing Corporation). The system is under preparation, the most probable first target is the public lighting modernisation (CFL), under normal banking conditions.

5.) Preferential Loan for energy targeted reconstruction of panel built housing (from the end of 1996)
The source of the capital is: 30 MDEM German state loan. Preferential interest rate is: 10%. The difference between normal and soft interest rates is financed by the state budget.

6.) Energy Savings Fund for Public Institutions (from early next year)
There is a joint proposal of Ministry of Industry and Trade, Ministry of Finance and Ministry of Environmental Protection to establish a public-institutions-oriented soft loan system to reduce the effect of the energy price increase. The source of the system is the state budget (5 MUSD).The Government will discuss this proposal in this year.
First approval this week already.

7.) Energy Savings Central Fund (medium future, uncertain)
A Ministry of Industry and Trade proposal and initiative for new legislation deal for funding energy savings .We propose introducing a small tax (max 0.5 %) on electricity and natural gas as an "energy cent". This would raise an estimated 20 MUSD yearly. Recently the Ministry of Finance has some objection against this proposal. The future of this Fund is uncertain.

Beyond the beforementioned financial tools we have a number of bilateral or European Union based grant money programmes to promote the energy efficiency efforts in Hungary, but in my presentation I'd like to focus your attention to the business or bank conform financing mechanism.

I wish you a very successful Conference and a nice stay in Budapest. I hope you will enjoy the Hungarian hospitality, the good Hungarian foods and wines.

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Energy Efficiency and its Financing in Hungary

Introduction and Welcoming Remarks

Dr. Miklós Poós
Director for Energy Co-ordination
Ministry of Industry and Trade

I am honoured and delighted to welcome you on behalf of the Hungarian Ministry of Industry and Trade to this „Energy Efficiency Market Development in Hungary Conference", in this beautiful 1100 years old country. I am very happy that you have been able to establish such stimulating programme for today, and I thank all the distinguished speakers and moderators in advance for their activities.

In Hungary, the energy - included the energy price, and the privatisation - is one of the most important political issues a typical front page story. This situation is caused by two factors: Firstly the high proportion of the energy bill in the family budget, because we have one-fifth or one-sixth income with the similar energy prices as in the well developed countries, secondly the Hungarian way of privatisation of the energy sector is unique in the world, there is only a slight similarity with some Latin-American countries. For this reason, energy is a highlighted topic in social and governmental level too.

The Government in accordance with its National Energy Policy, among others, recognises a potential break-out point from this income-price pitfall. The only one realistic possibility is the energy conservation and efficiency increasing. For this reason the Government created and accepted a National Energy Conservation and Energy Efficiency Increasing Programme in 1994, and also an Action Plan for its implementation, last year. The energy efficiency situation in Hungary is as follows:

Energy use in Hungary is significantly less efficient today as compared with well developed countries. This is because, among other reasons, the economy was sheltered from the rapid oil price rises that have occurred from the 1970's onwards, which led to major improvements in energy efficiency in most free market economies. Low energy prices and the over-emphasis on heavy industry led to high energy consumption per unit of economic output (energy intensity), while at the same time the low productivity of the economy and the low standard of living was reflected in a lower per capita consumption of energy than in OECD countries.

For comparison in 1992 primary energy consumption was 2.49 toe per capita in Hungary, while it was 3.26 toe in Austria and 7.96 toe per capita in the United States. However, energy intensity - energy consumption per unit of output - is considerably higher in Hungary than in the OECD countries. In 1993 primary energy intensity per $1000 US of GDP was 0.73, compared to 0.40 in OECD countries.

The Hungarian energy sector, in line with other sectors of the economy, has been significantly affected by the transition process. Overall energy demand has declined from 23.7 Mtoe in 1989 to 16.9 Mtoe in 1993. Also, the structure of demand has undergone important changes. Industrial energy consumption has declined from 9.76 Mtoe in 1989 to 5.3 Mtoe in 1993, a reduction of 36%, while during the same period residential and service sector energy use decreased from 8.2 Mtoe to 8.0 Mtoe, a reduction of only 2.5%. Energy use in agriculture also

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These facts underline the importance of the energy efficiency sub-policy in Hungary, but the Energy Efficiency Programme implementation is impossible without a well-functioning financing background, which covers the different demands and areas. To build-up this complex system is a continuous, never ending activity and challenge. We have some existing financial tools, we have some near and medium future plans. These are the next:

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USAID ENERGY EFFICIENCY MARKET DEVELOPMENT PROGRAM FOR EASTERN EUROPE

1996 SURVEY of ENERGY MANAGERS

by:

Michael Ellis
Hagler Bailly Consulting

INTRODUCTION

This Energy Efficiency Market Development Program builds upon the results of the 1991 USAID Emergency Energy Project, in which energy management programs were carried out in various industrial, commercial, and public enterprises.

In the 1991 project, the primary objective was to achieve short-term, low-cost energy savings, focusing on oil and gas, and U.S. contractors had primary responsibility for the work, assisted by a local subcontractors. In the Energy Efficiency Market Development (EEMD) project, the effort was extended to include greater attention to management and organizational issues, and primary responsibility for the work will shift to multiple East European private sector enterprises.

The EEMD project in Hungary, Romania, and Bulgaria is designed to serve as a catalyst to assist private energy service firms to develop a market for energy efficiency services, and to develop their capability to serve this market.

The major activities under this program have been:

1.Training in energy efficiency for private sector engineers on market-oriented business subjects (such as management, accounting, economics and finance), energy audit techniques, hands-on use of energy efficiency monitoring equipment, performance contracting, project management, industrial management, quality, maintenance and optimization, marketing and management for energy efficiency service companies, and a certification examination (Certified Energy Manager by Association of Energy Engineers, AEE).

2. Establishment of a local chapter of AEE, supply of US energy audit equipment, and assistance to develop AEE as a sustainable market-oriented professional association.

3. Energy management programs in representative facilities, predominantly industrial enterprises. Each program will include advice in energy management from local experts, an energy audit report, and a grant to be applied as cost-sharing toward the purchase of US equipment. Each client

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enterprise has signed a contract to participate in the program, and will pay a market-based fee to the local consultants for the services.

4. Conference and exhibition on industrial energy management. Project results will be reported to plant directors, chief engineers, production managers, and energy managers in a conference, with related publicity.

OBJECTIVES

The general objective of the EEMD project will be to serve as a catalyst to accelerate the development of a market for an energy efficiency industry, and to assist firms in the private sector to develop their capability to serve this market.

The specific objectives of the EEMD project are:

1. Foster the development and capability of private firms to provide energy efficiency services, equipment, and financing to industrial clients;

2. Assess the climate for investments in energy efficiency projects, and provide advice, studies, and seminars to promote increased private investment in energy efficiency;

3. Improve energy efficiency in specific pilot sites (especially industrial enterprises), through provision of energy audits and energy-saving equipment;

4. Expand East European-U.S. technical and commercial ties through linkages between energy efficiency associations, engineering and energy service companies, and equipment suppliers.

THE SURVEY

A survey of private energy service companies who participated in the program from the inception, through to the completion of energy efficiency projects, was conducted in 1996. The purpose of this survey was to assess the business operations of these firms and evaluate the impact that the USAID EEMD program has had on developing a market for energy efficiency services.

The survey covered the period 1992 through 1996 and addressed the following indicators:

1. Company Profile
2. Business Activities
3. USAID Training Program
4. On-Site Technical Assistance
5. Association of Energy Engineers
6. Recommendations for Future Programs

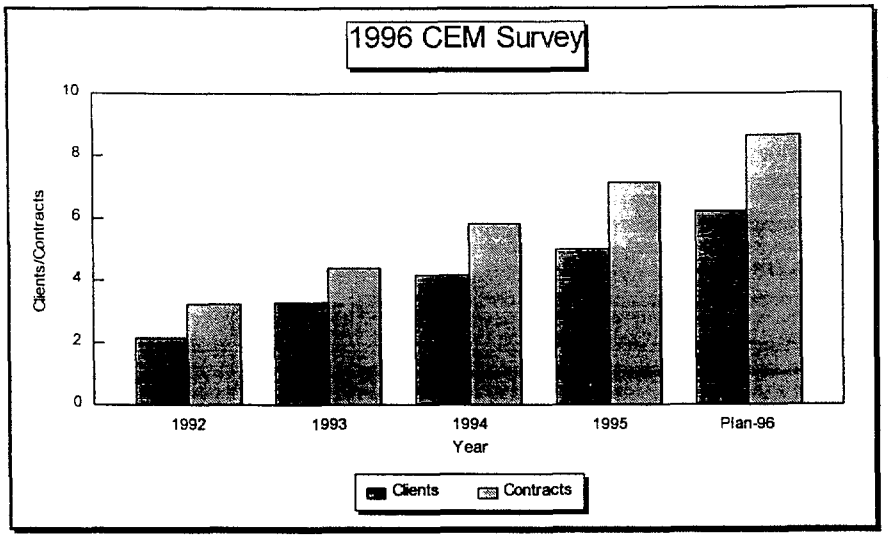
The results of the survey have been compiled and the key conclusions and findings presented in this brief report.

FINDINGS

Company Profile:

All of the firms experienced a significant increase in the number of clients and number of contracts for the period 1992 through 1996: for Hungary there was a three-fold increase, for Bulgaria a five-fold increase, and for Romania a two-fold increase. In Romania, The ratio of contracts to clients also increased from approximately 1:1 to 1.25:1.

Turnover increased at a healthy rate, averaging 300% for Hungary, 1,400% for Bulgaria, and 2,500% for Romania.



Full-time staff remained relatively constant for all firms for all three countries, but part-time employment (associates, consultants, etc.) Increased sharply with increasing contract work.

A summary of the results of the company profile survey are included herein as attachments.

Business Activities:

The survey respondents were asked a series of six questions:

1. How helpful was the USAID program to improving your capabilities to carry out the normal business activities of your firm?

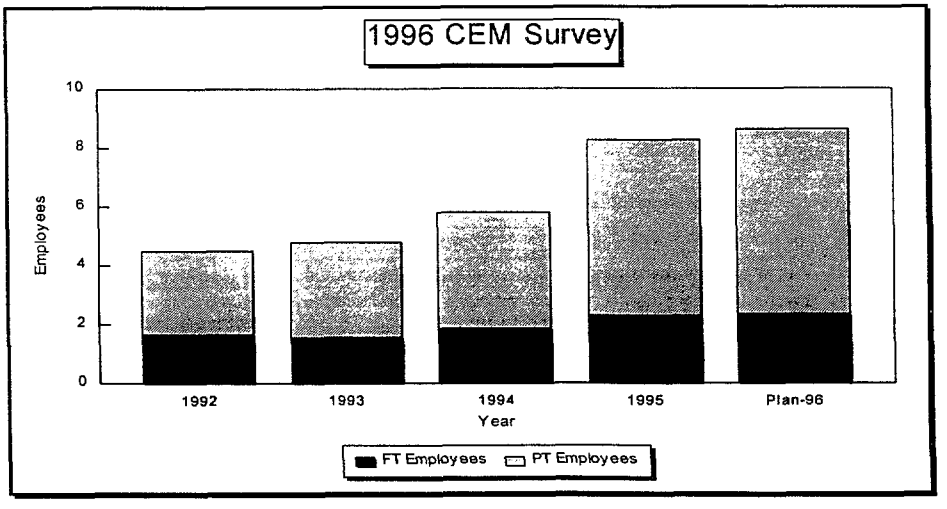
The majority of respondents answered *very helpful*, and cited management and marketing techniques as the primary enhancement.

2. As a result of the USAID program, have you ventured into any new areas of business activity, or expanded the range of services you provide to your clients?

The major response was yes, but many respondents made note of the difficult domestic economic conditions and the impediments to expanding their business.

3. Has you level of business activity increased as a result of benefits your firm may have gained from the USAID program?

This question generated a mixed response from *just a bit* to *yes a lot*, and again reflected



the general economic conditions of the country.

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4. Was your participation in this USAID program helpful in enhancing the professional standing of your firm?

This question generated the most number of positive responses with the AEE energy manager certification noted as the greatest benefit.

5. Was the USAID program helpful in making you aware of the commercial market potential of energy efficiency and related activities?

Again, this question yielded a mixed response from *somewhat helpful* to *extremely helpful*, with the difficult commercial market opportunities cited as the major hurdle.

6. Was the USAID program helpful in enhancing your capabilities to offer services to your clients in the field of energy efficiency?

This question also yielded a large number of positive responses with most CEMs indicating a higher level of confidence in offering energy efficiency services.

Training Program

The survey respondents all completed the CEM training program and were asked a series of six questions regarding the training program:

1. Was the training program relevant to your business activity?

Yes, all respondents cited the various program elements as having a direct bearing on their business activities.

2. What particular aspect of the training program was most beneficial and what was the least beneficial?

Most participants did not make a distinction, however, the more immediate and applicable topics (e.g. performance contracting) were cited as the most beneficial.

3. Did you obtain CEM certification and if so, was the certification program helpful in enhancing your capabilities, professional standing, or marketing capability?

Yes, all the participants passed the certification exam and felt that the certification enhanced their professional standing.

4. Has your business realized a higher level of expertise and professional capability as a result of the training program?

Yes, particularly in the business and organizational management areas.

5. Has the general level of professional competence among individual staff members been enhanced by the training program?

Yes, particularly in the business and organizational management areas.

6. What other training activities would you like to see offered to make your business successful?

Some of the training areas mentioned are:

- marketing
- proposal writing
- organizing an ESCO
- DSM
- business plans

- organizational efficiency
- financing energy efficiency projects
- AEE outreach training programs

ON-SITE TECHNICAL ASSISTANCE

Four questions were asked of the respondents relating to the on-site technical assistance of USAID advisors on the industrial audit and energy efficiency improvement projects:

1. Did working with the advisor help you develop skills and methodologies that were helpful in enhancing your ability to provide similar energy audit services for your clients?

The majority of participants answered *very helpful* to this question, citing the experience of the on-site advisors.

2. Did working with the advisor help you develop skills and methodologies that were helpful in enhancing your ability to provide similar energy audit services for your clients?

Yes, particularly in the presentation of results and organization of energy audits.

3. Was the equipment provided to your client plant helpful to the development of your own business?

Again, the equipment was rated *very helpful* in the majority of responses

4. Overall, did the USAID program give a significant boost to marketing your services?

Most respondents rated the USAID program as *very helpful*, although they also illustrated the problems of marketing energy efficiency services in their respective countries.

ASSOCIATION OF ENERGY ENGINEERS

The survey respondents were queried on the benefits of the AEE chapters established in each country:

1. Have you been active in the local chapter of the Association of Energy Engineers?

Yes, most respondents are very active.

2. Do you feel that the development of the AEE chapter is worthwhile?

Everyone agreed that the AEE chapter is worthwhile, primarily for professional development and contacts. Many respondents cited the need for additional AEE programs.

3. USAID provided energy auditing equipment to the AEE Chapter. Did the USAID-supplied equipment help you in your business?

The consistent response was, *very helpful.* Most respondents cited the availability of advanced diagnostic equipment is significant benefit of the AEE chapter.

4. For those who attended the AEE meetings in Atlanta, was your participation in these events worthwhile?

Yes, particularly the opportunity to meet US experts and equipment manufacturers and make contacts.

RECOMMENDATIONS FOR FUTURE PROGRAMS

There were a wide variety of recommended programs for consideration:

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- Funding of energy efficiency projects is a major problem in Eastern Europe and additional technical assistance in this are would be helpful.

- Continued support of local AEE chapters and expansion of the AEE programs and services

- Promotion of joint ventures with US companies

- Training in project financing and energy audit technologies

- Establishment of an energy efficiency fund

- Expanded CEM certification programs

- Joint Eastern European AEE activities

- Training in demand-side-management

- Training in environmental impact of energy efficiency

- How to organize an energy service company

- Training and support for performance contracts

- Broad based promotional and information dissemination programs

- Additional diagnostic equipment

SUMMARY

The overall response to the survey was very positive, particularly in the more practical areas of: training, on-site technical assistance, and energy audit equipment.

The CEMs also recognized the advantage of AEE chapter membership and potential beneficial services offered by the Chapters.

The recommended future actions all concern positive and proactive programs which would serve to support the development of private sector orientated energy service companies.

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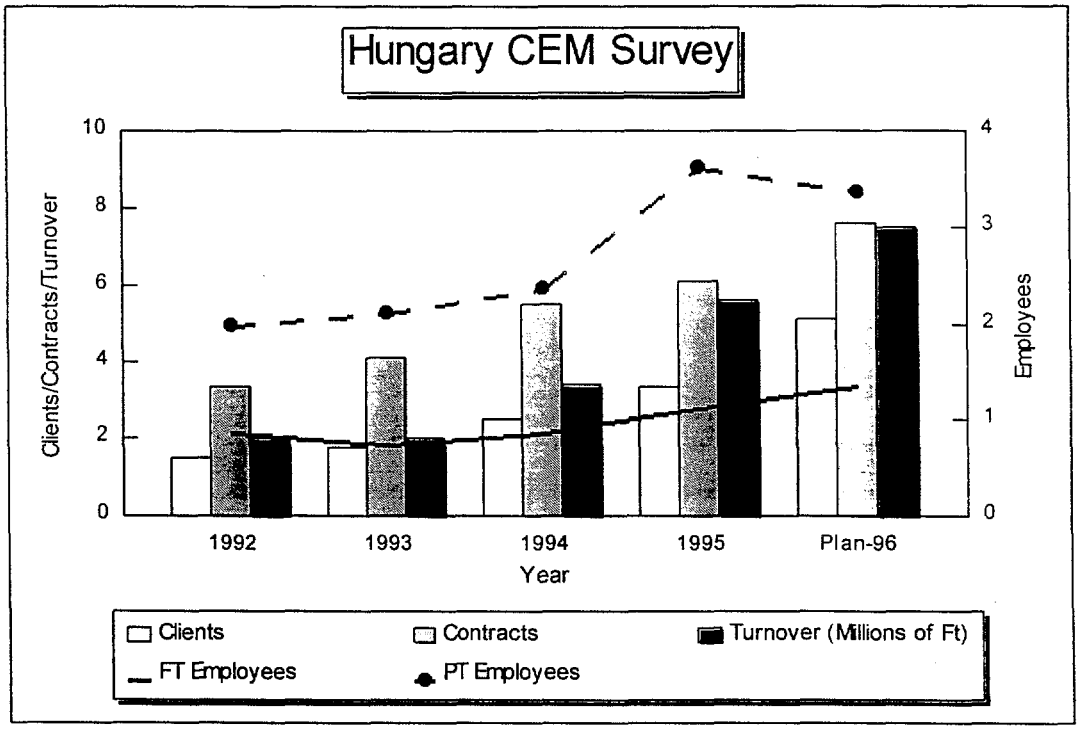
USAID EEMD Program - Hungary
Survey of Hungarian Certified Energy Managers
Company Profile
Averages

Category	1992	1993	1994	1995	Plan-96
CLIENTS	12	14	20	27	41
Average	1.50	1.75	2.50	3.38	5.13
%	0%	17%	43%	35%	52%
CONTRACT	27	33	44	49	61
Average	3.38	4.13	5.50	6.13	7.63
%	0%	22%	33%	11%	24%
TURNOVER	16.00	16.00	27.50	44.90	60.00
Average	2.00	2.00	3.44	5.61	7.50
%	0%	0%	72%	63%	34%
FT EMPLOY	7	6	7	9	11
Average	0.88	0.75	0.88	1.13	1.38
%	0%	-14%	17%	29%	22%
PT EMPLOY	16	17	19	29	27
Average	2.00	2.13	2.38	3.63	3.38
%	0%	6%	12%	53%	-7%



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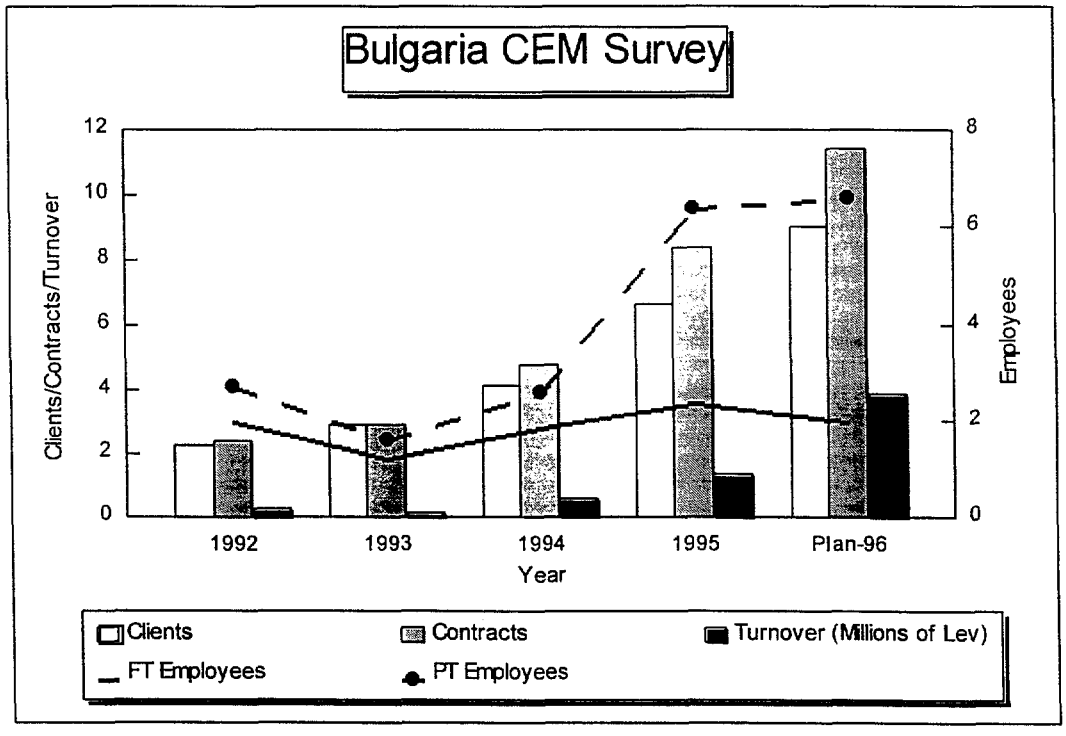
USAID EEMD Program - Bulgaria
Survey of Bulgarian Certified Energy Managers
Company Profile
Averages

Category	1992	1993	1994	1995	Plan-96
CLIENTS	18	23	33	53	72
Average	2.25	2.88	4.13	6.63	9.00
%	0%	28%	43%	61%	36%
CONTRACT	19	23	38	67	91
Average	2.38	2.88	4.75	8.38	11.38
%	0%	21%	65%	76%	36%
TURNOVER	1.93	0.96	4.63	10.53	30.84
Average	0.24	0.12	0.58	1.32	3.86
%	0%	-50%	380%	127%	193%
FT EMPLOY	16	10	15	19	16
Average	2.00	1.25	1.88	2.38	2.00
%	0%	-38%	50%	27%	-16%
PT EMPLOY	22	13	21	51	53
Average	2.75	1.63	2.63	6.38	6.63
%	0%	-41%	62%	143%	4%



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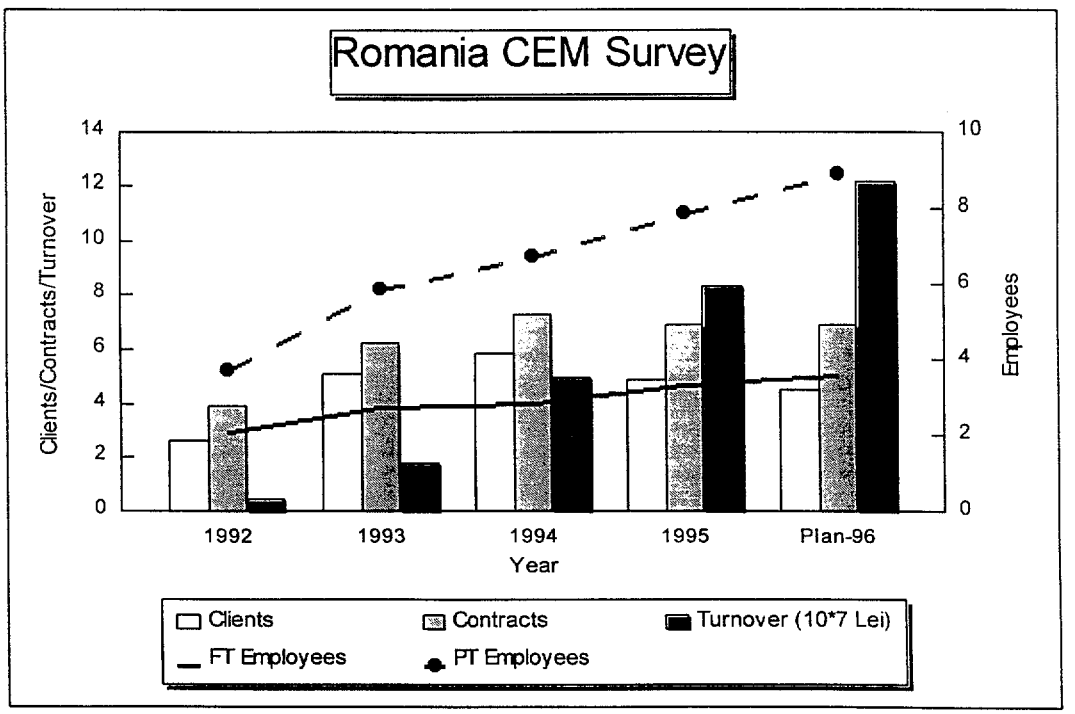
USAID EEMD Program - Romania
Survey of Romanian Certified Energy Managers
Company Profile
Averages

Category	1992	1993	1994	1995	Plan-96
CLIENTS	21	41	47	39	36
Average	2.63	5.13	5.88	4.88	4.50
%	0%	95%	15%	-17%	-8%
CONTRACT	31	50	58	55	55
Average	3.88	6.25	7.25	6.88	6.88
%	0%	61%	16%	-5%	0%
TURNOVER	3.64	14.46	39.53	66.40	97.50
Average	0.45	1.81	4.94	8.30	12.19
%	0%	297%	173%	68%	47%
FT EMPLOY	17	22	23	27	29
Average	2.13	2.75	2.88	3.38	3.63
%	0%	29%	5%	17%	7%
PT EMPLOY	30	47	54	63	71
Average	3.75	5.88	6.75	7.88	8.88
%	0%	57%	15%	17%	13%



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REDUCTION OF PRIMARY ENERGY USE IN DUNA IRON AND STEEL WORKS

Dr. Albin Zsebik, CEM
András Morenth
József Mudra

THE PROJECT IN BRIEF

1. **Waste Heat Utilisation for Energy Supply to Heating Systems within the Plant and in the Town, resptectively**
   Waste heat from screen cooling in the pusher type continuous furnaces had been utilised before our investigation. Having analysed technological processes we found numerous other opportunities to utilise heat transported to the environment by cooling and by exhaust gases, respectively.

2. **Vibration Analyser**
   By the use of a vibration analyser $ 35.000 US cost savings have been achieved in a year by $ 22.146 US investment. The payback time is 0.63 years. IRR calculated for a 5 years project life time is 157%.

3. **Ultrasonic Tester**
   Use of an ultrasonic leak detector helped reduce annual loss of steam, gas, pressurised air rapidly. Yearly savings of $ 11.500 US have been achieved by $ 6.695 US investment. The simple payback time is 0.58 year. IRR calculated for a 5 year project period is 171%.

4. **Steam Traps, Pumping Trap, Liquid Drainers**
   Membrane type steam traps were replaced by those of new kind of technology. Wrong electric condensate pump is replaced by pumping drop trap. Pressurised-air network liquid has been discharged by automatic drain traps, instead of manual discharge.Annual savings of $22.500 US have been obtained by $13.300 US investment. The payback time is 0.59 year. IRR is of 168%.

BACKGROUND OF THE PROJECT

The USAID Industrial Energy Efficiency Project in Hungary has assisted private Certified Energy Managers (CEMs) in developing an energy service company practice and thus bring needed energy consulting services to Hungarian industrial enterprises. The program has consisted of training and energy auditing activities, conferences and exhibitions, and procurement of equipment for energy efficiency demonstration projects. One of the Hungarian industrial enterprises for the consulting services in energy management was DUNAFERR Energy Supplier Co., Ltd.

DUNAFERR Energy Supplier Company, Ltd. (DUNAFERR Energiaszolgáltató Kft.) was established by the state-owned joint stock company of iron and steel metallurgy, DUNAFERR Rt. The state-owned joint stock company offered many of its own established limited companies, among others also the Energy Supplier Co., Ltd. for sale by privatisation. In the privatisation procedure of the

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Energy Supplier Co., Ltd. a considerable step was made ahead in spring 1996. The American company, TENECO strengthened its intent of purchase by a preliminary contract in the first step. This preliminary contract was finalised in summer 1996. The new owner entered into obligations for large scale developments, among others for establishment of new heat and power sources.

Prime responsibility of the Energy Supplier Co., Ltd. is for providing the DUNAFERR Rt. Company Group with energy. It disposes of heat also to firms outside the company group in form of steam and/or hot water. One of its largest outside customers is DUNAQUA-THERM Rt, which supplies the purchased heat to district heated flats and public institutions in the town of Dunaújváros.

Peak load of the consuming system of DUNAFERR Energy Supplier Co., Ltd was 92 MW, annual electricity consumption was 600.000 MWh, total installed electric power generation capacity of the plant was 67 MW, before the start of the USAID/CEM program, based upon plant data and information.

IMPLEMENTATION OF THE USAID PROJECT

Major dates of program implementation

Audit	1994
Delivery of equipment	1994-95
Installation and commissioning	1994-95
Monitoring	1995-96

Summary of delivery of equipment, installation and commissioning

- Vibration Analyser - fully implemented
- Steam trap ultrasonic tester - fully implemented
- Flue-gas analyser (O2/CO meter) for Boiler No. IX. - equipment delivered, but not yet installed, because of uncertainties in privatisation, mostly in decisions of the new owner, concerning boiler and heat service development
- Steam traps, Pumping trap and Liquid Drainer - fully implemented.

Waste-heat Utilisation Opportunities for Energy Supply to Heating Systems within the Plant and in the Town, respectively.

Screen-cooling heat of pusher type continuous furnaces had been utilised before our investigations. Having analysed technological procedures we found many other possibilities for waste heat utilisation. In one case of our investigations 100 MW heat could be utilised by warming up 40°C water to a temperature of 100°C and 114°C, respectively. The schematic circuit diagram is shown in **Figure 1**.

Surveys indicated that all waste heat with higher temperature than 80 °C from the plants can easily be integrated to the nearby district heating system. In order to estimate the volume of potential use of the waste heat we assumed that existing substations and end-users in buildings will be converted in such a way that **return water tempreature in the primary circuit will be 40°C in a determinant period of the year.**

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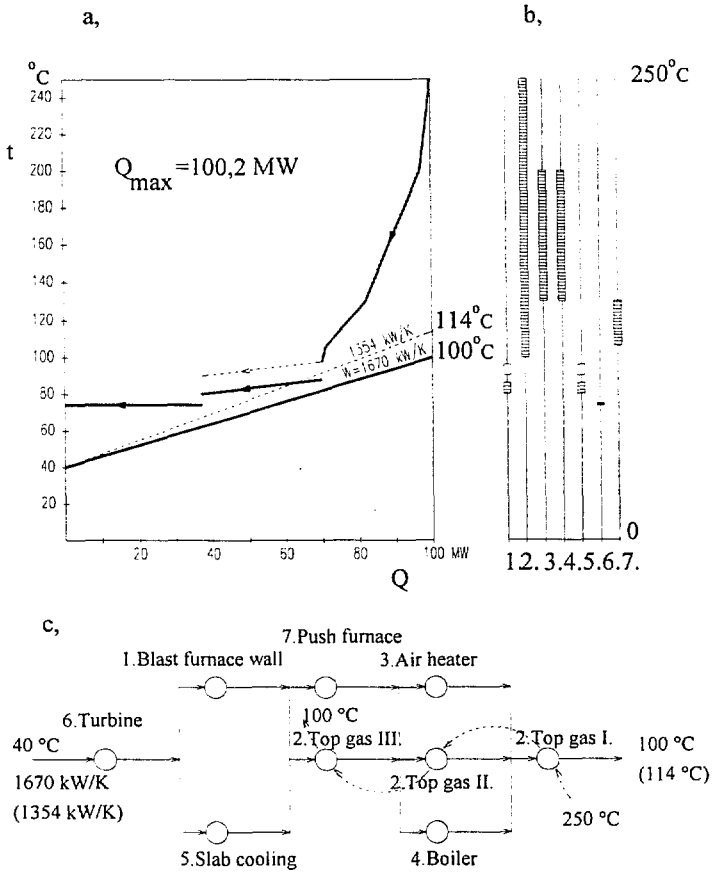

Figure 1. SCHEMATIC CIRCUIT DIAGRAM AND t-Q DIAGRAM OF WASTE-HEAT UTILISATION IN A METALLURGY PLANT

In evaluation we took into account the heat consumption, what is indicated by **Figure 2**. In this case we took into consideration the two separate parts of the town district heating network (Town 1 as **V1** and Town 2 as **V2**) and the plant heating system (**GY**) as interconnected and show up how can the 1.304.890 GJ annual heat demand be met by waste heat utilisation.

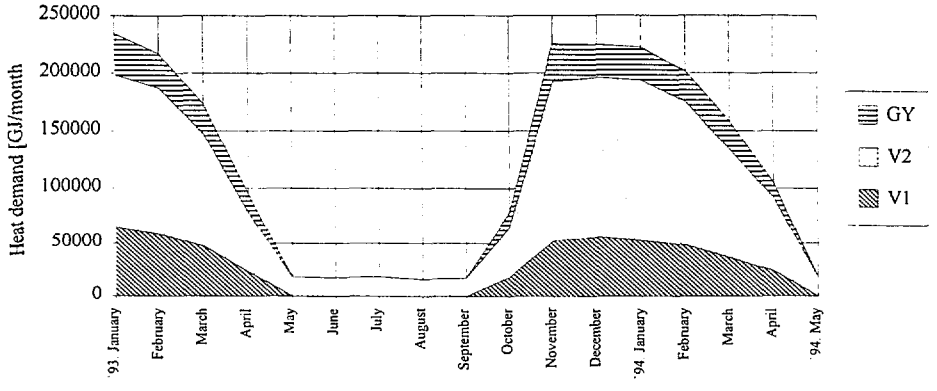

Figure 2. HEAT DEMAND OF THE INVESTIGATED DISTRICT HEATING SYSTEM

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One of the investigated variations is based upon the break-down of heat production as indicated by **Figure 3**. In this case hardly any fresh steam is needed to meet heating demands.

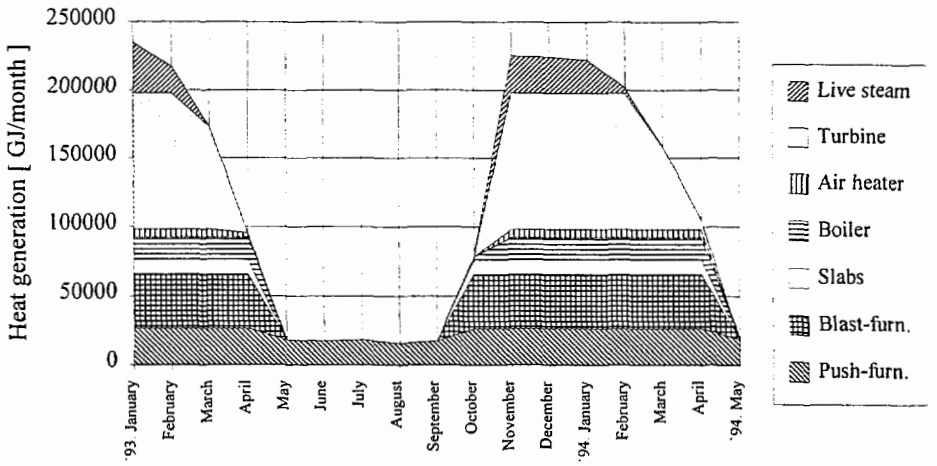
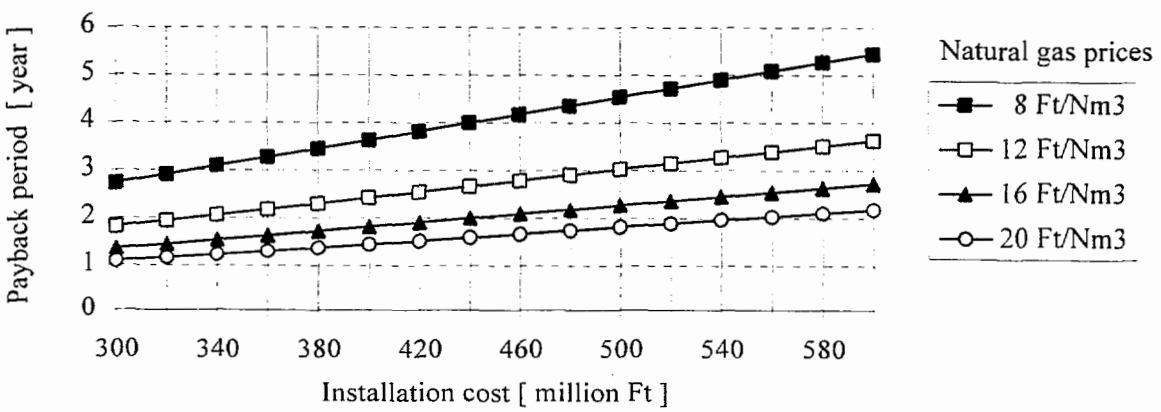


Figure 3. BREAK DOWN OF HEAT GENERATION

Legend of Figure 3.:

Push-furn.	- recovery of heat from the cooling of pusher-type furnaces
Blast-furn.	- heat recovery from the cooling of the blast furnace shroud
Slabs	- heat recovery from the cooling of the slabs (block-cooling)
Boiler	- flue-gas-heat recovery from boiler
Air heater	- flue-gas-heat recovery from the air heater
Turbine	- heat from turbine extraction
Live steam	- heat from live steam.

In the course of the evaluation of an investment, both expected cost savings in natural gas ($\Delta V_{n.g.}$) and investment costs based on quotations of suppliers - with (ΣB_{VAT}) and without (ΣB) VAT have been taken into account. As it is apparent from **Figure 4.** waste heat recovery is a short payback investment in general.



$\Delta V_{n.g.}$=14 million Nm^3/year ΣB = 252 million Ft ΣB_{VAT}= 315 million Ft

Figure 4. PAYBACK PERIOD DEPENDING ON INVESTMENT COSTS AND NATURAL GAS PRICES

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Considering that gas savings show not only economic benefits but are important also from environmental aspects, it is obvious that the utilisation of opportunities like the ones described above must be encouraged.

Vibration Analyser

At the DUNAFERR Energy Supply Co.,Ltd. there are 6 steam-turbines, 3 steam-turbo blowers and a lot of other kind of mostly rotational propulsive machines in operation. The age of machines is about 10-40 years. Control and maintenance was not organized appropriately, and because of the lack of a quality instrumentation, vibration was not checked up in previous years.

Aiming at to survey the condition of equipment, to cut down - by preventive maintenance - the costs, caused by frequent break-downs, a vibration analyser was delivered in the framework of the USAID project.

The plant was provided with an **IRD 885 Vibration Analyser, with balancing diagnostic device.**

A number of about 200 machines, in the range of 1000 measuring places, on 3000 measuring points were inspected, since the vibration analyser has been in use. A reference list is set up for the system, by the help of which sound mechanical condition of the equipment is regularly controlled.

Cost savings in the past two years by use of the equipment are estimated, as follows:

TABLE 1.

Prevention of emergency break-down	HUF 4.000.000	$26.000 US
Setting of machines after maintenance, quality improvement	HUF 3.000.000	$20.000 US
Replacement of hired inspection services, cost reduction	HUF 3.000.000	$20.000 US
Registration of sound techical condition of equipment, intangible assets (intellectual advantages)	HUF 5.000.000	$33.000 US

Ultrasonic Steam Trap Tester

Use of ultrasonic leak detector helped reduce annual loss of steam, gas, pressurised air rapidly. By the help of a systematic application, expected payback period of the equipment will be about 0,46 year. More than 2000 Gestra-make, membrane-type steam traps had been installed earlier at the plant. Operational experiences indicated that half of the steam traps were out of order.

It was experienced, that the heat loss in return water is reducable by ~10%, through repair work only. The tester is utilisable also in other kind of leak detection. Similar favourable result was achieved in repair and maintenance of gas, pressurised air, steam pipeline networks, storage tanks and heat exchangers.

An **ULTRAPROBE 2000** type ultrasonic leak detector was delivered to the plant, to check up - among others - steam traps and repaire or replace defective ones.

Cost reductions in the last two years by use of the equipment are estimated, as follows:

TABLE 2.

Loss reduction by gas network leak detection	HUF 2.500.000	$16.500 US
Loss reduction by pressurised-air leak detection	HUF 1.000.000	$6.500 US
Loss reduction by steam network inspection and steam trap testing, respectively	HUF 1.500.000	$10.000 US

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Steam Traps, Pumping Traps, Liquid Drainers
In order to replace membrane-type steam traps new ones were introduced of an other kind of technology. Instead of changing wrong electric condensate pump a new pumping drop trap was ordered.

Pressurized-air network liquid used to be discharged periodically by opening drain valves manually. Open drains caused losses frequently both in air and energy. Newly delivered Automatic drain traps have helped to reduce air, energy and maintenance costs.

Cost savings in the last one year and a half, by use of 25 Armstrong-type devices both in steam and pressurised-air networks are estimated, as follows:

TABLE 3.

3.000 ton steam-loss reduction in steam networks	HUF 4.500.000	$30.000 US
Air-loss reduction by replacement of manual dewatering	HUF 700.000	$4.600 US

Summary results of actual savings and some financial indices are indicated in the following table:

TABLE 4.

Equipment taken in use in the course of the project	Investment costs in $ US	Savings in $ US/year	Simple payback time in year	IRR
Vibration analyser	22.146	35.000	0.63	157 %
Ultrasonic tester	6.695	11.500	0.58	171 %
Steam traps	13.290	22.500	0.59	168 %

FURTHER RECOMMENDATIONS FOR ENERGY EFFICIENCY IMPROVEMENT

Maximize the benefits of the equipment

- Stabilize Load on Larger Boilers at Optimum Level
  Stabilizing the load on the larger boilers at about 80% of capacity, use the smaller ones to absorb load swings. Repeated large load swings seriously degrade efficiency. The largest and most efficient boilers can be base-loaded at their maximum efficiency point by manual controls, while allowing the smaller boilers to swing.
- Check O2 Sensor on Boiler No. II. and optimize Combustion Efficiency. If boiler No. II. is running too lean, the air/fuel ratio is too lean, there is a serious safety threat, since the stack gases will contain CO. Check the stack to verify the O2 reading. If O2 is really 0.4 %, try checking CO but be careful not to poison the CO sensor (this would happen in a stack with more

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checking CO but be careful not to poison the CO sensor (this would happen in a stack with more than 4000 ppm CO). It might be wise to run an initial check using the Fyrite liquid O2 analyzer. If the Fyrite tests verify the plant-fixed O2 sensor reading, try taking a quick CO measurement with your electronic analyser. Watch the CO readout, and pull the probe immediately if the reading goes beyond 4000 ppm. Adjusting the air/fuel ratio on this boiler would constitute a good ECO, since high CO readings indicate unburned fuel in the stack gases.

- Reduce Boiler Blowdown: Monitor and control the amount of blowdown to maintain acceptable water quality. Get copies of the logs of boiler water quality tests and check to see if too much water is blown down. Test water quality regularly, and use data in adjusting blowdown. Determine frequency of tests, number and volume of blowdown on the basis of water quality level. Prevent from blowing down too much water, and thus wasting energy.
- Reduce Excess Air in Boilers No. III., VII. and VIII. Use methods of Productive Maintenance aiming at to reduce shut-down time of burners in general. Keep running natural gas burners as many as possible, even at low fire, rather than running only one or two of them.
- Find and repair or replace leaking steam traps. Carry on making surveys on steam traps and other similar equipment by using ultrasonic tester, keep register and follow-on when calculations prove replacements profitable.
- Increase steam temperature to turbines. Increase and hold steam pressure and temperature in turbines at the rated value of 39 bar at 440°C. Check up steam extraction temperature and desuperheat the steam in the boilers by water spray accordingly.
- See if steam pressure can be increased to turbines. The same logic applies here as in the steam temperature issue. However increasing the steam pressure is more complex and more costly than increasing the temperature, and should be analysed more carefully before introducing it. Although the turbines will run more efficiently at the higher steam pressure, there will also be an energy cost to boost the pressure. One will have to burn more fuel and spend more feedwater pump energy to produce the higher pressure. Economy of the measure must be calculated.
- Institute better system of daily reports to track Equipment Operating Efficiency. Feed back collected data from installed meters to operations managers and equipment operators. Work out data on the daily efficiency of operation.
- Check Electric Contract Peak Demand against actual needs. Analyse MVM electric bills and historical data to determine if annual contracted demand can be reduced.

Suggestions for Longer-Term Studies as Follow-on Work

- Analyse installation of new CHP equipment and reduction of Steam System Load Swings. It is worth considering analyse installation of a new combined gas-steam-cycle power station versus updating existing old equipment. By the help of a dispatching center reduce swings on the 6-bar system, which comes from the waste heat boilers at the converter.
- Develop a Turbine/Generator Dispatching Strategy. Given the use of extraction turbines and backpressure turbines, variations in steam demand will affect the electric generation output. Analyse steam production, power generation. energy consumption and heat utilisation of the Plant, according to principles of Integrated Ressource Planning and Demand Side Management. It was established on the basis of the energy audit, that there are opportunities for optimisation of energy production and use. By the help of a well defined operational strategy,

including turbine/generator dispatching, an energy dipatching center can considerably increase efficiency both of energy production and use.

- Reduce self-consumption of power. Begin introducing adjustable speed drives (variable frequency control) in boiler fans and pumping applications, including the main supply pumps for district heating. Total Productive Maintenance. Use computer software, planning schedules, and other techniques to improve maintenance department's ability to carry out preventive maintenance. Move toward a system of Total Productive Maintenance.

Concerning 'next step' activities

Besides realisation of short term, mostly low- and medium cost recommendations above, which may improve energy efficiency significantly, we find it worth considering to realise a system level development of idustrial waste-heat utilisation - submitting the project also to external investors - upon the basis of principles, as follows:

- sustain existing waste-heat utilisation of continuous (pusher-type) furnaces, slightly transforming it by connecting newly established waste-heat utilisation systems to the existing one;
- build waste-heat utilising systems in block cooling, in boiler No.IX., to Cowper-stoves in furnaces and connect them to the existing systems of the plant, or to those of the town, respectively;
- utilise heat of screen-cooling systems in blast furnaces or a part of it;
- make it possible that the system adopt itself comparatively flexible to heat demands, by effecting those necessary alterations, associated with the connection of waste-heat utilising systems to the plant or town systems, what make it obviously possible that the newly established system will be capable to be operated in a multi-variable way of operation.

SUMMARY AND EVALUATION

In the course of the energy audit, interviews had been held in the Company from January 18 to 22, 1994 with the General Manager, the Technical Director, the Economic Director, and senior managers, to carry out quick reviews also on technical operation of the plant. Heat and power generation facilities were inspected. An agreement was reached on possible equipment to be supplied, aiming at to improve boiler efficiency, test steam traps, and test turbine vibration. Experts provided the Genereal Manager with advice on technical operations and business strategy.

In April 1994 experts of the JOMUTI Kft. drew up action plans on the basis of energy audit for energy savings. Based upon this action plans, after consulting with experts of Hagler Bailly Consulting, Inc., USAID assisted the project by financing energy efficiency equipment, made in the USA.

The utilisation of delivered equipment has been influenced by different factors. One of those factors was that DUNAFERR Energy Supply Co., Ltd. had been rolled in 1995 to the list of companies, which were due to be privatised.

The management of the company has made considerable affords to improve energy efficiency. Hopefully the new owner, the American company TENECO, will pay even more attention to that.

REFERENCES

Industrial Waste Heat Utilisation Potentials in Duna Iron Works for District Heating; Study; December 1994., Technical University Budapest, Department for Control and System Engineering; Team Leader Dr. Albin Zsebik.

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ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY

DEMONSTRATION PROJECTS AT INDUSTRIAL PLANTS

Plant name:	**Chemical Works of Gedeon Richter** 1475 Budapest, Gyömrõi 19-21.
Consultant company:	**Kontravill Inc.** 1154 Budapest, Domaháza 28.
Contact person:	**György Virágh, C.E.M.**
Phone:	(361)-271-9553

A. Background

The general objective of the project served as a catalyst to accelerate the development of a market for an energy efficiency industry in Hungary, and to assist private firms, - new ESCOs - in the private sector to develop their capability.
Kontravill Inc. joined in the EEMD project in 1993.

B. Brief account

After the well managed training we signed a contract with a pharmaceutical company, Chemical Works of Gedeon Richter to participate in the program. Our agreement included a comprehensive energy audit. Consultant of RCG/Hagler, Bailly helped our firm as advisor in the work. USAID, based on our energy audit, accepted 4 recommandation:

⇒ *new steam metering equipment,*

⇒ *combustion analyzer,*

⇒ *feedwater pump seals,*

⇒ *ultrasonic leak detector.*

The total amount of realized USAID assistance was $63.338.

C. Analysis

Agree with Factory Energy Division we choosed low-cost, short-therm improvements. Because of the low cost and quick payback, these projects could be implemented from the company's annual budget.

1. Chemical Works of Gedeon Richter tried to set up a new computerized steam metering system. They built in 25 flow sensors for local metering. In this project, by USAID help, plant will measure the 85% of steam consumption in 29 points. They will put into operation 4 pcs. new flow sensors, a *data acquisition system*. It will collect data through radio modems and analyse with a computer program.

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2. The factory has 4 boilers for steam generation. Receiving the new *combustion analyzer*, they can check the boiler operation every day, if necessary.
3. Replacement of *feedwater pump seals* reducing electric energy consumption and losses of hot water.
4. After the set up steam trap cadaster and new periodical checking system, the portable *ultrasonic leak detector* have been taken in use.

D. Economic summary

The yearly budget of energy division in 1993 cca. was $8.600.000.

The cost of energy sources was appr. 60 %.

The calculated payback periods in our proposals were between 2,1 and 3,9 years.

1. Unfortunately the biggest part of USAID assistance arrived in September, 1996. Therefore Factory is before installing steam metering and *data acquisition system* so we don't have exact results on this area.
2. Use of the new *combustion analyzer* increased combustion efficiency with cca. 1,8-2%, they can save appr. 6000 m^3 natural gas per year.
3. The saving of electric energy consumption after replacement of *feedwater pump* cca. 10%.
4. The periodical checking system based on new portable *ultrasonic leak detector* will result a steam trap management and safety, efficient operation.

After all, my company, agree with Chemical Works of Gedeon Richter, are glad of participate in USAID program from 1993 to 1996. Both of us thanks for assistance.

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ENERGY EFFICIENCY MARKET DEVELOPMENT IN HUNGARY

DEMONSTRATION PROJECTS AT INDUSTRIAL PLANTS

Plant name:	**Komlói Fûtõerõmû Kft.** 7300 Komló, Bem u. 24.
Consultant company:	**Kontravill Inc.** 1154 Budapest, Domaháza 28.
Contact person:	**György Virágh, C.E.M.**
Phone:	(361)-271-9553

A. Background

The general objective of the project served as a catalyst to accelerate the development of a market for an energy efficiency industry in Hungary, and to assist private firms, - new ESCOs - in the private sector to develop their capability.
Kontravill Inc. joined in the EEMD project in 1993.

B. Brief account

After the well managed training we signed a contract with a heating plant, Komlói Fûtõerõmû Kft. to participate in the program. Our agreement included a comprehensive energy audit. Consultant of RCG/Hagler, Bailly helped our firm as advisor in the work. USAID, based on our energy audit, accepted 3 recommandation:

⇒ *adjustable speed driver,*

⇒ *combustion analyzer,*

⇒ *ultrasonic leak detector.*

The total amount of realized USAID assistance was $32.783.

C. Analysis

Agree with Plant we choosed low-cost, short-therm improvements. Because of the low cost and quick payback, these projects could be implemented from the company's annual budget.

- In 1994 Komlói Fûtõerõmû Kft. tried to buy a new hotwater pump, because the old one was an old type with low efficent. This motor continually operating. In 1995 Plant bought the new motor. In this project, by USAID help, plant put into operation an Alan Bradley type *adjustable speed driver*.
- After the receiving the new *combustion analyzer*, plant can check the boiler operation every day, especially by SOx side.

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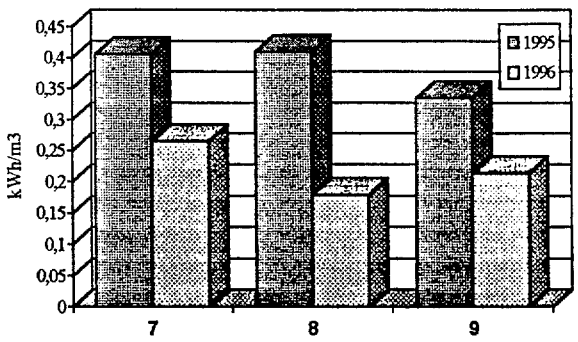
- After the set up steam trap cadaster and new periodical checking system, the portable *ultrasonic leak detector* have been taken in use.

D. Economic summary

The calculated payback periods in our proposals were between 2,45 and 4,16 years.

- The next chart shows the results of first three operating month of built in *adjustable speed driver*. The specific electricity consumption decreased, the fall cca. 43 %.



- Use of the new *combustion analyzer* increased combustion efficiency with cca. 1,5-1,8%, they can save appr. 400 t heavy fuel oil per year.
- The periodical checking system based on new portable *ultrasonic leak detector* will result a steam trap management and safety, efficient operation.

After all, my company, agree with Komlói Fûtõerõmû Kft, are glad of participate in USAID program from 1993 to 1996. Both of us thanks for assistance.

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SAVE ENERGY - SAVE MONEY !

Consultant company:	**Kontravill Inc.** 1154 Budapest, Domaháza 28. HUNGARY
Contact person:	**György Virágh, C.E.M.**
Phone:	(361)-271-9553

"If you can't meter it, you can't manage it".

The main area of activity of **Kontravill Inc.** - established in 1990 - is elaboration of expert reports based on mesurements and monitoring. We are using special measuring equipment for checking and gathering data on energy in industry, in institutional, in residential sector and in many other fields.

The measurements are mostly related to energy consumption, storage, emission, losses, faults, leakages, etc.

Our activities:

⇒ Energy audits,

⇒ Energy balances,

⇒ Heat technological measurements,

⇒ Thermographical examination service.

We are using a big set of equipment of prominent manufacrturers - AGEMA Infrared Systems AB/Sweden, Testoterm/Germany, ITT/USA, Yokogawa/Japan, Omega/USA, Bacharach/USA, UE Systems/USA.

Our small and flexible company has adequate personel, expertise in energy management (CEM) and equipment to carry out activities, as listed above.

Kontravill Inc.

GYÖRGY VIRÁGH C.E.M.
Manager

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INCREASING EFFICIENCY OF DISTRICT HEATING IN DUNAÚJVÁROS

Dr. Albin Zsebik, CEM
András Morenth
Csaba Pomázi

THE PROJECT IN BRIEF

1. Substation of a residential building was modernised by upgrading the level of automatisation, as a pilot project, with Honeywell equipment. Heating/radiator system of the selected building has been reconstructed and provided with thermostatic valves and cost allocators. Also Domestic Hot Water (DHW) meters have been installed in the appartements. As compared with a reference building, there were about 40% savings achieved in total heat consumption and 47% savings in DHW consumption. The total installed cost was $10.000 US. The yearly energy cost reduction is about $2500 US (depends on the heat price). Expected payback period is of 4 years.
2. Eight residential substations were modernised with Johnson Controlls equipment, by furnishing them with Direct Digital Controllers (DDC), connected to a supervisory Energy Management System (EMS). Energy cost reduction is $10.300 US in a year, by a $30.262 US total installed cost. The simple payback time is of 2.94 years.
3. A portable leak detector have been taken in use. By reducing losses in hot water, the simple payback time of the $6.900 US equipment is about 0.46 year.
4. Use of a $13.000 US computer-type portable ultrasonic flow meter is expected to be resulted in a $69.000 US yearly cost reduction, by pushing down average room tempreture and saving ~23 TJ energy in a year. Expected payback period is 0.19 year.
5. Modernisation of further 10 selected residential substations by Honeywell equipment (DDC, EMS and software) in a total installed cost of $40.600 US. Expected yearly energy cost savings are about $13.000 US. The simple payback time is of 3.13 years.

BACKGROUND OF THE PROJECT

Considerable changes in economic incentives and environmental regulations, accessible computer, control and other equipment, new technical potentials all have been resulted in a significant appeal for increasing energy efficiency both on global and on local level. Remarkable steps were made also by DUNAQUA-THERM Heating Distribution and Water Supply Company in favour of improving efficiency of services. They worked out and realised numerous proposals in the field of energy and cost management. They initiated working out a long term development strategy in 1994, with an objective of reducing heat supply costs in the town and began to realize a

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refurbishment of the heating systems. USAID gave support to that activity.

In January 1994 a US expert had helped Hungarian experts in providing DUNAQUA- THERM Co. with an energy audit. In the course of this co-operation interviews had been held in the Company from January 24 to 28, 1994 with the General Manager, the Technical Director, the Economic Director, and with the head of the District Heating Department, aiming at to carry out quick reviews on organizational, financing and tariff structure, technical operation of the company and on heat conservation projects. Water production and heat distribution facilities were investigated. An agreement was reached on equipment to be supplied for improvement of automation in heat substations. Experts assisted the Genereal Manager in handling problems of organizational and operational structure of the company.

In May 1994 experts of JOMUTI Kft., on basis of the energy audit mentioned above, drew up a Development Strategy for the Dunaújváros District Heating System (operated by DUNAQUA-THERM). Based upon this development strategy DUNAQUA-THERM began to operate a long term development program, assisted by USAID with the delivery of US made equipment.

IMPLEMENTATION OF THE USAID PROJECT

Modernization of consumer substation at Károlyi Mihály street 8.

Károlyi Mihály street 8. (K.M.8.), a district heated residential building of 40 flats, constructed of prefabricated elements in 1967, with 300 kW heat demand and 280 m^3/month domestic hot water (DHW) consumption, had been selected as a pilot project building, where the level of automatisation of the substation was upgraded. The building of Károlyi Mihály street 7. (K.M.7.) was selected for reference in evaluations. Improvement of the heating/radiator system, including introduction of consumption-related billing, and installation of DHW meters also took place in the project buiding. Radiators in the heating system have been equipped with Honeywell thermostatic valves and cost allocators which, together with metering the use of cold and domestic hot water in each flat separately, make possible a cost allocation proportional to actual consumption. The substation of the project building has been refurbished to up-to-date standards, improving overall efficiency, ensuring a reliable operation of the renovated radiator system and enabling an adequate monitoring and verification, by installing **Honeywell regulation and control equipment.** Reconstruction of the substation was based on changing to water-flow regulation with digital regulators which autonomously serve the regulation of the substation, and keep contact with a central supervisory computer.

The refurbishment was financed partly by own resources, partly by credit from the German Coal Aid Fund.

Equipment was installed in 1994, the staff is satisfied with them. The monitoring of energy savings started at the begining of the heating period of 1994/95, in compliance with the Monitoring Plan. The company staff participated in the monitoring program and evaluation. Data collection was made with the installed meters, to facilitate consumption-related billing. Some measurements will include continuous data logging of different parameters. Data logging with short sampling intervals is essential for the determination of side-effects of interventions

The main heat and water meters which are essential for identifying the real consumption were checked for their accuracy. These meters were tested and certified by OMH (National Office of Measurement), which was accepted as the proof of accuracy for the purposes of monitoring. Copies of certificates were obtained from the owners of the devices.

Since heat consumption was not metered before the refurbishment of the substation,. we couldn't get data preceding the interventions. In order to get a clear picture on the effects of energy efficiency measures, Károlyi Mihály street 7. was selected as a reference building. This is identical to the building of Károlyi Mihály street 8., as far as building

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envelope, structure and year of construction is concerned, but neither energy efficiency measures nor interventions took place there.

In order to establish reliable information on the energy savings which were achieved due to the demonstration project, we compared heat consumption of the pilot project building with that of the selected reference building for identical periods.

In order to check the reliability of collected data, a comparison was made between the energy consumption figures of the same building in consecutive years. A correct comparison obviously requires compensation for the effect of the weather. It is especially true in the direct case, since the winter in 95/96 was much harsher than many before. The compensation is done by using the degree-day principle. The amount of heat necessary for heating is proportional to the temperature difference between the room and outdoor temperatures. It was assumed that 20°C is to be maintained all along the heating season. According to Hungarian technical standards, the long-time mean value of outdoor temperatures is +4°C during the heating season. Thus the mean temperature difference in a "standard" year is 20-4=16°C. The actual temperature difference in year *i* is $20-t'_i$, where t'_i is the mean value of outdoor temperatures in the heating season of that year. If the

space heat consumption of that heating season is multiplied by the factor $16/(20-t'_i,)$ then we get what the energy use of the building would be in a standard year. This way a comparable figure is obtained. These figures are shown in the charts showing weather corrected data.

The following three charts show the energy consumption of the project building (K.M. 8.) and the difference between that and the reference building (K.M. 7) in a monthly breakdown. Individual charts show the total heat consumption (**Fig. 1.**), the space heating heat consumption (**Fig. 2.**) and the DHW heat consumption (**Fig. 3.**), respectively. It is to be noted that the lighter columns show the energy use of building K.M. 8., while the length of the darker columns mark the difference from the reference. It may also be worth remembering that since this difference columns are added to the light columns, the top of the columns mark the actual consumption of building K.M. 7., and the difference is always positive (i.e. K.M. 7. always used more energy than K.M. 8.).

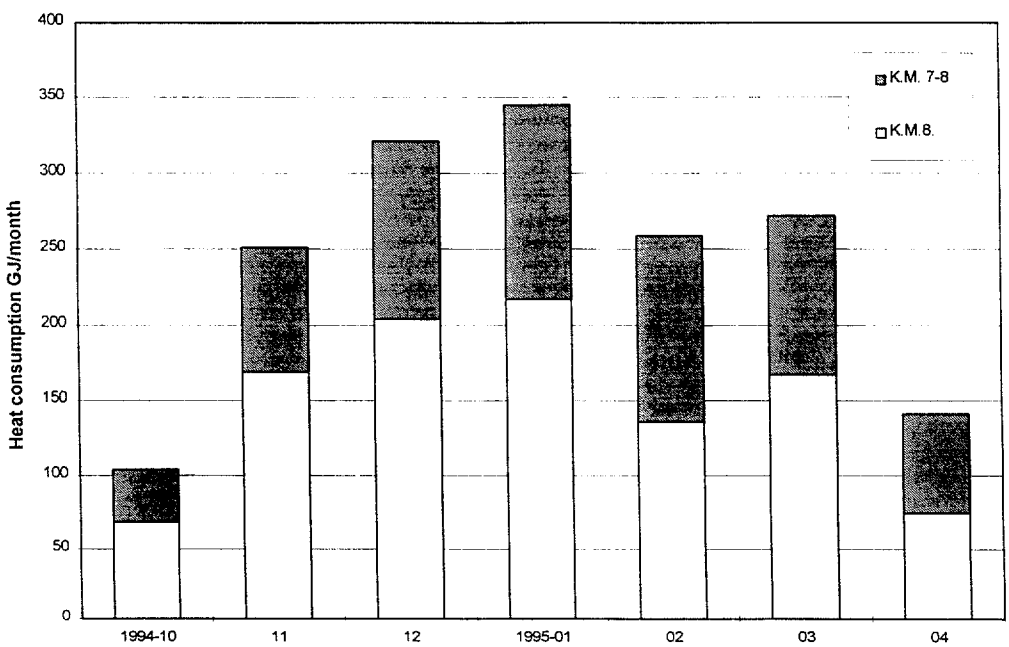

Fig. 1. HEAT CONSUMPTION IN BUILDINGS K.M.8 AND K.M.7.

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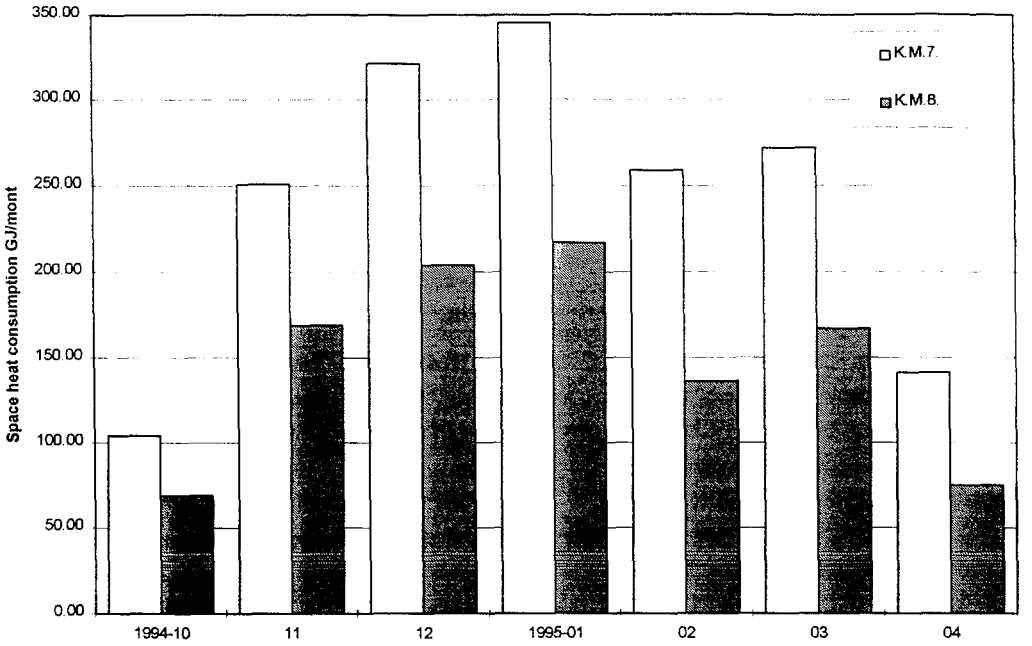

Fig. 2. SPACE HEATING HEAT CONSUMPTION IN BUILDINGS K.M. 7. and K.M. 8.

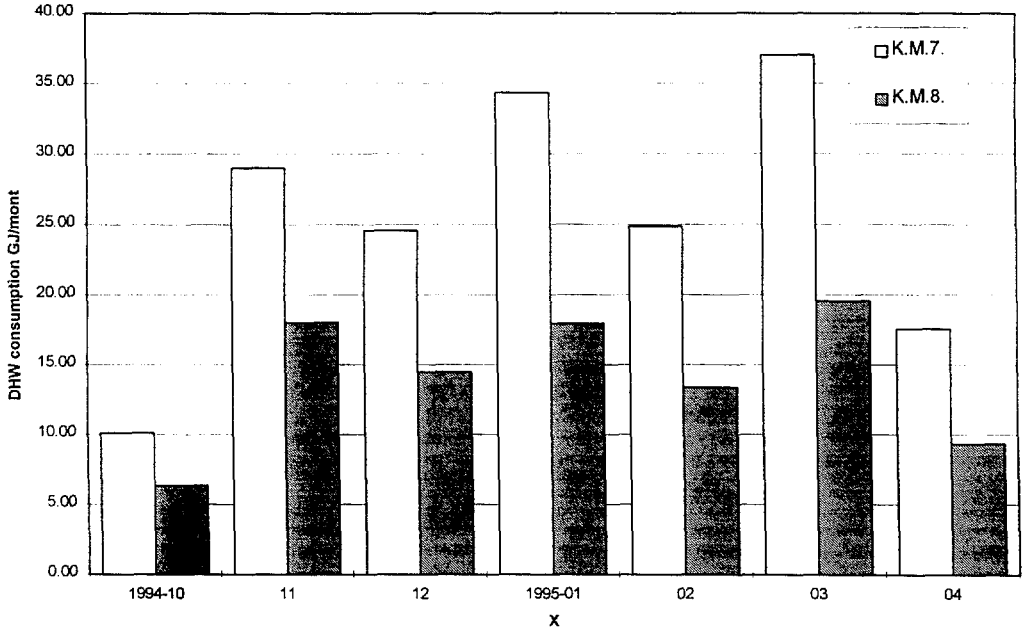

Fig. 3. DHW HEAT CONSUMPTION IN K.M.7. and K.M.8.

If the trends are observed from the charts, it is interesting to note that neither the energy used for space heating, nor DHW consumption of the project building did not remarkably reduced.

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The following three charts show the daily energy consumption of the project building (K.M.8.) and the difference between the reference building (K.M.7.) in a monthly breakdown. Individual charts show the total heat consumption (**Fig. 4.**), the weather compensated space heating energy consumption (**Fig. 5.**) and the DHW heat consumption (**Fig. 6.**), respectively.

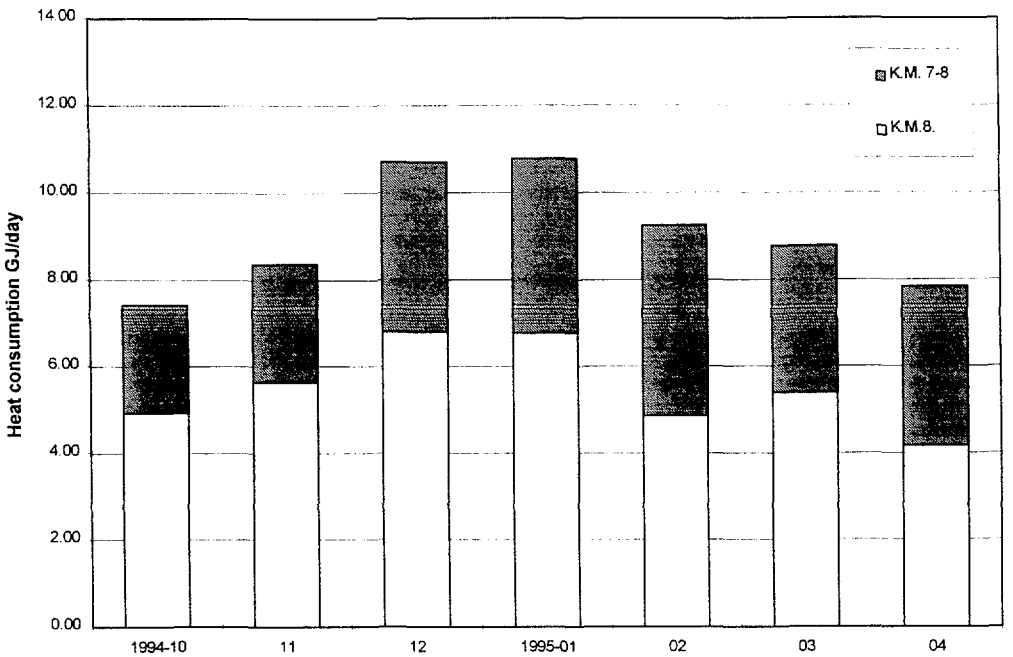

Fig. 4. DAILY MEAN HEAT CONSUMPTION IN K.M.7. and K.M.8.

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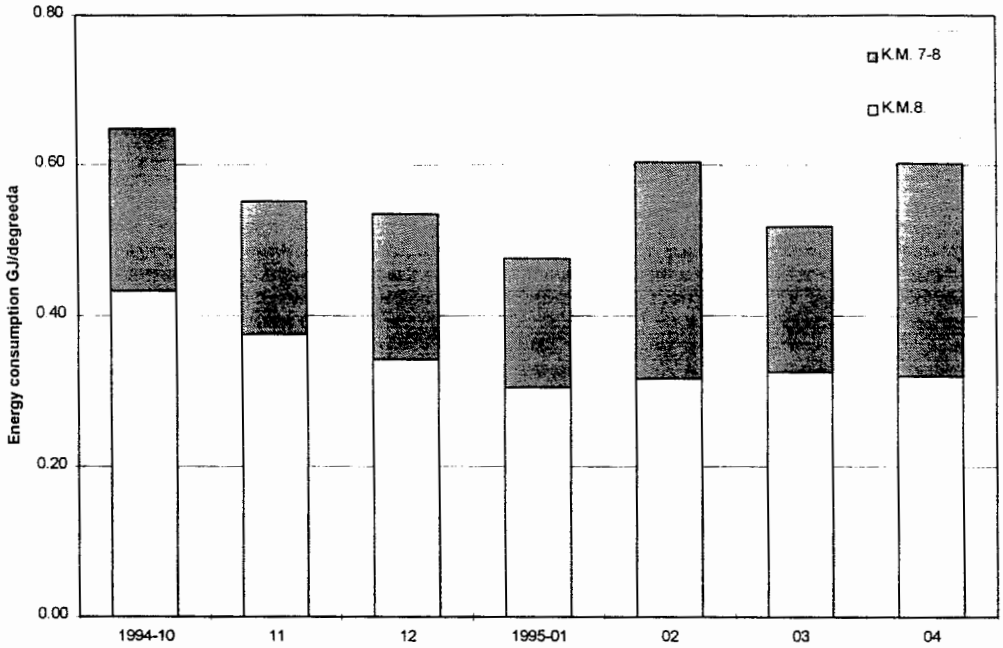

Fig. 5. WEATHER COMPENSATED DAILY MEAN SPACE-HEATING HEAT CONSUMPTION IN BUILDINGS K.M.7. and K.M.8.

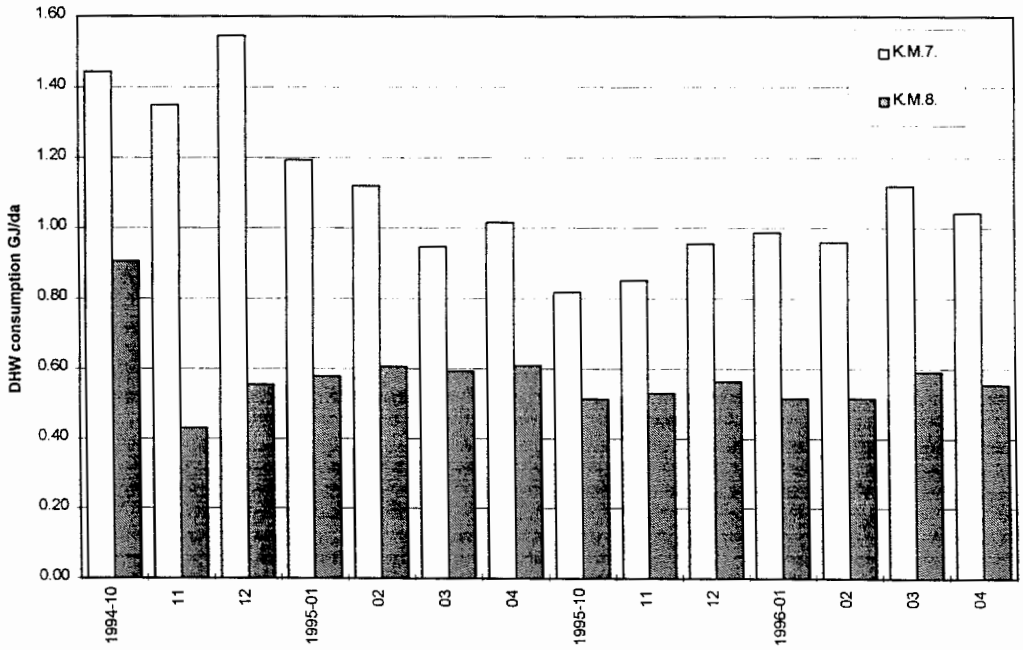

Fig. 6. DAILY MEAN DHW HEAT CONSUMPTION IN BUILDINGS K.M. 7. and K.M. 8.

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The next chart (**Fig. 7.**) shows the total energy consumption data in the heating seasons of 1994/95 and 1995/96. **Fig. 8.** shows DHW consumption in the same time. The total savings are within the 656-818 GJ/year range, with a mean value of **734 GJ/year**. This value gives an average of savings as **30.8 %,** which will be used for further calculations. It is interesting to investigate the origin of the savings. This is much easier if the space heating energy is examined alone, without DHW, according to the previous method.

The investigation shows that less savings were achieved by the heating improvements compared to Domestic Hot Water. Savings in DHW are of 93,23-96,79 m3/year, which gives an average of savings as **47 %.**

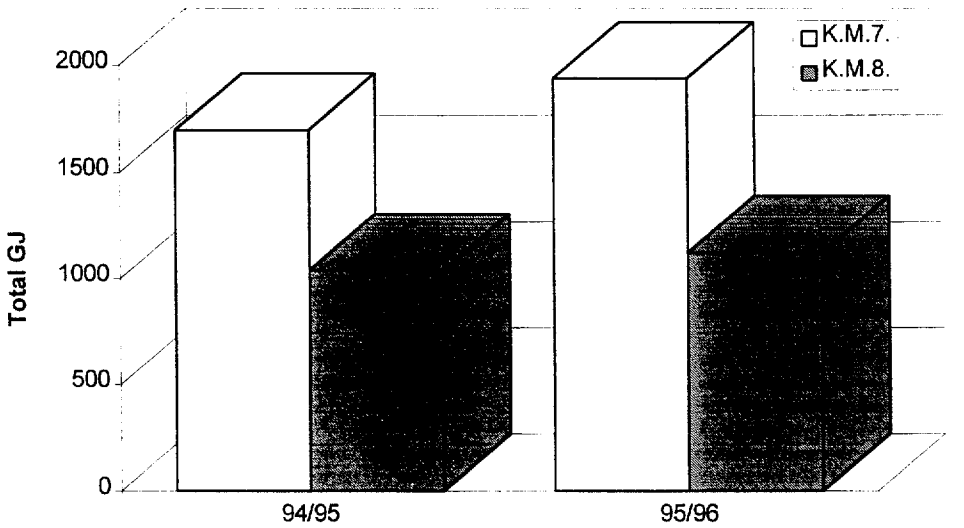

Fig. 7. HEAT CONSUMPTION/HEATING SEASON IN BUILDINGS K.M.7. and K.M.8.

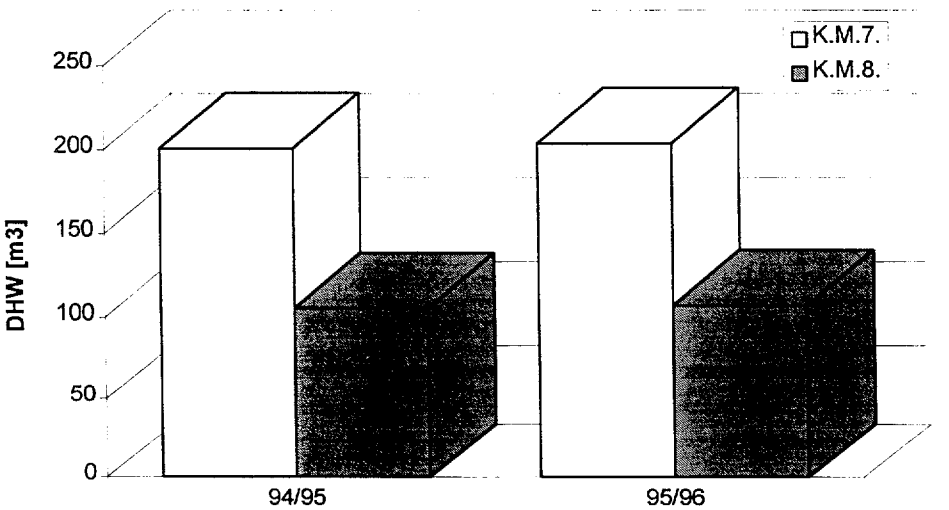

Fig. 8. DHW CONSUMPTION/HEATING SEASON IN K.M.7. and K.M.8.

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Economic analysis

Savings were calculated on the basis of results in energy savings and by applicable tariffs. Economic indices such as simple payback time and internal rate of return (IRR) were calculated for the project.

It is important to emphasise that the common idea of all economic analyses was to provide guidelines for further similar investments.

The money value of savings were calculated with uniform unit energy prices in order to facilitate comparison. The prices used were obtained from the average of current tariffs in Dunaújváros. The following prices were used for the analysis:

Customer DH heat rate: 542 HUF/GJ ($3,6 US/GJ)

Heat price at the heat source: 440 HUF/GJ ($2,9 US/GJ)

Total cost of installation (together with thermostatic radiator valves, heat allocators and DHW meters) is:

HUF 1,470.000 ~$ 10.000 US

This is compared to annual savings which are 322.960,-HUF - 397.828,-HUF (734 GJ/year) for the total energy use. This gives a simple payback of **4,55 years** and **3,7 years** for the different heat prices, respectively.

In the course of a sensitivity analysis, the effects of investment cost and unit heat price upon payback time was examined. The results are shown in the following chart (**Fig. 9.**).

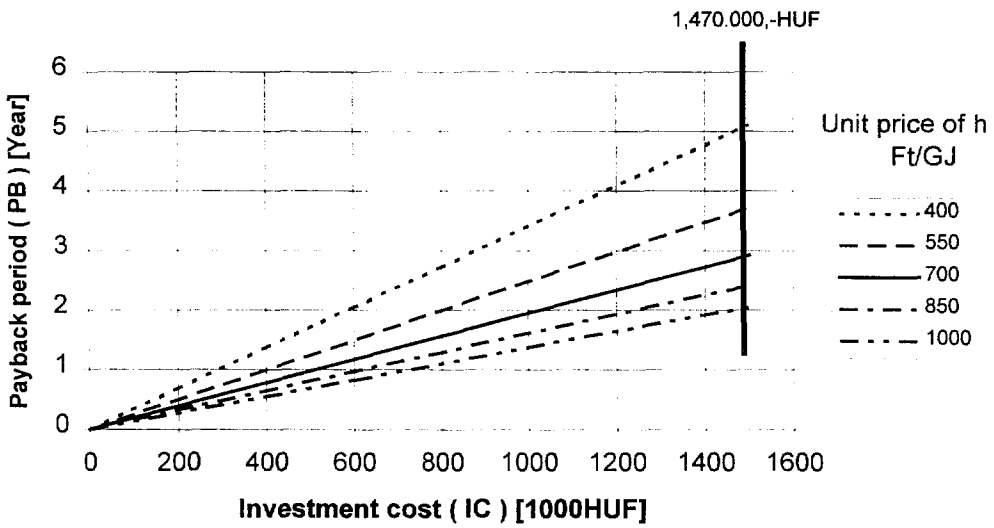

Fig. 9. IMPACT OF INVESTMENT COST AND HEAT PRICE ON PAYBACK TIME

A similar investigation was made regarding the link between the unit price of heat and IRR of the project. The results are shown in the following figure (**Fig. 10.**).

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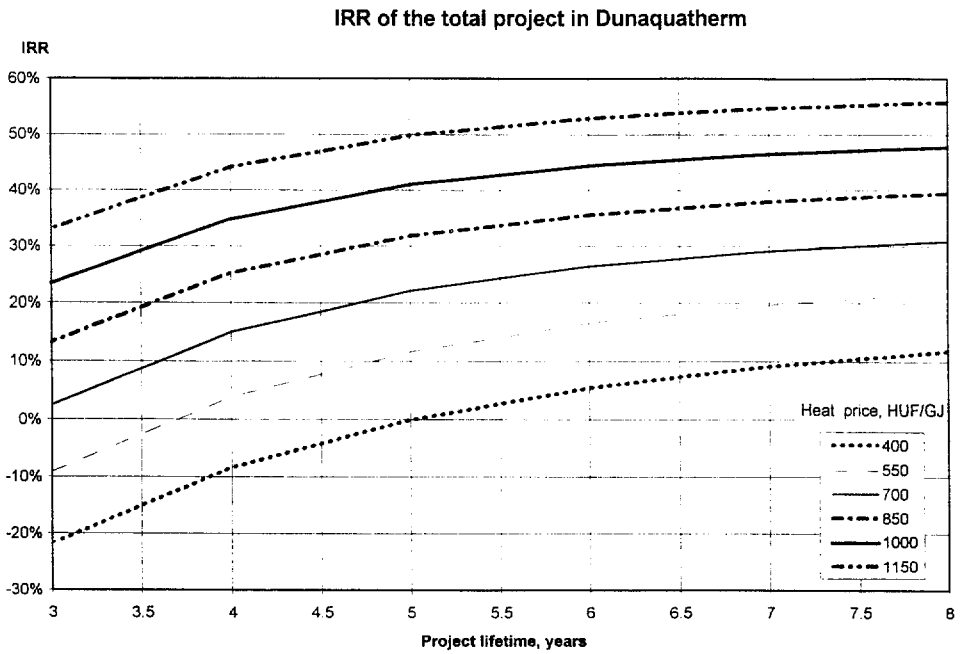

Fig. 10. IMPACT OF PROJECT LIFETIME AND HEAT PRICE ON IRR

UTILISATION OF EXPERIENCES GAINED FROM THE PILOT PROJECT

Modernisation of substations

Experiences gained from the pilot project were utilised within the framework of the long term development strategy, in which 57 substations in buildings of public institutions had been targeted for modernisation in 1994/95, further in the course of refurbishments in the residential heating system (~20.000 flats), what began within the framework of a nine-year project.

Eight residential substations and relevant heating/radiator systems were reconstructed by Honeywell equipment and those in further 10 buildings were made by Johnson Controls devices in the framework of the USAID project. Alltogether heating/radiator systems in 3000 flats have been improved in the course of 1995-96.

A long-term contract was also signed with the CEM`s company on consulting and planning work.

Leak detector

The XLT-20 type Acoustical Leak Detector, delivered by Fisher Research Laboratory has helped reduce annual loss of hot water rapidly. By systematic application along the 53 km long district heating pipeline network in the town, an expected payback period of the equipment will be about 0,46 year.

Portable Ultrasonic Flow-meter

The Controlotron make Uniflow computer type Flow meter, model 994P5 GLMB-33, helped adjust heating water flow in the primary and secondary heating network systems, decrease scattering and push down the average room temperature by that.

We suppose that the average room temperature with a proper adjustment (tuning) of the heating water flow in the secondary heating network systems could be reduced by 0,4°C. It means we can yearly save 2,4% and ~23TJ energy, respectively. An expected payback period of the flow meter will be about 0,19 year.

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SUMMARY RECOMMENDATIONS

The wide-spread use of district heating in the residential and public sector in Dunaújváros requires improvement of its relatively poor energy efficiency and economic performance. This makes it necessary, among others, to introduce new measures and equipment to the district heat supply, to modernise systematicly all the 500 substations in the network.

For any future considerations regarding similar projects, one of the major inputs for decision-making is a *reliable information on the economic viability* of such investments. Therefore it is an essential part of the monitoring actions not only to establish the achieved savings, but also to compare the financial benefits. Savings should be broken down to individual measures, wherever it is possible to evaluate the effect on economic performance of these measures directly.
Since the financial background for energy saving projects is rapidly changing in Hungary and such investments are usually long-term projects, the analysis of the *sensivity* of financial viability to different influencing factors is also an essential part of the project. The factors will include energy-price change, inflation, devaluation of the national currency, etc.

It has been found that projects of this kind result in benefits both on global and on local level. Energy is actually saved by such measures, which has a positive effect on the company's energy and financial balance, reduces environmental pollution, etc. On local level all projects provided advantages both to the customers and to the DH company. From one point of view these were supply side projects, from another view point demand side ones. Supply side benefits included more favourable operating parameters, reduced running costs while demand side advantages were comprised of increased comfort level, reduced or stabilised tariffs, individual control of energy use.

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JOMUTI Kft. (JOgi és MÛszaki Tanácsadó Iroda)

A céget a rendszerváltást követõen magánszemélyek alapították azzal a céllal, hogy az alapítók és az együttmûködõ szakértõk tapasztalataival segítsék Magyarországon az átalakulással járó új feladatok megoldását.

Jogi és mûszaki tanácsadóként

- egyrészt cégek alapításával, mûködtetésük segítésével,
- másrészt az energia menedzsment szakterülethez tartozó feladatok ellátásával foglalkozik.

Ez utóbbi területen külön kiemelhetõ

- az iparvállalatok energia gazdálkodásának, közületi és lakóépületek hõfelhasználásának ellenõrzése, javaslatok kidolgozása a hatékonyság növelésére,
- a távhõrendszerek és alrendszereinek mûszaki-gazdasági elemzése, korszerûsítése, üzemvitelének optimalizálása, valamint
- mindkét területen beruházás elõkészítési, kiviteli terv készítési és finanszírozás szervezési feladatok ellátása.

1996. évben tevékenységét a finn LPM cég magyarországi képviseletével, lemezes hõcserélõk összeszerelésével és a távhõellátásban alkalmazott kompakt fogyasztói hõközpontok készítésével bõvítette ki.

The company was founded by private persons following the political changes in 1989-90 with the primary objective of assisting to solve the new problems of the transformation by utilising the experience of the founders and co-operating experts.

The company is involved in

- the foundation of firms and companies, and providing assistance for their start-up and operation,
- performing jobs in the field of energy management as a legal and technical consultant.

In this latter area the following fields may particularly be mentioned:

- auditing and supervision of energy management of industrial plants and energy use of public and residential buildings, devising proposals for improving efficiency,
- technical and economical analysis, modernisation and optimisation of district heating systems and their subsystems and
- feasibility analysis, constuction design and finance management in both areas.

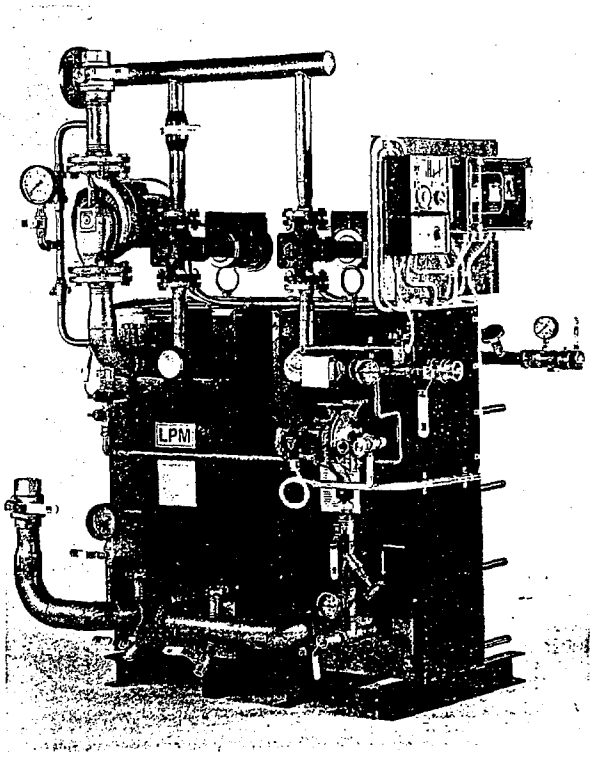
The company extended its field of activity with representation of LPM Co. Finland in Hungary with assembly of plate type heat exchangers and with manufacturing compact consumer substations for district heating.

Cím/Adress:

1172 Budapest, Almásháza u. 55. tel.+ fax: (36 1) 257 7369 tel.: (60) 314 346

1173 Budapest, Pesti u. 197. tel.+ fax: (36 1) 258 2963

Kompakt hőközpont **LPM LJ-2**



Fűtés,
Használati melegvíz

Az LPM LJ-2 kompakt hőközpont LPM LS lemezes hőcserélőivel és szabványos elemekből készül. Kicsi, megbízható és könnyen beszerelhető. Az LPM LJ-2 kompakt hőközpontot a Finn Távfűtési Egyesület tesztelte és jóváhagyta. Az LPM mérnökei számítógépes programot fejlesztettek ki a hőközpont méretezésére és szimulálására, amely a méretek, szabályozó szelepek és szivattyúk gyors és pontos kiválasztására alkalmas. A programot az LPM képviselői és forgalmazói használják, fűtési, légkondícionálási és HMV rendszerek tervezésére.

Műszaki adatok:	Primer és szekunder
Maximális üzemi hőmérséklet:	120 °C vagy 150 °C
Maximális üzemi nyomás:	1,6 MPa
Maximális próbanyomás:	2,1 MPa
Hőcserélő lemez anyaga:	Rozsdamentes acél AISI 304
Hőcserélő lemez vastagsága:	0,7 mm
Hőcserélők hőszigetelése:	30 mm-es ásványgyapot, festett fém burkolatban

Fűtési és HMV hőcserélő teljesítményei különböző menetrendekkel		Teljesítmény [kW/hőcserélő]
Prim. hőmérséklet / nyomásesés	Szec. hőmérséklet / nyomásesés	max.
115-45 °C / 3 kPa	40-70 °C / 7 kPa	1800
115-55 °C / 3 kPa	50-80 °C / 5 kPa	1600
115-50 °C / 3 kPa	40-80 °C / 5 kPa	2200
115-65 °C / 5 kPa	60-80 °C / 15 kPa	1900
70-25 °C / 20 kPa	5-50 °C / 27 kPa	1900

Az árajánlathoz szükséges adatok:

- Hőcserélők teljesítménye
- Primer / szekunder: hőmérsékletek
- Primer / szekunder: maximális folyadékáramok
- Primer / szekunder: maximális megengedett nyomásesések
- Kapcsolási rajz vagy más információ, ha eltérő az alaptól
- Tervezett szállítási idő
- Hőközponti helyiség méretei

Alapfelszereltsége

- LSL fűtési hőcserélő
- LSK HMV hőcserélő
- Digitális hőközpont szabályozó
- Fűtési és HMV cirkulációs szivattyúk
- Szivattyú szabályozók
- Elzáró és szabályozó szelepek
- Hő- és nyomásmérők és érzékelők
- Elektromos csatlakozók
- Hőcserélő szigetelések

A hőközponti elemek típusa a vevő által választható. Eltérő felszereltséggel, kiegészítésekkel és kapcsolással is rendelhető. (Pl.: Égtáj szerint megosztott fűtési hőcserélőkkel, stb.)

LPM

LPM Magyarországi Képviselet
JOMUTI Kft.
1173 Budapest, Pesti u.197.

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(36 1) 258 29 63
257 73 69

Termékmenedzser:
Tel.+Fax: 117 26 82

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SUMMARY ON IMPLEMENTATION OF THE USAID'S ENERGY PROJECT FOR THE ÉRV RT. (NORTH HUNGARIAN WATERWORKS) AND NITROKÉMIA RT.

Dr. Mihály Szaniszló

1. ÉRV RT (KAZINCBARCIKA)

1.1. General nature of project

At the competition of energy efficiency programme the ÉRV (regional water utility of Northern Hungary) Rt. obtained the following devices by Rendszertechnika Kft's agency within the scope of the USAID's project No.1.:

- 2 pieces universal reductor yokes, type: MX 1200 S
- 1 pieces ultrasonic flow meter, type: UNIFLOW 994 85 GLMB-3
- 1 piece portable computer, type: Compaq Contura
- 1 piece electric data collecting equipment, type: RUSTRAK

Among the consumed energy carriers the electric energy is of high priority as regards both volume and cost in the ÉRV Rt. and it represents about 70 percentages of the total energy cost. We have found project remunerative within two or three years in the domain of electric energy management.

Within the scope of the USAID's project No. 2. the following projects will be come on:

- water plant No.1. of Borsodszirák 3 pieces Chesterton pumps
- water plant No.2. of Kazincbarcika 2 pieces Chesterton pumps
- water plant No.2. of Kazincbarcika 1 piece speed drive and programming unit, type: Allen-Bradley

During August of 1995 a complete study was compiled for the above USAID's project No.2. which implies technical parameters of the machines installed now, the measured data, informations about envisaged equipments, as well as calculations for economy and energy conservation.

During the summer of this year the installation plans of the delivered equipments i.e. those of the envisaged pumps, were done and the realization as well as putting into operation were performed in the month of September.

1.2. Monitoring program

Measurement and evaluation for the energy savings:

- On the original system to perform measurements of state using devices received by the USAID's budget i.e. RUSTRAK device measuring power and UNIFLOW flow rate meter as well as the instruments of the plant and the measuring equipments individually installed. The base-line data to be measured for comparison are: flow-rate of water, volume of water, electric power, consumption of electricity, pressure, speed (r.p.m.). These data define the instantaneous diagrams measured in the different hours of the day and in different periods for the existing pumps ($H=fQ$, $p=fQ$, $\eta=fQ$) as well as for the connecting pipe-line network.
- Data will be gathered and recorded on the site of installation.
- Units of pump will tested by instantaneous measurements to determine any deviation from the manufacturer's data. This measurement will be carried out immediately following installation and monthly in later times.

Instruments used for the measurements:

- transportable ultrasonic flow-rate meter (USAID)
- transportable electric power analyser (USAID)
- transportable personal computer (USAID)
- transportable pressure transmitters
- transportable differential-pressure transmitters
- transportable tachometer

Evaluation of the energy savings means the difference between the values of the previous state and those of the new state and it will be calculated by:

- specific value of kWh/m^3 in the same hours of the day

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- specific value of kWh/m^3 at the same conditions of operation
- efficiencies of the pumps measured individually
- data of production and electricity bill for longer periods (2 to 4 months, whole year later on)
- The costs will be resulted from the data of consumption or rather they will be modified by cost savings expected in the maintenance costs.

During the elapsed short time we performed several measurements to reach primary conclusions based on the comprehensive data of the meterings.

According to the evidence of measurements the installed pumps fulfilled the evidence of measurements the installed pumps fulfilled the expected and envisaged values in most instances.

1.3. Benefits of project by Plant Managers

The installed new machines are hydraulically fitted in with the utility system while their electric energy consumption and claimed power are about the projected values, but these values will be more favourable after the adjustment of the machines.

Consequently we have good hopes of the fulfilment as regards parameters of project, specially the envisaged rate of return.

After the measurements and experiences of one whole meteorological year we can give a final opinion about the good quality of the speed-drive installed at the well, since it has to follow optimally the seasonal fluctuations in the output of well-water of the well-pump to be controlled.

Here savings in energy and cost will be resulted from the abandonment of the throttle-control at the well-pump as well as an effect diminishing maintenance will be produced from the operation of production controlled by speed-drive sparing well.

2. NITROKÉMIA RT.

2.1. Steam Meter Project

The central power station of the Nitrokémia Rt. generates heat in a volume of 1 360 000 GJ per year.

In the scope of the USAID's project steam metering devices have been installed into beginning section of the magistral lines of distribution.

The steam volume supplied via magistral lines amounts to 81 to 82 percentages of the annual output.

The steam supply is to meet the Nitrokémia Rt.'s needs for technology and heating.

Implementation of the metering enables:

on the production side
- to collect data hourly
- to know structure of customer data for 24 hours
- to be acquainted with periods of peak and valley in the consumption
- to make continuously available specifics of the energy conversion
- to make possible the most economical operation of the production equipments with the knowledge of the customer needs

on the consumer side:
- to make possible the array of supply network to be chosen the most advantageous with knowledge of the customer needs
- to diminish losses of conveyance

2.2. Condenser project

200 kVAr condenser of the USAID project No. 2 was installed about 1 year ago and it is operating continuously and reliably.

Measurement and evaluation:

On the site of installation (at the 0.4 fkV secondary side of the transformer) to measure active and reactive powers (averaged values for 15 minutes) in two cases: condenser will be on and off.

Harmonics and possibly flickering will be measured

Power factors ($\cos \varphi$ 1 and $\cos \varphi$ 2) will be calculated from the measured data (P1, Q1, P2, Q2).

Calculation of the energy and cost savings.

$\cos \varphi 1 = 0.79$, $\cos \varphi 2 = 0.92$

energy = 350 kWh/month

result = 2 million Ft/year

2.3. Benefits of project by Plant Managers

At Nitrokemia Rt. consuming of electric power and steam are the greatest.

In the scope of USAID 1. project expertes of Rendszer-technika Kft. determine the energy saving possibilities and the 2. project brought concrete results, as well.

Results are:
- expense saving by the installed condenser
- reduction of steam loss by the measuring instruments

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RENDSZERTECHNIKA

RENDSZERTECHNIKA FEJLESZTŐ KFT
System Technique Development C. L.
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Telefon: (36-1) 117-3370, 138-1638
Telefax: (36-1) 117-3370

Integrált, hatékonyan működő rendszer tervezése

Rendszer integrátor
Rendszertechnika Kft.

A Rendszertechnika Fejlesztő Kft-t a több mint 40 éves Villamosenergiaipari Kutató Intézet (VEIKI) alapította 1990-ben az Intézet Rendszertehcnika Főosztályából. A cég fő tevékenységi körei: energiagazdálkodási rendszerek tervezése, kódolása, mérése, energetikai mérnökirodai tevékenység, villamosenergia rendszertervek kidolgozása, fővállalkozás cégstratégiák, átalakítási tervek, részterv-vek rendszerbe integrálása.

Kutatási, tervezési klasszikus szolgáltatások:

- megvalósíthatósági tanulmány
- stratégiai tervezés
- energiagazdálkodás elemzés
- rendszertervezés
- szoftver készítés
- átvilágítás
- diagnosztikai mérések
- helyzetfelmérés, szervezés
- minőségbiztosítás, termékfelelősség
- tanácsadás
- terhelés regisztrálás és kiértékelés
- fővállalkozás

Referenciák: MVM Rt., ELMŰ Rt., DÉMÁSZ Rt., DÉDÁSZ Rt., TITÁSZ Rt., OVIT Rt., PV, MOL Rt. (DKV Százhalombatta), Szekszárdi Húsipari Vállalat, Verebély Technikum, stb., NITROKÉMIA Rt., ÉRV Rt. (Kazincbarcika)

Együttműködések külföldi cégekkel: ABB, Schlumberger, Landis-Gyr, Siemens, USAID

Nyitott a Rendszertechnika Kft. további új témák, tevékenységek, vállalkozások fogadására, más vállalkozókkal, társaságokkal, szakértőkkel közös érdekű együttműködésre.

Kérjük, forduljanak hozzánk bizalommal személyesen, telefonon vagy telefaxon.

A feladatok, a problémák megoldása Rendszertechnikával.

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Új szolgáltatások:

- teljes körû innováció
- energia auditok
- tarifa vizsgálat
- DSM, integrált forrástervezés
- minõségi paraméterek mérése
- zavartatási mérések
- katasztrófa riasztás
- feszültség szabályozás
- környezeti hatásvizsgálat
- energetikai szerzõdések
- vevõ, fogyasztói elemzés

Developments in the Global Energy Efficient Marketplace

Part 1: The Association of Energy Engineers

Albert Thumann, P.E., CEM, Executive Director of the Association of Energy Engineers

The Beginning

In 1977 the role of the energy engineer and the energy manager was not defined. When the Association of Energy Engineers (AEE) embarked on its mission to promote the information exchange in the emerging energy marketplace it also needed to define the role of the energy engineer manager. The energy engineer emerged as the systems integrator who utilized all technologies from lighting to heating and air conditioning to makeing buildings and plants more efficient. The energy manager needed a fundamental understanding of the efficient technologies involved but also needed expertise in financing energy projects and purchasing fuels. The Association of Energy Engineers is comprised of engineers and managers from all disciplines including professionals with electrical, mechanical and process backgrounds. In addition, AEE members come from various segments of the marketplace as indicated in Figure 1.

FIELD OF EMPLOYEMENT	
	27.7
Consultant	4.4
Equipment Supplier	.3
Architect	9.7
State, Local or Federal Government	8.3
Contractor	2.2
Educator & R&D	26.8
Energy User (Building, Plant & Facilities)	3.1
Other	15.6
Utility & Energy Supplier	2.0
Developer & IPP	
PERCENT	

Figure 1: Field of Employment

The true strength of AEE is that it brings together consultants, end users and utilities in an important forum to share information. The mission of AEE is to promote the scientific and educational aspects of those involved in the energy industry. AEE growth has truly been outstanding as indicated in Figure 2.

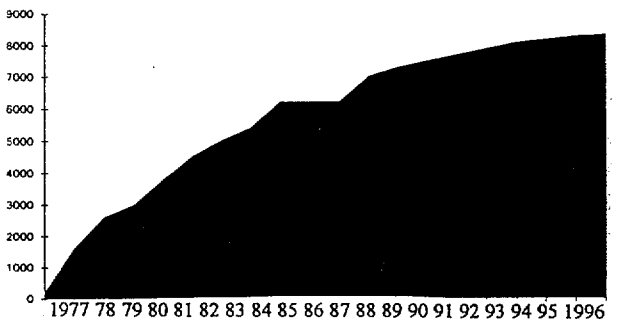

Figure 2: AEE Membership Growth

Today AEE membership includes 8,338 members in 71 countries. The Association of Energy Engineers is a non-profit professional society continues to provide the leadership role in the energy industry.

Chapters

The Association of Energy Engineers chapter network includes 56 chapters comparing 39 in the United States and 17 international cities. Members have the opportunity to meet with professionals in their area, participate in meetings and address issues of importance in their areas. In addition, chapters have the opportunity to network with professionals in other chapters. Each year at the World Energy Engineering Congress, the Chapter Leadership meeting is held. Workshops to help chapters reach their potential are presented at this time.

The AEE international chapters continue to grow. International Chapters include:

Brazil
British Columbia, Canada
Bulgaria
Caracas, Venezuela
Hong Kong
Hungary
Japan
Malaysia
Mexico (Guadalajara)
Mexico (Monterrey)
N. Alberta, Canada
Netherlands
Philippines
Romania (Bucharest)
Romania (Cluj Napoca)
Trinidad
Ukraine

Certification

Certification is an essential ingredient in developing qualified energy engineers and managers. The Association of Energy Engineers has developed the Certified Energy Managers Program. The below highlights the Association of Energy Engineers certification program.

AEE Certification Programs

AEE is recognized as a leader in promoting high quality industry standards and develops certification programs to meet industry needs.

Why Become Certified?

Certification is part of total quality management. When an individual becomes certified in a designated field it recognizes the professional achievement in the eyes of colleagues, governmental agencies, perspective employees and clients. Certification establishes a standard of professional competence which is recognized throughout the industry and inspires the development through encouragement of long-term career goals. Certification also promotes quality through continuing education to assure a high level of competence in constantly changing fields and enhances the status of professionals in the industry.

What Certification Programs Does the Association of Energy Engineers Offer?

Industry demands specialization and certification needs to meet these requirements. The Association of Energy Engineers offers certification programs in lighting and specialized areas. The most important certification program is the Certified Energy Managers Program (CEM) and is described below.

Certified Energy Managers Program (CEM)

Started in 1981 the CEM program now includes 2,300 professionals and represents virtually a who's who in energy management. The CEM program has been used as follows.

- The US Agency for International Development has used the CEM program in the Ukraine, Romania, Hungary and Bulgaria to develop qualified energy service professionals.
- Companies such as Johnson Controls and Honeywell have used the CEM program as a job requirement in performance contracting.
- The state of Kentucky has recognized the CEM program as a requirement to do performance contracting.
- The US Government recognizes the CEM as meeting the training requirements of facility federal managers.
- Utilities such as Florida Power & Light, Detroit Edison, El Paso Electric, Commonwealth Edison, Niagara Mohawk and United Illuminating are using the CEM as part of their total quality management efforts.
- To bid on various government projects the candidate had to be a CEM.

In addition, the Association of Energy Engineers offers the following certification programs.

Certified Lighting Efficiency Professional (CLEP)

The CLEP program was developed out of the need to identify specialists in lighting efficiency. The CLEP program includes 435 professionals who have been certified and are recognized as meeting the certification requirements of the EPA Green Lights Lighting Management Company Ally Program. The program includes a two-day refresher course and a four hour examination.

Certified Indoor Air Quality Professional (CIAQP)

The CIAQP is a program designed to meet the growing needs of businesses to identify qualified indoor air quality practitioners who solve the problems created by "sick building syndrome" as well as facility managers who are responsible for operating healthy buildings while maintaining comfort and reducing energy costs. The program includes a two-day refresher course and a four hour exam.

Internet Access

The Association of Energy Engineers has established a home-page on the internet. The address is *aeecenter.org*. The home page is illustrated in Figure 3. Information on seminars, conferences and shows, as well as a current list of chapters.

The Association of Energy Engineers is a society of over 8,000 professionals involved in all areas of the energy field. With a 19-year track record of excellence in service to its membership of energy and environmental engineering professionals, AEE is dedicated to remaining in the forefront of a rapidly changing network of industries. To serve its members, AEE seeks to provide practical direction and reasonable solutions in areas of energy management strategies, contingency planning and viable alternatives for dealing with fuel price increases in a positive way.

Figure 3. Association of Energy Engineers Home-Page

The World Energy Engineering Congress

The 20th World Energy Engineering Congress (WEEC) will be held at the Georgia World Congress Center in Atlanta, Georgia, USA, November 19-21,1997. This is the most important event AEE presents each year. In 1997 WEEC will be expanded to include special events coinciding with AEE's 20th anniversary. The WEEC features eleven conference tracks, 44 sessions, 180 speakers, networking banquet and luncheons and the big 500-booth exposition. Collocated events include the Energy Service & Power Marketing Center, Plant & Facilities Expo, Strategic Gas Forum, and the Environmental Technology Expo. In addition, the annual Executive Committee and Chapter Leadership meetings are held.

Continuing Education Programs

In 1997 AEE has added a complete line-up of new seminars. These seminars are presented around the United States and can be conducted as an in-house course in any location around the world. AEE has presented these programs in the Ukraine, Eastern Europe, Australia and cities around the world. Seminars for 1997 include:

- Measurement & Verification
- Performance Contracting
- Financing Energy Projects
- Applying HVAC Pump Systems
- Optimizing the Performance of Motors & Drives
- Upgrading HVAC and Central Plants

Awards Program

The Association of Energy Engineers gives special recognition both to individuals and companies who have demonstrated notable contributions to the profession and exceptional service to the Association. This recognition is awarded on both a chapter basis and as part of AEE's international awards. Award plaques are available from AEE for chapter presentation. The international awards are presented at the AEE Awards banquet as part of the World Energy Engineering Congress. In 1996, AEE created the International Energy Project of the Year to recognize an energy management project developed and installed outside the United States. The project is recognized for its first-of-a-kind approach in the country where it is or will be installed.

Publications

AEE members receive, as part of their membership, complimentary subscriptions to the following:

- **Energy Engineering** published since 1904. This authoritative journal's editor is Dr. Wayne Turner, a noted author and expert in the field. Each issue is 80 pages published in a 6x9 format and issued six times a year.
- **Strategic Planning for Energy & the Environment** is published quarterly and edited by William Payne. Each journal is 80 pages and published in a 6x9 format and covers the

Development in the Global Energy Efficient Marketplace

Part 2: Where is the industry heading

Albert Thumann, P.E., CEM, Executive Director of the Association of Energy Engineers

Where is the Industry Heading

The United States spends; $500 billion for energy, $210 billion for buildings, $180 billion for transportation and $110 billion on industry annually. On an international scene, economic growth in developing countries is causing increases in energy use. There is world wide concern that increase energy use causes environmental degradation and global warming. The Association of Energy Engineers annually surveys its members to find out market trends and evaluate the effectiveness of various energy products. The results below are based on 949 responses and was issued this year.

Product Evaluation & Installation

The reason energy management technologies makes good sense is because of high use satisfaction. Energy Management Systems, Lighting Efficiency Products and Motors and Drives are effective strategies as indicated in Figure 4.

	Very Good	Good	Poor	Very Poor
Energy Management Systems	38.6%	53.9%	7.0%	.5%
Thermal Storage	11.2%	58.0%	27.8%	3.0%
Lighting Efficiency Products	56.2%	39.3%	4.4%	1%
Waste Heat Recovery	17.1%	57.2%	24.9%	.8%
Cogeneration	17.6%	51.2%	28.1%	3.2%
Waste-to-Energy Plants	10.0%	39.3%	43.3%	7.4%
Efficiency Motors	29.9%	59.7%	9.8%	.7%
Adjustable Speed Drives	36.6%	54.0%	8.8%	.6%
Interruptible Power Supplies	12.2%	53.7%	31.7%	2.3%
Gas Cooling Equipment	10.4%	49.6%	36.3%	3.7%

Figure 4: Product Evaluation

Market trends and what technologies are being adopted are illustrated in Figure 5. Again, it can be seen that products with highest user satisfaction are planned for installation during the next twelve months.

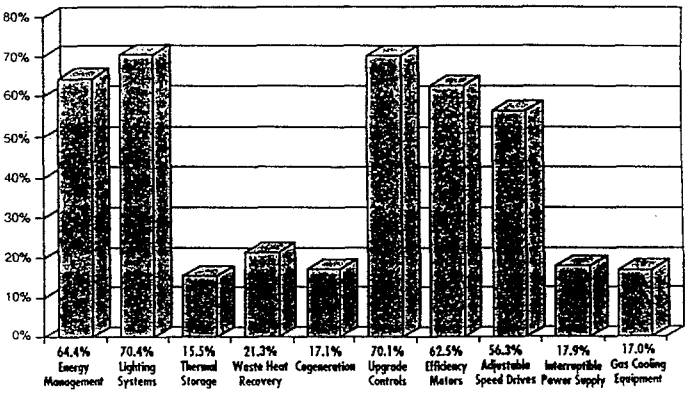

Figure 5: Products Planned for Installation in Next 12 Months

Selling Energy Management Services

In selling energy management services there are several client issues:

- User Satisfaction with Products
- Savings Achieved
- Energy Awareness.

The AEE survey indicates that the results of installing energy- management systems have truly been outstanding; 39% have saved their companies $2 million or more and 8.2% have achieved and energy cost reduction of 35% or more. These results are truly outstanding as illustrated in Figure 6 & 7.

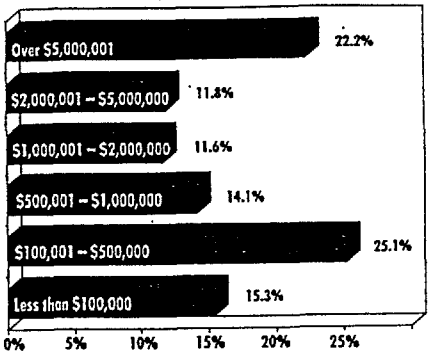

Figure 6: Accumulated Energy Costs Saved

% Savings	% Respondents
0-10%	25.4
11-15%	25.7
16-20%	20.1
21-25%	10.2
26-30%	7.3
31-35%	3.1
36-40%	3.6
41-45%	2.4
46-50%	1.2
Over 50%	1.0

Figure 7: Estimated Accumulated Savings Since Program Started

Impact of Utility Restructuring

The utility marketplace is radically changing from a year ago. Utilities are merging and acquiring new companies and providing services to their customers. The reason is clear that utility customers would switch if prices were lower as indicated in Figure 8.

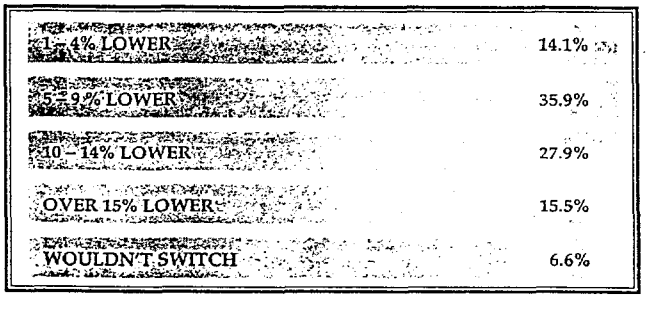

Figure 8: Would You Buy Power from Another Supplier if Utility Rates Were Lower

Cogeneration & Independent Power

The survey indicated that 52.1% felt that international was the best market for cogeneration and independent power. Figure 9 shows international locations where good cogeneration and independent markets exist.

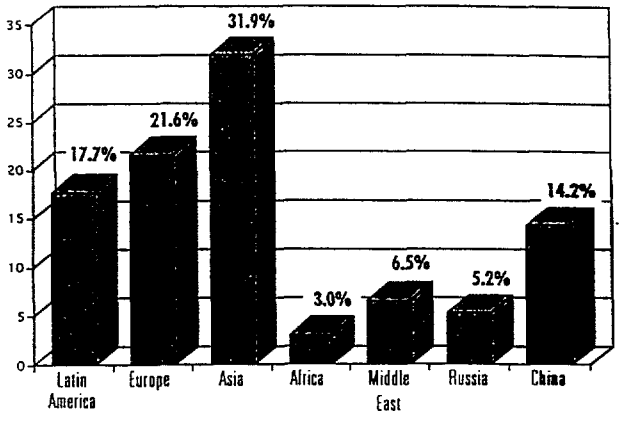

Figure 9: International markets for Cogeneration & Independent Power

Measurement & Verification

In 1995, North America installed $5 billion in efficiency equipment for their buildings in order to save money and conserve energy and water. If all cost effective efficiency investments were made in public and commercial buildings, the United States alone would save $20 billion per year on energy bills, create 100,000 jobs and significantly reduce pollution. When firms invest in energy efficiency they want to know how much they saved and how long their savings will last. Unfortunately until now efficiency financing has been limited because investors and financial institutions have lacked reliable means to measure and ensure energy savings from efficiency investments. To overcome this barrier, the Department of Energy has led the development of the North American Energy Measurement and Verification Protocol. This document provides a common way to carry out and measure savings and will greatly increase the quality and reliability of energy efficiency investment.

This protocol can be obtained electronically on the World Wide Web by accessing the US Department of Energy's "Energy Efficiency and Renewable Energy Network (EREN) homepage at *www.eren.doe.gov*.
A free copy is availabe from Scott McGaraghan:

US Department of Energy Contractor
Room 8 F089
1000 Independence Ave. SW
Washington, DC 20585
Scott McGaraghan@hq.doe.gov
Fax: (202) 586-1737

The Bridge to the Energy Future

The energy industry is alive, well and growing. High use satisfaction with energy management technologies and new measurement and verification protocols make investments in this industry a wise choice. The Association of Energy Engineers and its chapters in Eastern Europe are playing a key role in the dissemination of energy efficiency and in speeding up the adoption of technologies that improve a company's profitability. The Association of Energy Engineers's members and certified energy managers are instrumental in building the energy infrastructure in Eastern Europe and providing a bridge to our energy future.

The Association of Energy Engineers in Hungary

T. Jászay
President AEE Hungarian Chapter
Professor, Technical University of Budapest

USAID energy activity started in Hungary shortly after the collapse of the communist political and economic system. US representatives appealed to the new Hungarian government, that took office after the first free election, with offers of support already in September 1990. To ease the energy supply crisis in the region first for the 1990/91 winter, President George Bush announced the Emergency Energy Assistance Program in Prague in October 1990. Beneficiaries of this program were Bulgaria, Czechoslovakia, Hungary, Poland, Romania and Yugoslavia. The Hungarian Ministry of Industry and Trade started to prepare the implementation of this Program immediately.

The Emergency Energy Assistance Program started in Hungary on February 15. 1991 with four components. Namely:

1. **Energy Efficiency in Industries**
2. **Energy Efficiency in Refineries**
3. **Petroleum Procurement Training**
4. **Energy Pricing Training**

Component 1. became the most successful among the four components of the Emergency Energy Assistance Program. In the framework of it energy audits were made by Hagler, Bailly assisted by EGI Contracting Engineering Co., one of the Hungarian companies with a good historical record in energy conservation engineering. Instruments and equipment of a considerable value were donated to each of the audited companies in line with the demands identified in the course of the auditing. EGI too has got a certain share of the instruments for its contributions to the Program.

The Emergency Energy Assistance Program, and Component 1. particularly, was pointed at identification of no cost and low cost energy saving potential at the companies. At the same time the audits uncovered medium cost medium term cases as well. Finally higher investment demand cases were registered too for the longer term.

Results of Component 1. covering a wide variety of industry branches (BUSZESZ /alcohol and yeast, BUDAFOKI PAPÍRGYÁR /paper, FÕVÁROSI SÜTÕIPAR /bakery, OROSHÁZI ÜVEGGYÁR /glass, BUDAPESTI VEGYIMÛVEK /chemicals, MOTIM /alumina, CSEPELI FÉMMÛ /copper and brass, FÕTÁV /district heating) were presented to the public in a two days seminar with 300 participants, organized by USAID and the Hungarian Ministry of Industry and Trade on January 23-24, 1992. Representatives of the equipment suppliers attended the seminar also and contributed to the technical program of the sessions.

As an outcome of auditing and the efficiency improvement measures 7.7 million USD energy saving has been achieved at the eight companies covered by the program. This sum represented 12% of the energy bill of the companies. Return of investment was shorter than one year in average.

USAID support has been continued in framework of the Regional Energy Efficiency Project. As part of this project, among others, in 1992/93 Phase II of Component I started with three main items on the agenda. Namely:

- **Training of private energy managers and consultants.**
- **Running efficiency projects by the trained energy managers.**
- **Support of NGOs.**

The training was a Certified Energy Manager (CEM) course run by the Association of Energy Engineers. Selection criteria for admission were: private enterpreneurship in energy efficiency already going on or being commenced, engineering background and an acceptable command of English. The course in general was held in Hungary but the final, 10 days long, preparation and the examination took place in Atlanta.

Out of the 15 applicants finally 9 trainees finished the course and passed the examination successfully. They are the CEMs active in Hungary since 1993, who constitute the core of the AEE Hungarian Chapter.

The next step of the above outlined program was to find and select projects for the fresh CEMs where they can demonstrate their skills. Hagler, Bailly - as main contractor of USAID - was still a supportive partner of the CEMs, but in this phase the companies, where the energy audits and efficiency measures were made, had yet to pay for the work done. USAID has financed a part of the purchase of instruments and equipment necessary in this efficiency project. USAID's share in the financing was considerably lower in this phase than in - in the introduction mentioned - first, starting phase of the program.

Seven of the fresh CEMs took part in this phase of the program. A detailed report on this energy efficiency projects is the main item on the agenda of the *„Energy Efficiency Market Development in Hungary"* conference to be held in Budapest on November 15, 1996.

Finally as a fulfillment of the third point of Phase II, the **Hungarian Chapter** of the Atlanta based **Association of Energy Engineers** has been established in Budapest. AEE Hungarian Chapter has by now 24 members. Membership spreads beyond the borders of Budapest to some major centers of the economy in the Hungarian countryside too, contributing by this to the decentralization of economic power and activity.

A pleasing feature of the AEE Hungarian Chapter is the presence and activity of young engineers in it. The strong ties of the Chapter to the Technical University of Budapest and the spirit of enterpreneurship, which is characteristic of the Hungarian youth and last but not least the perception of business opportunities in energy efficiency bring a number of well trained and talented graduates and Ph.D. students to the Hungarian Chapter. The Chapter in general and the two university professors among the chapter members particularly pay attention to recruit new members from the best of their classes.

The university connection works on the opposite way as well. Knowledge and experience collected in the energy efficiency activity through the Chapter, brings a lot of up to date and interesting information, case studies and attracting examples in the teaching process.

Coming to the more general featuring of the energy / energy efficiency situation in Hungary and in connection with this to AEE's role in today's Hungary one has to stress that there is plenty of room and plenty of demand for energy efficiency activity.

Hungary is on its way of transition from a centrally planned, ideology-driven-economy to the market economy of the 21st century. Like all the Central European countries we have the unprecedented task to *transform an omelet into fresh healthy eggs*. In this transition a sound energy economy, efficient and effective use of energy plays an important role.

Just to outline the general situation one has to mention that Hungary is heavily (more than 50%) dependent on energy imports and this imports are rather one-sided. Namely with the sole exception of the Adria-pipeline, Hungary has oil and gas pipeline connections just to the CIS countries. Despite of this unbalanced situation Hungary has had no energy shortages, or supply interruptions in the last 35 years. Energy supply was continuous and reliable. Even the high voltage (750kV), high capacity (2000 MW) electric transmission line worked well and for a while Hungary imported nearly 30% of its electric power from the former Soviet Union. Since the end of Soviet occupation and disbanding the Warsaw Pact and COMECON, diversification of energy imports is a priority and certain progress in that direction has already been achieved by now.

Concerning energy efficiency and energy intensity one has to mention first that the Hungarian energy consumption is **3 toe/cap, year.** That is practically the same as the per capita consumption of the economically eminent Japan. Taking just this indicator in account, one can not speak about energy squandering in Hungary. But looking at the value added that the Hungarian economy produces while using this acceptable amount of energy: the **toe/GDP energy intensity indicator,** the picture becomes quite bleak. The energy intensity in Hungary is at least three times

higher than in Japan and so mainly not because the **toe** counter, (energy consumption) is big, but because the denominator, the **GDP** is small. Explanation of the situation lays in the faulty economic policy of central planning, where material processing was over-dosed and manufacturing of high quality products was neglected.

In the last years a number of energy guzzler, low income industries were fully or partially closed and by that the total primary energy demand has decreased. Looking at 1993 data, primary energy supply intensity per unit of GDP in Hungary was 0.73 toe/1000 USD, compared with an average ratio of 0.40 toe/1000 USD in the OECD. The high energy to income ratio makes Hungary vulnerable to oil - and in general - to any energy price shocks which can not be ruled out surely in the future. Restructuring the product mix, increasing the share of high added value items in industrial production, increasing the share of the service sector seem to be the strategic directions that may improve Hungary's energy intensity indicator.

Parallel to the industrial and economic restructuring outlined above, a lot of management and technical ways and means of energy efficiency improvement have market potential in Hungary. A huge market potential that presents itself for energy efficiency business, where AEE itself and the AEE trained Hungarian CEMs may show up and demonstrate their skills.

Society and the economy as a whole is (or at the latest after the 1. of January, 1997 will be) very receptive to energy efficiency measures and ideas. For starting in January 1997 finally and after all, cost covering and real value reflecting market prices will be introduced in the Hungarian economy. A very serious decision and action which was delayed by the Government as long as possible at all (or a bit even longer). An action that will send to the economy correct signals and make the economy more healthy by that, but at the same time, under the prevailing general income situation, makes financial compensation for the really needy unavoidable. In my guess those who really need a compensation represent about 25% of the population and a very little fraction of the energy consumption. In this way just a very small fraction of the energy bill will be compensated on a strictly social basis instead of subsidizing the energy consumption of the whole economy and society.

All this means that the stage is set for the energy efficiency business in Hungary by January 97. What AEE and AEE Hungarian Chapter can do in the given situation is, to start to prepare projects right now. Doing so our starting speed will not be zero in January 97.

AEE Hungary has to take in consideration the Government's *Action Program for Energy Conservation*. This Program envisages energy savings in the range of 6% to 30%, depending on availability of finances. For the first ten years the Program estimates a 420 to 2100 million USD investment in energy efficiency, 10-15% of which should be government funding. The expected energy saving for this period is 60 to 120 PJ, depending on how much money can be channeled in the energy efficiency business. For the second ten years investment estimates are 1.2 to 4.0 billion USD and expected energy savings 190 to 300 PJ.

Financing remains the most difficult part of the process not least because financial infrastructure is in a relatively early stage of development. According to International Energy Agency proposals the Government could and should improve access to finance by.

- Sovereign guaranties to allow international financial institutions to develop credit lines or revolving funds for energy efficiency investments through local banks, or to lend to municipalities, district heating companies and public institutions.

- Participation with bilateral donors in establishing guarantee funds to manage risks associated with efficiency investment financing.

- A legal and fiscal framework for the development of energy service companies and third party financing, an area in which Hungary lags behind some other countries in Eastern Europe

The Hungarian Government's Action Program and the International Energy Agency proposals correspond with the aims, ideas and practical methods of AEE. Aware of the facts and taking full advantage of its AEE Atlanta background AEE Hungarian Chapter can step in the new era of real energy prices confidently and with dynamism.

For a successful AEE Hungarian Chapter

- Co-operation and communication inside the Chapter and to Atlanta as well has to be intensified.

- An aggressive public relation campaign has to be started.

- The training of new Hungarian CEMs has to be solved on a Hungarian teaching staff basis with an AEE Atlanta support and supervision in Hungary.

Summing up, energy efficiency market development in Hungary has made a considerable progress during the years behind us. Starting with projects on a grant money basis and continuing the activity with considerable USAID support AEE Hungary is on the doorstep of comprehensive project definition and co-financing on commercial terms. American experience in ESCO activity remains extremely valuable for the Hungarian CEMs. General economic boundary conditions in Hungary move in the direction that sets the stage for grand scale energy efficiency market development in the near future.

AEE CHAPTER STATUS REPORT

András Morenth
President Elect
AEE Hungarian Chapter

HISTORY

Background

Establishment of the AEE Hungarian Chapter (further Chapter in the text) was rooted in the USAID funded Regional Energy Efficiency Project, in the second phase of the Emergency Energy Assistance Program.

Founding members of the Chapter were 9 CEMs, trained and qualified by AEE in 1993, on one hand, and USAID selected participants of the Emergency Energy Program, on the other hand. Founding membership was of 12.

USAID financed three year dues payment for all founding members to AEE International, Atlanta, in 1993.

The Chapter was registered as a Hungarian Association of Energy Engineers, in accordance with Hungarian law, after having received the Chapter Charter, on the basis of approval of Chapter Bylaws in Atlanta.

Date and Place of Registration in Hungary

June 2, 1995, Pécs, Baranya County.

Founding Officers of the Chapter

President: Prof.-Dr. Tamás Jászay, Hungarian Representative to Energy Efficiency Project 1992-96, Point #3, (Support to Co-operation with Non-Governmental Organisations),

President Elect
(Vice President): Miklós Gellért, CEM,

Treasurer: György Virágh, CEM,
Secretary: László Soós, CEM.

Changes in Chapter by-law

(a) Miklós Gellért resigned from Vice Presidency in July, 1995;
András Morenth elected by the General Meeting of the Chapter as President Elect (Vice President) in February, 1996.

(b) Location of Chapter Headquarters changed from 7636 Pécs, Barackos út 24. to
1154 Budapest, Domaháza utca 28.

PRESENT STATUS OF THE CHAPTER

Legal Status

Status of the Chapter in Atlanta is International Chapter in Region VI.
Status of the Chapter in the Hungarian Law is "association", which permits a limited scope of enterpreneurship.

Membership status

Membership of the Chapter is of 24 at present, 12 of which are members, 9 student members and 1 associated member. All members and student members are of good standing. AEE Atlanta confirmed dues payments quite recently.

Financial Status

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Income of the Chapter is from membership dues payment. Members pay HUF 10.000, student members pay HUF 1000 per person in a year, which cover international and local dues. International dues to be paid have been defined by AEE International, Atlanta, for members as $30 US (HUF 4500) per person, for student members as $5 US (HUF 750) per person. Local income of the Chapter after deduction of international payments from dues paid by the membership (HUF 80.000 in a year) does not cover administrative costs and Chapter-maintenance of equipment.

Professional Status

Professional status of the Chapter is of a high level. (See ANNEX 1.)

MISSION STATEMENT OF THE CHAPTER

The Chapter is - in harmony with the Mission Statement of the Association of Energy Engineer's[1] - to promote energy efficiency, and environmental technology in industries, institutions in form of co-operation among energy professionals, for the benefit of the Hungarian energy industry. Chapter members provide variety of consulting engineering services in the field of energy efficiency, ranging from energy audits, feasibility studies, project financing and management consulting.

ACTIVITIES OF THE CHAPTER

Chapter members, who were trained and certified in the framework of USAID supported Energy Éfficiency Project Point #1, in 1993, worked out and implemented energy efficiency projects in Point #2, in different industrial plants and institutional buildings, from 1993 to 1996. Presentations and panel discussions in the morning session gave insight to that.

As a chapter they were actively involved in an introductory conference to energy professionals, institutional and governmental officials in May, 1994, at the Technical University, Budapest, further in organising the USAID sponsored conference on "Expanding the Energy Efficiency Market in Central and Eastern Europe", held in Budapest at the Hotel Grand Thermal on June 12-16, 1995.

[1]The Association of Energy Engineer's mission is to promote the scientific and educational interests of those engaged in the energy industry and to foster co-operative action in advancing the common purposes of its members and to promote activities designed to enable the industry to be conducted with the greatest economy and efficiency.

The Chapter holds meetings in every month. Attendance is in average about 50%. The program of meetings is dominated by administrative questions this year.

Chapter members received equipment donations in the framework of their CEM training. Chapter treasurer, György Virágh worked out a scheme of leasing agreements, what improves registration and report on utilisation of the equipment and helps making maintenance better controlled.

OBJECTIVES OF THE CHAPTER

Short term objectives (1-6 month)

1. Improve administrative work of the Chapter, both on organisational and technical level.
   (i) Department Leader of Department for Energy, Technical University, Budapest, Dr. László Rádonyi is so kind to take over the trouble of Chapter Secretariat, in a part-time work of his doctorandi and one of the secretaries at the department. Work started with taking part in organisation of this conference.
   (ii) Technical level of communication of Chapter members must reach a minimum standard very soon.
2. Increase membership of the Chapter with
   (i) energy professionals, who have already indicated willingness to that;
   (ii) corporate sustaining members.
3. Start improving publicity of the Chapter by regular publications;
4. Improve exchange of professional information at the Chapter meetings, consequently;
5. Launch scholarship program for student members, in harmony with those organised by AEE Atlanta.

Medium term objectives (within 2 years)

1. Promote participation of adequate Chapter members in USAID supported follow-on projects and in any other energy efficiency projects. Improve Chapter co-ordination in project definition and implementation;
2. Make up a scheme of training and certification, make it workable, in harmony with
   (i) AEE programs;
   (ii) USAID supported follow-on project conceptions;
   (iii) training programs of other organisations of energy assistance.
   Find potentials for local participation in training and certification.
3. Improve financial status of the Chapter
   (i) by increasing membership,
   (ii) making publications,
   (iii) collecting fees for leasing US equipment,

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(iv) by increasing the role of Chapter expertise in organising local and international meetings and conferences.

4. Promote to turn the scope of work of Chapter members from consulting engineering towards comprehensive project engineering and build up an ESCO-like image of the Chapter on the basis of that.
5. Initiate partnership with, and/or associated membership in Energy Associations, Environmental Organisations and energy related NGOs.

Long term objectives (within 5 years)

1. Make the Chapter financially self-sustaining.
2. Make the Chapter capable to work as an ESCO or as a partner of financially strong ESCOs in comprehensive energy efficiency projects.

SUPPORT DEMANDED TO THE CHAPTER

Application for USAID Assistance in 1995

Dr. Tamás Jászay, Chapter President, submitted a project proposal to US Agency for International Development, Bureau for Europe, Energy and Infrastructure Division on August 10, 1995 for the following three activities:

1. Certified Energy Manager (CEM) Training Program
2. Introductory Publication
3. Computer for AEE Chapter and E-mail Access to Members

Total estimated cost of proposed activities was $ 75.000. No official feed-back obtained on this application yet.

Updating the submitted application

General scope and overall background of the application is still valid. However the main accent would be laid first on co-operation among Chapter members and that with institutional and business partners of the Chapter. E-mail should be considered as a tool of basic communication. Administrative work of the Chapter secretariat must be compensated in a reasonable way. No computer is needed from assistance by now, but more E-mail access is required to make all members accessible by that. Nine already have E-mail address (including five student members). Fifteen others should be taken into account to begin with. Not monthly account payment is of real importance, but a well structured data base software for one computer in the Chapter.

Financial support to Chapter publicity is still worth considering. Well defined scope and outlook of a publication may help build and maintain an image of the Chapter, the global AEI network and that of the whole assistance program. It can better disseminate information, what conferences try to do on an ad hoc basis.

Certified Energy Manager (CEM) training is only one on the AEE menu list. Accent has changed, as far as the title of training and certification is concerned. The main stress within the subject should be laid upon practical information and filling up gaps in awareness, such as financial preparation and implementation of comprehensive projects, build up and hold connections to funding institutions, etc. Importance of local participation in the process cannot be emphasised enough. It does include significance of use of local language and special local expertise.

Summing up the updating conception of the submitted proposal, it is kindly requested to get a feed-back upon the framework of potential scope and scale of financial support to the Chapter soon. Chapter starts to work out details immediately.

ACKNOWLEDGEMENTS,

to USAID Bureau for Europe, Division of Energy and Infrastructure in Washington and to the AIDRep Office in Hungary

Thanks and friendly regards to Robert Ichord, Robert Archer and to Leonard Rogers who have taken part in USAID support to the Hungarian Energy Sector since the very beginning. The same applies to Ira Birnbaum in Washington and Bruce Abrams in Budapest, who newly joined the deal, but have contributed a lot to that.

to Hagler Bailly Consulting, Inc.

Some of ours got acquainted with David Keith, as that time Principal of RCG/Hagler, Bailly, in late 1990. Our co-operation has always been featured by an "esprit de corps", a very friendly relation. Thanks and special regards to David Keith, Director of Hagler, Bailly Consulting, Inc., by now, as well as to Mark Oven, Laurent Pommier, Michael Ellis and others for direct work in project co-ordination and conference organisation. The same applies to Dr. Géza Homonnay, local representative of Hagler Bailly in Hungary, for his significant contribution to the CEM training organisation.

to AEE

Thanks to AEE Atlanta, as our "Mother Organisation" in general, and personally to Al Thumann, Executive Director, and Barbara Stroup, Executive Administrator, in particular, for their invaluable help given and care taken in the course of establishment of the Chapter.

to ELECTROTEK, as Prime Contractor to USAID in the follow-on project

Personal regards to Charles Smith, Vice President, to Larry Markel, Vice President and Project Manager in Hungary, to Dennis Watson, project specialist and to

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George Reeves, consulting partner to Electrotek, in the multiannual follow-on USAID project.

Thanks to all, who accepted our invitation to this Meeting and Conference, especially to

- the Ministry of Industry and Trade, personally to Dr. Miklós Poós, Director for Energy Co-ordination, for representing the Hungarian Civil Service at the Conference and for giving us some hint about governmental efforts aiming at to improve energy efficiency in Hungary to-day;
- the Hungary-EU Energy Centre, Ian Brown, Senior Advisor, for information about an EU based revolving fund and about potentials in preferential project financing under commercial terms;
- the GEF administration, for promoting the "treble E" concept (Energy-Environment-Economy) in practical terms;
- International Financing Institutions, such as IFC and EBRD, for their efforts and initiatives for promoting energy efficiency funding facilities by co-financing.
- to all speakers and contributors to the work of the Meeting and Conference.

Thanks again and best wishes to all of you.

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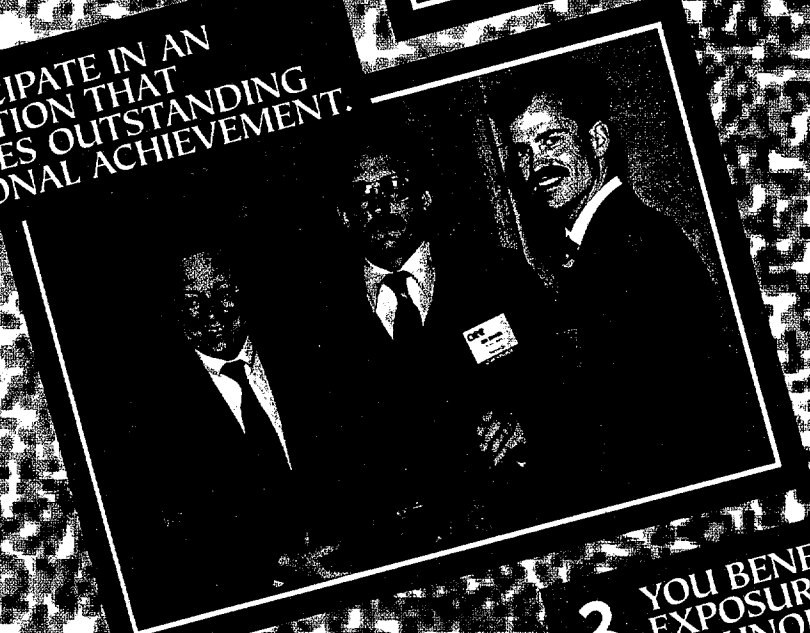
3 REASONS YOU SHOULD JOIN THE ASSOCIATION OF ENERGY ENGINEERS®

1 YOU GAIN ACCESS TO VITAL INDUSTRY-SPECIFIC INFORMATION THAT KEEPS YOU FULLY INFORMED.

2 YOU PARTICIPATE IN AN ORGANIZATION THAT RECOGNIZES OUTSTANDING PROFESSIONAL ACHIEVEMENT.



3 YOU BENEFIT FROM EARLY EXPOSURE TO NEW IDEAS, TECHNOLOGIES, & SERVICES AT OUR PROGRAMS & EXPOS.

20th Anniversary 1977–1997

aee

Two Decades of Achievement!

MEMBERSHIP APPLICATIONS INSIDE!

Membership offers unique opportunities for you to gain and

As a member of AEE, you have key access to both the vital information you need and the peer professionals whose expertise can help you achieve your goals. AEE provides a framework within which you can network and promote your business interests, and, through its programs, enables you to acquire the "tools" needed to maintain your competitive edge into the next millennium.

PUBLICATIONS.

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- *Energy Engineering,* published since 1904, is an 80-page, 6" × 9" softcover technical journal issued six times a year;
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Certification enables you to remain in the forefront of your p

To help raise the professional standards of certain key disciplines within the industries it serves, AEE has developed a number of important certification programs. Through certification, our industry's professionals demonstrate that they have achieved high levels of competence in specialized areas.

Certified Energy Managers Program (CEM)

Started in 1981, the CEM Program now comprises some 2,196 professionals and represents a veritable *"Who's Who in Energy Management."* The CEM Program has gained strong acceptance nationwide, as evidenced by corporations using CEM as a prerequisite in job descriptions and by government agency specifications that require the counsel or services of a CEM as designated by AEE. In addition, the U.S. Agency for International Development has sponsored the CEM Program in eastern European countries.

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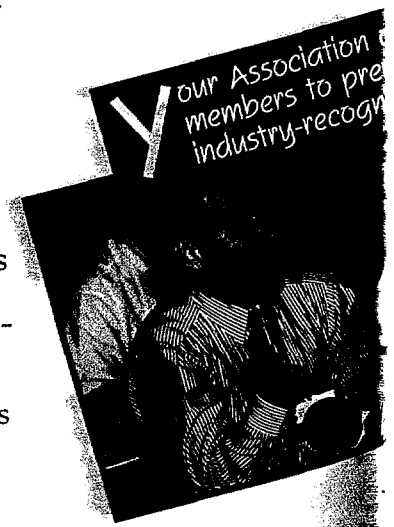
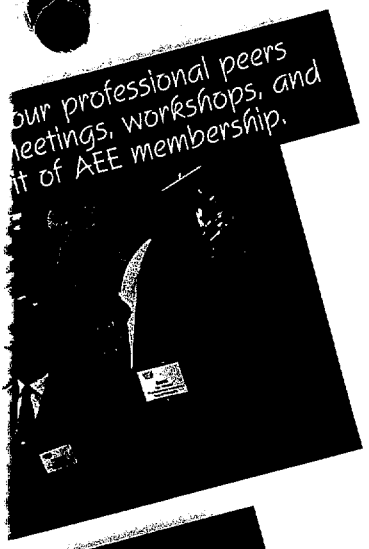
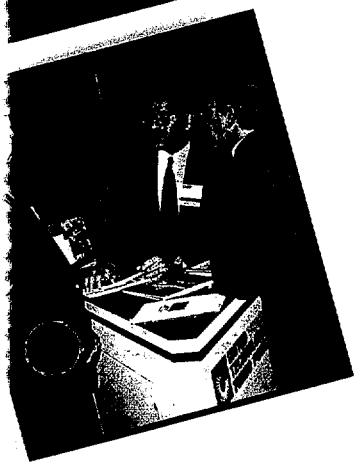


aintain your competitive edge — today and tomorrow.





Congress—now in its 19th year, is the flagship event featuring 176 technical presentations and 450 exhibits. The concurrent Environmental Technology Expo, OSHA Compliance Expo, Energy Service & Power Marketing Center, and the Plant & Facilities Expo, make this a "must attend" event for energy pros.

JOB REFERRALS.

In order to take a more active role in providing members with increased job opportunities, AEE has established the Job Referral Service, which is published in *AEE Energy Insight*. Unemployed AEE members are excused from membership dues while between jobs.

AWARDS.

AEE gives special recognition both to individuals and companies who have demonstrated notable contributions to the profession and exceptional service to the Association. This recognition is awarded on the local, regional, and national levels. Awards are given in six major categories: Energy Engineer of the Year, Corporate Energy Management, Energy Professional Development, Energy Manager of the Year, Energy Management Executive of the Year, and Energy Project of the Year. Awards are also presented in the cogeneration and environmental categories.

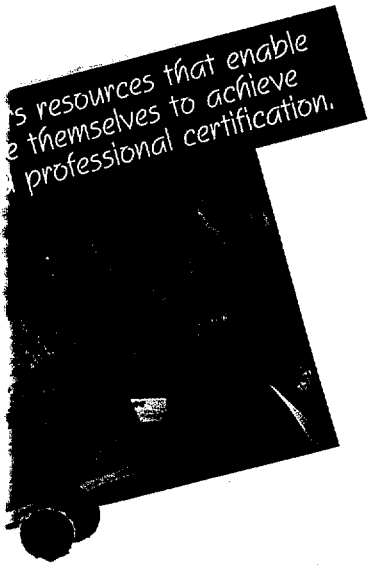
HALL OF FAME.

The Energy Managers' Hall of Fame recognizes individuals for their lifetime achievements in promoting both the practices and principles of energy management. A permanent display indicating all Hall of Fame honorees will be in place at AEE world headquarters. Each person admitted to the Hall of Fame receives an award — usually presented at an AEE convention — signifying the individual's particular accomplishments.

SCHOLARSHIP AWARDS.

Undergraduate scholarship assistance is provided through the Foundation of the Association of Energy Engineers, a nonprofit organization dedicated to furthering education in energy and management. To date, the Foundation has awarded a total of $173,500 in funds for use by outstanding students.

fession — ready to move ahead when opportunities arise.



and laws governing and affecting the entire field of cogeneration.

Certified Lighting Efficiency Professional Program (CLEP)

The CLEP Program focuses on providing recognition to those lighting professionals involved in both efficiency improvement, as well as state-of-the-art lighting design.

Certified Indoor Air Quality Professional Program (CIAQ)

The CIAQ Program recognizes those indoor air quality professionals who have achieved special high levels of competence demonstrated both by practical on-the-job experience and supported by a special certification examination.

Certified Demand-Side Management Professional Program (CDSM)

This program focuses on the non-technical aspects of DSM and is targeted to business professionals who are currently practicing in this industry. The program was developed to meet the growing need created by utility rebate and incentive programs, as well as by the increased numbers of energy service companies bidding on DSM projects.

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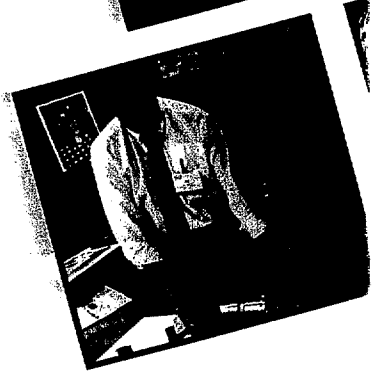

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Use this form to join AEE as a corporate member.

CORPORATE MEMBER APPLICATION

CORPORATE MEMBERSHIP OFFERS MANY TANGIBLE BENEFITS...PLUS LOTS OF EXTRA INTANGIBLES!

Organizations that realize the value of achieving a high level of visibility in the energy industry are likely candidates for AEE corporate membership. In itself, the decision to join indicates your interest in promoting and participating in high levels of professional excellence. And the following specific benefits more than justify the modest cost of membership.

POSITIVE EXPOSURE.
As a corporate member, your company logo will be prominently displayed at all exhibit programs, including:

- World Energy Engineering Congress
- GLOBALCON
- International Energy & Environmental Congress
- Competitive Power Congress

GREAT PUBLICATIONS.
Companies can designate three representatives to receive all AEE publications. Other delegates can be added at reduced rates. Company delegates receive:

- *Energy Engineering*
- *Strategic Planning for Energy & the Environment*
- *Energy User News*
- *AEE Energy Insight*

ANNUAL SURVEY.
Corporate members receive the annual AEE Survey, a 200-page survey detailing market trends and business opportunities.

MEMBER DISCOUNTS.
Corporate members enjoy a number of special discounts available to each of its employees.

HANDSOME PLAQUE.
Proudly display this handsome membership plaque indicating that you belong to AEE.

RECOGNITION.
Your company name will be prominently listed in the *Proceedings of the WEEC* and *AEE Energy Insight.*

PLEASE TYPE OR PRINT ALL INFORMATION.
Our organization wishes to become a sustaining member of the Association of Energy Engineers in the corporate classification. Our payment in the appropriate amount is enclosed. *(Membership cannot be processed unless payment is included with application form.)*

Company Name _____

Company Address _____

City/State/Zip/Country _____

Telephone (_____) _____ Fax (_____) _____

E-Mail Address _____

CORPORATE MEMBERSHIP DELEGATES

Primary Delegate ☐ MR. ☐ MS. _____
LAST FIRST
Primary Delegate's Title _____

Second Delegate ☐ MR. ☐ MS. _____
LAST FIRST
Second Delegate's Title _____

Third Delegate ☐ MR. ☐ MS. _____
LAST FIRST
Third Delegate's Title _____

Enrollment Classification	*Annual Dues*
☐ SUSTAINING CORPORATE MEMBERSHIP FEE *(Includes participation of three delegates designated by the corporate member above.)*	$745.00

PLEASE NOTE: Membership in AEE is a prerequisite to membership in the following divisions:

☐ In addition, enroll our company in the **Cogeneration & Competitive Power Institute**	$100.00
☐ In addition, enroll our company in the **Environmental Engineers & Managers Institute**	$100.00
☐ In addition, enroll our company in the **Energy Services Marketing Society**	$100.00
☐ ADDITIONAL DELEGATES may be designated for an annual fee per delegate of	$85.00

Select method of payment:
☐ **CHECK ENCLOSED** (Payable in U.S. funds to the Association of Energy Engineers)
☐ **CHARGE TO MY CREDIT CARD**
☐ American Express ☐ VISA ☐ MasterCard

CARD NO. _____

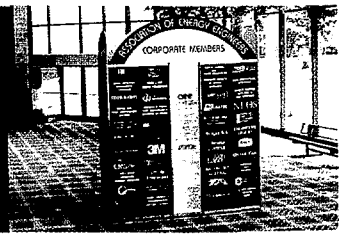
Expiration Date _____ Signature _____ AMOUNT ENCLOSED ☐

(FOR OFFICE USE — PLEASE DO NOT WRITE HERE)

Amount Paid _____ Date Paid _____
Per. Ck. No. _____ Co. Ck. No. _____
Process Date _____ By _____

Code
B C D

A key benefit of AEE corporate sustaining membership includes your corporate name on the Membership Wall on display at AEE expos, including WEEC, GLOBALCON, IEEC, and CPC.



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Use this form to join AEE as an individual member.

INDIVIDUAL MEMBER APPLICATION

PLEASE TYPE OR PRINT ALL INFORMATION.
I wish to become a member of the Association of Energy Engineers in the member classification checked. My payment in the appropriate amount is enclosed. *(Membership cannot be processed unless payment is included with application form.)*

Name ☐ MR. ☐ MS. _____
FIRST MIDDLE INITIAL LAST

Title _____

Company Name _____

Company Address _____

City/State/Zip/Country _____

Telephone (_____) _____ Fax (_____) _____

E-Mail Address _____

Home Address _____

City/State/Zip/Country _____

Check one box to show where AEE mail should be sent: ☐Company ☐Home
If you are a registered Professional Engineer or Architect, indicate state(s) and registration number(s):

State _____ No. _____ State _____ No. _____ State _____ No. _____

Experience in energy field _____ years

EDUCATION: University _____ Degree _____ Field _____ Year _____

University _____ Degree _____ Field _____ Year _____

I certify that the statements in this application are correct and I agree, if elected, that I will be governed by the Constitution and Bylaws of the Association as long as I continue as a member. I furthermore agree to promote the purposes of the Association so far as shall be in my power.

APPLICANT'S SIGNATURE DATE

If sponsored by a member, please have member sign:

PRINTED NAME SIGNATURE

Enrollment Classifications *Annual Dues*

☐ SENIOR MEMBER $115.00
A graduate of an engineering college or university or a registered Professional Engineer or Architect with **six** years' experience in energy engineering or energy management.

☐ MEMBER $115.00
An individual with an engineering, architectural, business, or law degree or a registered Professional Engineer or Architect. *(Persons who are qualified by experience or related degree may petition in writing for full membership consideration.)*

☐ AFFILIATE MEMBER $115.00
A person interested in the objectives of AEE who does not meet the criteria to be a full member.

☐ STUDENT MEMBER ..... $ 15.00
An individual who is a *full-time* matriculated student. *(Send evidence of full-time student status.)*

☐ RETIRED MEMBER ..... $ 15.00
An individual retired full-time who is no longer involved in any career activity.

PLEASE NOTE: Membership in AEE is a prerequisite to membership in the following divisions:

☐ In addition, enroll me in the **Cogeneration & Competitive Power Institute of AEE** ..... $ 20.00
☐ In addition, enroll me in the **Environmental Engineers & Managers Institute of AEE** ..... $ 20.00
☐ In addition, enroll me in the **Energy Services Marketing Society of AEE** ..... $ 20.00

Select method of payment:
☐ **CHECK ENCLOSED** (Payable in U.S. funds to the Association of Energy Engineers)
☐ **CHARGE TO MY CREDIT CARD:**
☐ American Express ☐ VISA ☐ MasterCard

CARD NO.

Expiration Date _____ Signature _____ AMOUNT ENCLOSED _____

(FOR OFFICE USE — PLEASE DO NOT WRITE HERE)

Amount Paid _____ Date Paid _____

Per. Ck. No. _____ Co. Ck. No. _____

Process Date _____ By _____

Code

D

JOINING THE ASSOCIATION IS EASY!

Whether you elect corporate or individual membership, you may fax your completed application to the AEE Membership Department at: **(770) 446-3969.**

—OR—

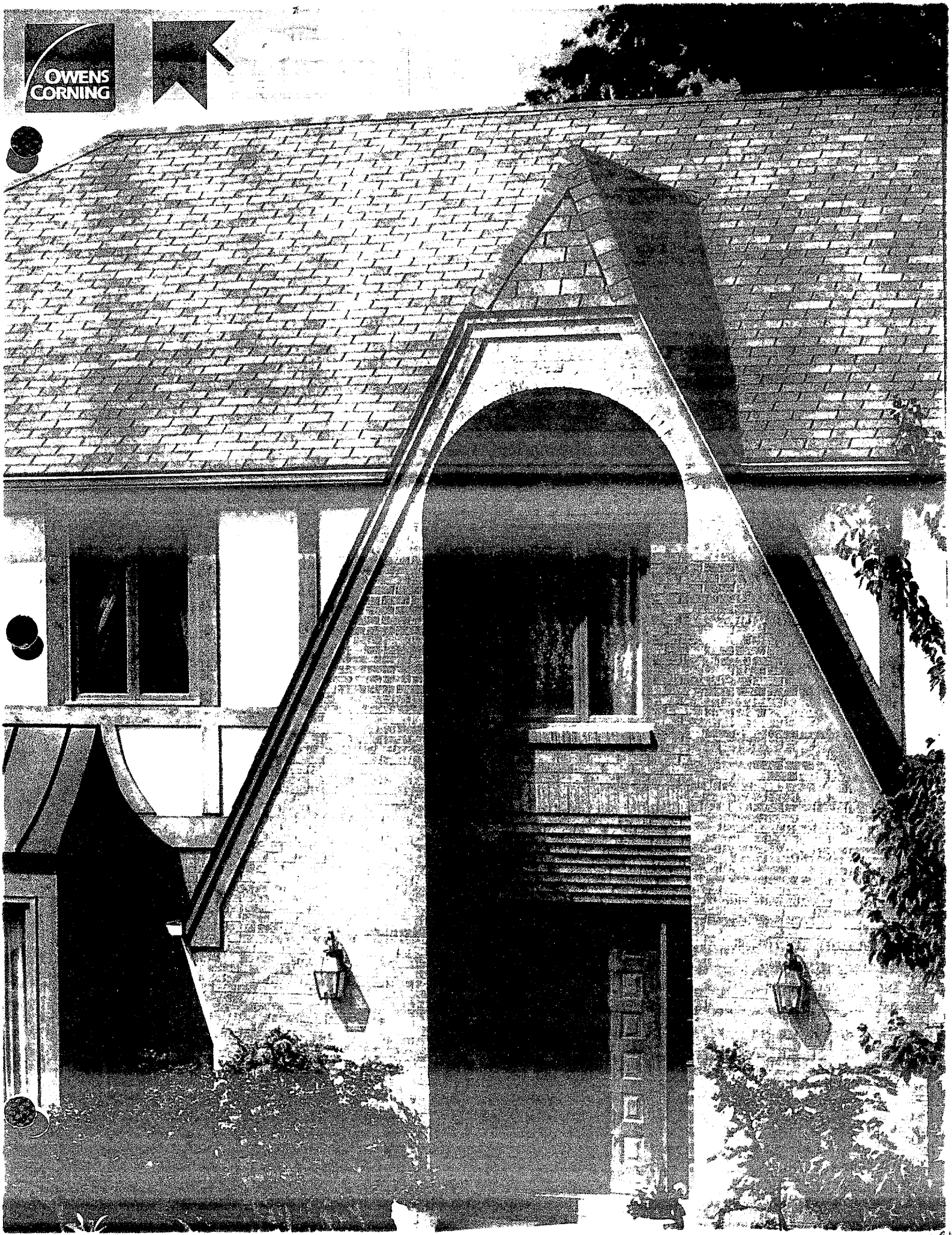
You may mail your completed application to:

THE ASSOCIATION OF ENERGY ENGINEERS®
Membership Department
4025 Pleasantdale Road
Suite 420
Atlanta, GA 30340-4264

NON-PROFIT ORG.
U.S. POSTAGE
PAID
THE ASSOCIATION OF ENERGY ENGINEERS

THE ASSOCIATION OF ENERGY ENGINEERS®
4025 PLEASANTDALE ROAD, SUITE 420
ATLANTA, GA 30340-4264

395


OWENS
CORNING

A SUPREME és a CLASSIC zsindelyek

gondoskodnak az Ön otthonának tartós védelméről.

Ezek a háromhasábos bitumenes zsindelyek egy erős üvegfátyolból és az azt bevonó bitumenrétegekből állnak, hogy biztosítsák otthonának tartós védelmét, valamint a hosszabb élettartamot, és a nagyobb tűzállóságot. Megvédik házát az időjárás viszontagságaitól és a káros ultraibolya sugárzástól.
Az Owens-Corning cég 1959-ben lépett be a tetőfedő anyagok piacára az üvegfátyolos tetőzsindely bevezetésével.
A XX. század elején kezdődött tömeggyártás óta ez az egyik legjelentősebb technológiai újítás ebben az iparágban. Az üvegfátyol előnyeinek felismerése gyorsan folytatódott tovább.
Sok előnye miatt ma ez a legelfogadottabb tetőfedőanyag a háztulajdonosok, a vállakozók, az építők és az építészmérnökök körében.
Az Owens-Corning cég mint a minőségi építőanyagok gyártója annak érdekében, hogy fenntartsa vezető pozícióját és ellássa az ezzel járó kötelezettségeit gyakran vezetett be az üvegfátyol hordozóanyaghoz hasonló technológiai újításokat.
A vezető szerep fenntartásának érdekében mind a mai napig kutatásokat végez központjában és évről évre dollármilliókat költ fejlesztésre.
A termékfejlesztés csak egy a sok kellék közül mely elengedhetetlen egy vállalat számára amely sikeresen szeretné kielégíteni a tetőfedőanyag piacot.
Tizennégy stratégiailag telepített helyi termelőüzemmel rendelkezik az Egyesült Államok egész területén.

Elkötelezettség a minőségért

Mint a tetőfedés technológiai vezetője az Owens-Corning cég az "Elkötelezettség a minőségért" jelszóval biztosítja, hogy minden egyes eladott tetőzsindely tökéletes minőségű legyen.

Kivételes alap- anyagminőség, kivitelezés és szavatossági védelem

- A "Zsindely szíve" az üvegfátyol a maximális vízállóságért.
- Tökéletes gyártási eljárás a tépő- és nyújtószilárdság érdekében.
- Kivételes szavatossági védelem.

Több lehetséges szín- és stílusválaszték

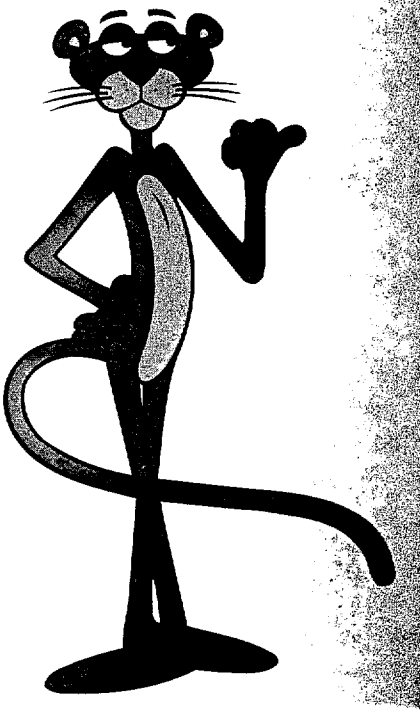
- Esztétikus minőség minden árfekvésben.
- A legnépszerűbb színek, melyek összeillenek a ház többi elemével, mint a tégla vagy a festés.
- tervezés, hogy minden építészeti ízlés megvalósítható legyen.

Napjainkban a háztulajdonosok szeretnék ha otthonuk kifejezné egyéni stílusukat. Az Owens-Corning segít kielégíteni azt az igényt.
A színek változatosságával minden vevő saját ízlésének megfelelő otthont teremthet.

Az otthon melege

Az Owens-Corning cég kiváló minőségű üveggyapot hőszigetelő anyagot is gyárt mellyel biztosíthatja házának tökéletes hőszigetelését.

Hogy döntésében segíthessünk keressen fel bennünket és kérje szakmai tanácsadásunkat.



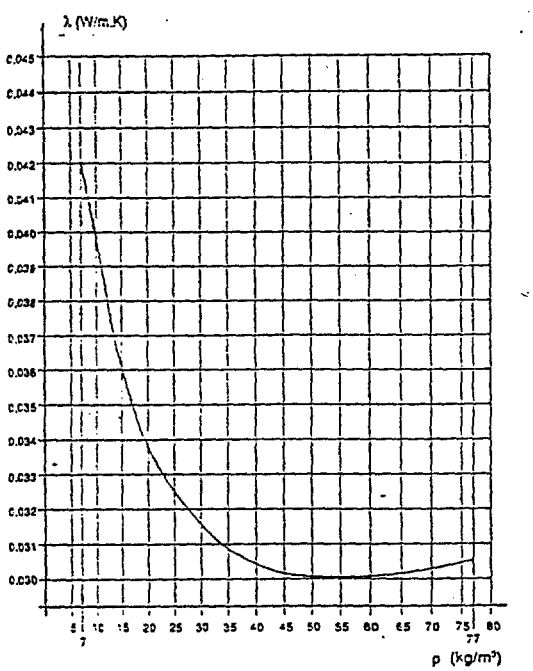
Thermolan® üvegyapot szigetelőanyagok az Önök szolgálatára

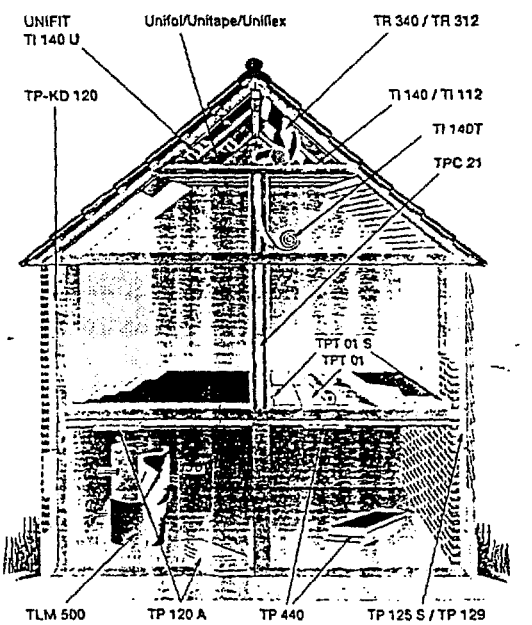
Az **Owens-Corning** amerikai vállalat európai tevékenysége 1979-ben a belgiumi Visé városában megépített **Thermolan®** márkanevű, hő- és hangszigetelő anyaggyár üzembeállításával indult, melynek termékeit épületek, gépjárművek-, berendezések-, valamint szerkezetek szigetelésénél alkalmaznak.

A termékskála a következő: csőhéjak, essztrichszigetelő lapok, szigetelő filcek, válaszfal filcek és lapok, kasírozott filcek, UNIFIT szarufaburkolói filc, peremszigetelő csík, kétrétegű falszigetelő lapok, hangszigetelő lapok, épülethomlokzati szigetelőlapok, kazettás faburkolatokhoz alkalmas szigetelőlapok.

A Thermolan® üvegyapotból két hővezetési kategóriában gyártanak szigetelőanyagokat λ = 0,035 $W.m^{-1}.K^{-1}$ és λ = 0,040 $W.m^{-1}.K^{-1}$ hővezetési tényező értékekkel a DIN 18 165 szabvány besorolása szerint.

A Thermolan® üvegyapot laboratóriumban, légszáraz állapotban a ρ testsűrűség függvényében mért λ hővezetési tényező értékeit mutatja az 1. ábra. A 14 kg/m^3 testsűrűség alatti üvegyapot-termékeknek magas a hővezetési tényezője, azaz a gyengébb a hőszigetelő képessége. Ezért 14 kg/m^3 testsűrűség alatti tartományban majdnem sehol sem gyártanak üveggyapot termékeket. Az üvegyapot szigetelőanyagok alkalmazásaira a 2. ábrán láthatunk példákat. Ezen szigetelőanyagok csaknem kivétel nélkül nem égehető anyagok a DIN 4102 szabvány szerint.





1. ábra A Thermolan® ρ testsűrűség függvényében a λ hővezetési tényező

2. ábra A Thermolan® szigetelőanyag alkalmazási példái

UNIFIT TI 140 U. Szorosan illeszkedő szigetelő filc. Univerzálisan alkalmazható filc a vágási irány megjelölésével, alkalmas a szarufák közé való pontos illesztésre, különböző szarufa-osztási távolságok mellett.

Thermolan TR 340. Szigetelő filc rögzítő peremmel. Eggyoldalúan alumíniumfóliával kasírozott szigetelőanyag rögzítőszalaggal. Szarufák közötti-, a belső tetőterekben-, és falakban való gyors rögzítésre alkalmas.

Thermolan TI 140. Üveggyapotból készült filc. Fedőréteg nélküli szegetelő filc alkalmas hő- és hangszigetelésre. Tetőterekben, válaszfalakban, és közfalakba való beépítésre alkalmas.

Thermolan TPC 21. Szigetelőlap.Tetőterekben, válaszfalakban és közfalakba való hő- és hangszigetelésre alkalmas. Alkalmas C - konstrukciójú (50 / 75 mm) tűzálló válaszfalak szigetelésére, amelyeket 12,5 mm-es gipszkarton lemezek burkolnak.

Thermolan TI 140 T. Válaszfal filc. Tetőterekben, válaszfalakban és közfalakba való hő- és hangszigetelésre alkalmas. Alkalmas C - konstrukciójú (50 / 75 mm) tűzálló válaszfalak szigetelésére, amelyeket 12,5 mm-es gipszkarton lemezek burkolnak.

Thermolan TPT 01 és TPT 01 S. Padlólap és peremszigetelő csík. Lépészaj csökkentésére alkalmas. Alkalmas úszópadlók hang-, és hőszigetelésére. Alkalmazható kettős falazású válaszfalakba.

Thermolan TP 125 S. Külső falszigetelő lap. Kűlső falszigeteléshez átszellőzött légréssel, magassági korlátozás nélkül, továbbá többrétegű falak zaj-, és hőszigetelésére.

Thermolan TP 129. Külső falszigetelő lap. Külső falszigeteléshez átszellőzött légréssel, magassági korlátozás nélkül. Alkalmas falak, födémek és előgyártott falszerkezetek zaj-, és hőszigetelésére.

Thermolan TPM 100. Falszigetelő lap fémkazettákba. Külső többrétegű fémkazettás falak zaj-, hő-, és tűzvédelmi szigetelésére az épület magassági korlátozása nélkül.

Thermolan TP-KD 120. Többrétegű falszigetelő lap. Többrétegű falak szigetelő falak zaj-, hő-, és tűzvédelmi szigetelésére alkalmas, levegőréteggel vagy anélkül.

Thermolan TC 504. Alumíniumfóliával kasírozott filc. Az egyik oldalán merevített alumíniumfóliával kasírozott filc, műszerek, épületgépészeti berendezések, klímaberendezések, stb. szigetelésére alkalmas.

Thermolan TLM 500. Lamellás matracszigetelés. Alumínium fedőfóliával hatékonyan biztosítva a szigetelőmatrac felszakadásmentességét. Csővezetékek, klímacsatornák és szerelvények, tartályok, gépek és gépi berendezések külső hang- és hőszigetelésére.

Thermolan TI 112 / TI 212. Tetők szigetelésére alkalmas matracszigetelés. Thermolan TI 112 kasírozatlan filc Thermolan TI 212 polietilénnel impregnált papírral kasírozott, párazárást biztosító filc.

Thermolan TP 116. Válaszfal filc. Lakó- és nem lakóterek, új és felújított épületek szigetelésére alkalmas szigetelőlapok. Alkalmazható keresztfalak, tűzálló fémvázas keresztfalak szigetelésére, vagy más szigetelőanyaggal együtt a jobb hőellenállás biztosítására.

Az Owens-Corning vállalatot 1938-ban alapították az Ohio (USA) Newark városában. Azóta, hogy az üvegszál feltalálója átalakította életünket és munkánkat: termékeinket felhasználják a házépítésnél, a gépkocsigyártásnál, de az űrhajók építésénél is.

A mai Owens-Corning Toledo (Ohio állam , USA) székhellyel az szigetelőanyagok gyártásához szükséges és textilanyagok merevítésére alkalmas üvegszálak gyártásában világelső, egyúttal világelső a polisztirol keményhab alapú és vinilészter műgyanta alapú szigetelőanyagok gyártásában is. Éves forgalma megközelíti a 3 milliárd amerikai dollárt és a világ 27 országában mintegy 17 000 alkalmazottat foglalkoztat.

Magyaroszági forgalmazó: **QUINT Service Kft.**

Kollár Lajos, 1203 Budapest, Jókai M. u. 7. Tel: 285 34 55, Fax 285 69 61

Képviselet magyaroszági érdeklődők számára:

Ing. Belo F ü r i, SK - 851 04 Bratislava, Blagoevova 16, Tel / Fax: 00 42 7 / 81 40 33

OWENS CORNING

Az Owens-Corning bitumenes tetőzsindely rétegfelépítése:

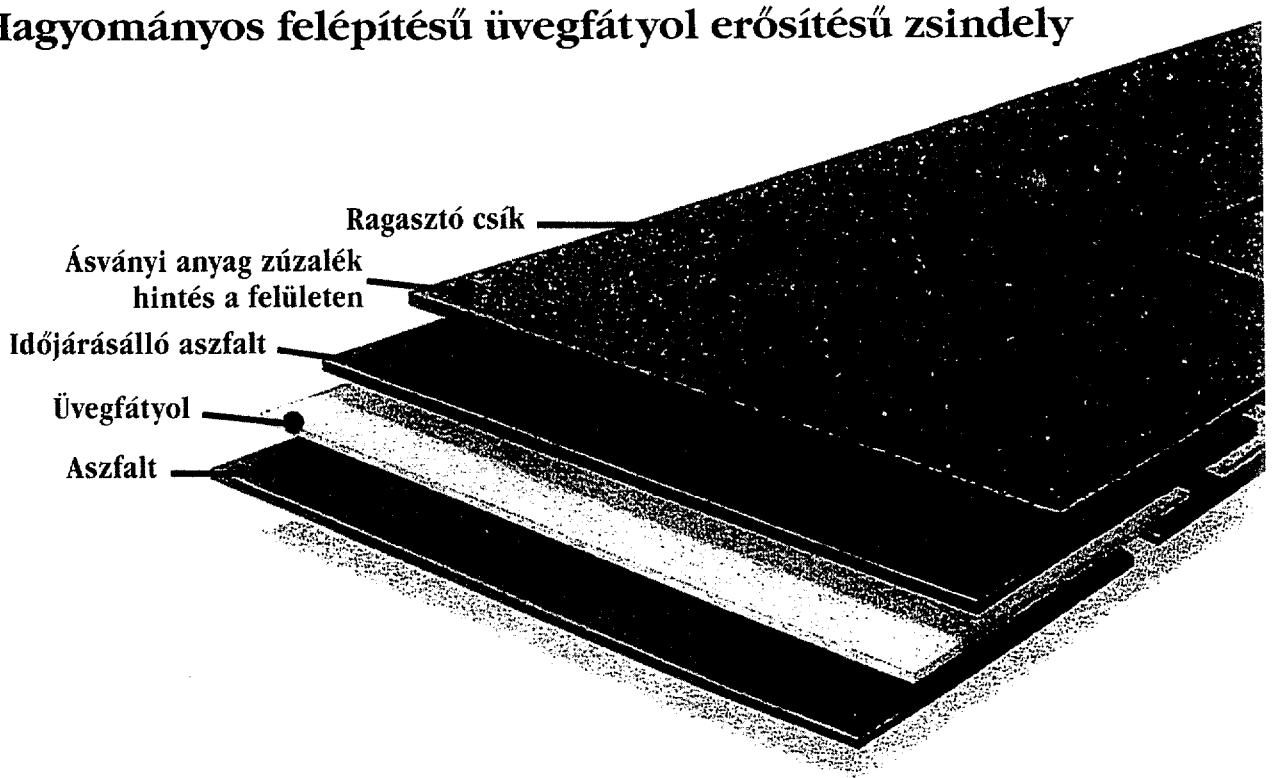
A gazdag színválasztékú természetes ásványi őrlemény biztosítja a védelmet a napsugárzás káros hatásai ellen és gondoskodik az esztétikus megjelenésről és az eleganciáról.

A megerősített "Heart - of - Pink" üvegszövet háló gondoskodik a tartósságról, az ellenálló képességről, a hosszú élettartamról és a nagyfokú szakítószilárdságról.

Az üvegszövet hálóra felhordott két oldali kiváló minőségű bitumen bevonat gondoskodik az időjárással (szél, vihar, eső, jég, fagy, forróság) szembeni ellenállóságról.

Az alsó homokszórás a tapadásmentes szállíthatóságot biztosítja.

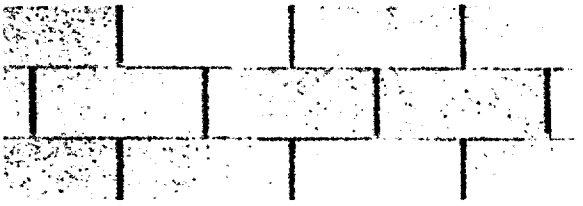
Hagyományos felépítésű üvegfátyol erősítésű zsindely



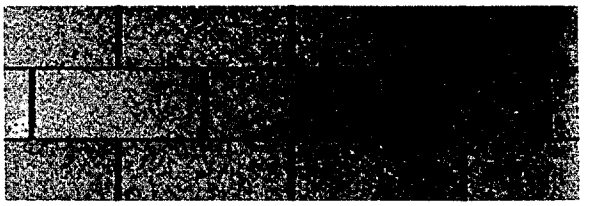
Forgalmazó:

QUINT Service Kft.
Bp. XX. Jókai M. u. 7.
Tel.: 285-3455
Fax: 285-6961

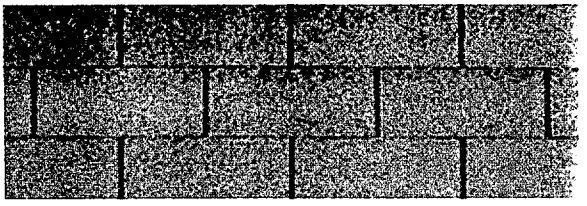
400



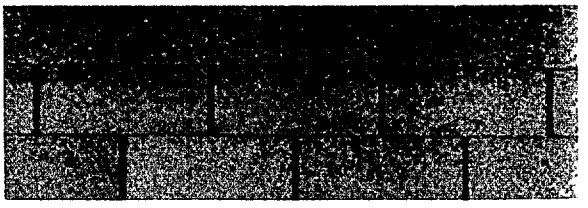
Aspen Gray *Classic Supreme*



Desert Tan *Classic Supreme*



Autumn Brown *Classic Supreme*



Driftwood *Supreme*

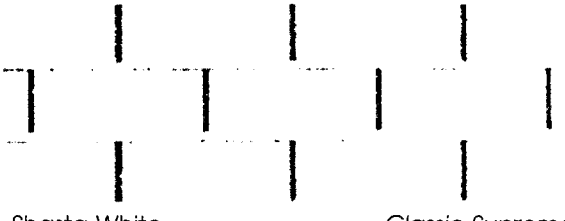
Bark Brown *Classic Supreme*

Estate Gray *Supreme*

Barnwood *Supreme*

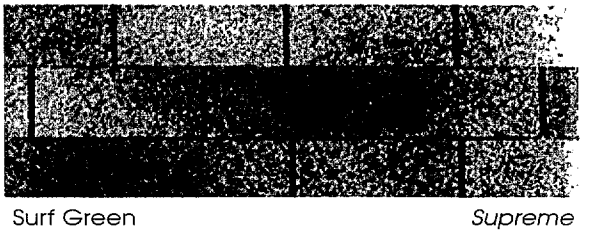
Onyx Black *Classic Supreme*

Brownwood *Supreme*



Shasta White *Classic Supreme*

Carriage Red *Supreme*



Surf Green *Supreme*

Chatcau Green *Supreme*

Weathered Wood *Classic Supreme*

Colonial Slate *Classic Supreme*

APV

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APV Hungary is a member of the APV group of companies, who trade in America under the name APV Crepaco. APV sells Industrial equipment and Food Processing machinery, produced in factories in the UK, Germany, Denmark and America. Total world wide group sales exceed $1 Billion per year. Sales turnover in Hungary and Romania is approximately $8 Million per year, of which 20% is Plate Heat Exchangers sold into the Energy supply sector, especially for District Heating applications. The Company has a manufacturing and assembly unit for Plate Heat Exchangers in Hungary, and plans to establish a similar facility in Romania in the near future. A dedicated staff of specialists are available locally to advise on all aspects of the use of Plate Heat Exchangers to improve energy efficiency, in both heat supply and refrigeration applications.

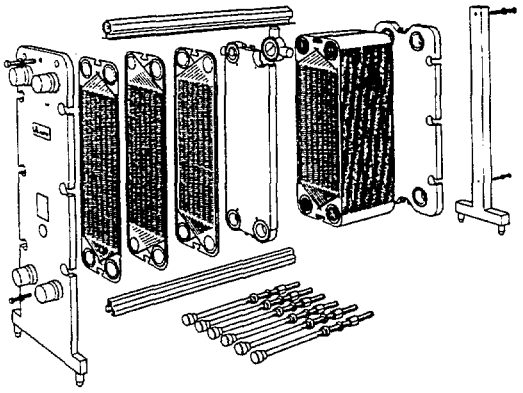
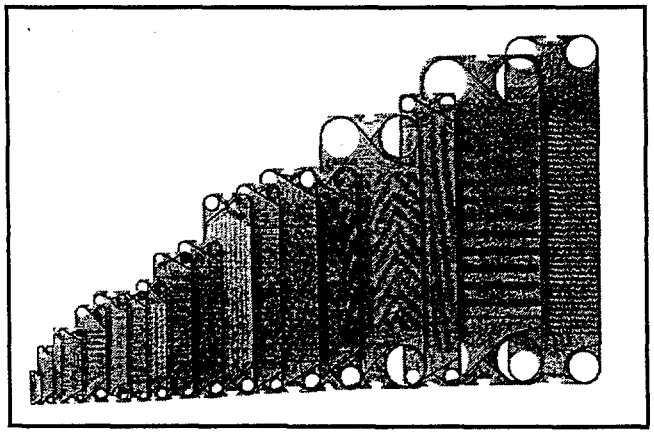


Plate heat exchanger

Since the first commercially successful design was introduced by APV's founder Dr. Richard Seligman in 1923, the plate heat exchanger has becom one of the most versatil and cost-effective methods for the indirect heating and cooling of fluids. The basic concept is to run fluids on either side of a thin metal plate so that heat may be transferred between the two fluids.

Constructions

The plate heat exchanger consists of a number of thin metal plates, supported between *top* and *bottom* bars and held together in a *frame*. Each plate is separated by a gasket. At one end of the machine is a fixed *head* and at the other a moveable *follower*, the whole plate pack being then compressed together by *tie bars*. Fluids can be admitted to the machine through *port*, which can be located at the head, the follower or at intermediate grids.



Plates

APV heat exchanger plates come in over 34 different corrugation patterns and 60 different sizes, so that the heat exchanger can be matched to a particular duty. The largest frame can accommodate up to 1000 plates, giving a heat exchange area of more than 3500 m^2. Heat exchanger plates are typically 0,5-0,6 mm thick. They are said to be *thermally long* (or hard) if they have corrugation patterns that run transverse or diagonal to the flow path. This will lead to a more turbulent flow path, improved thermal efficiency, heat transfer and higher pressure drop. Plates are said to be thermally short (or soft) if they have corrugation patterns that run with the flow. This will lead to less efficient heat transfer but a lower fluid flow pressure dorp over the plate. Plate pack configurations can be either long or short or a mixture of the two in the same plate pack.

Plate configuration

Plates are arranged throughout the plate pack in *passages* and *passes*. The number of passages refer to the number of individual channels through which the fluids can flow, and these passages can then be arranged in a number of passes through the plate pack. More passages will generally lead to a lower pressure drop per pass and a larger heat transfer area. Howevwr, lower velocity of fluid over each plate can lead to a higher risk of fouling and so less efficient heat transfer. More passes will generally lead to a higher pressure drop over the plate pack, but a higher flow rate over individual plates. This in turn can lead to higher velocities in the individual passages and so a higher thermal efficiency.

APV

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Gaskets

Gaskets are either glued on the plates or come as *Paraclip* gaskets where the gaskets are fixed on the plates with special spures (lugs), the so called clip-on type. Paraclip gaskets allow for easier maintenance and replacement of the gasket in comparison with the glue-on type, which must be bonded to the plate with adhesive. The gasket provides separation between the two fluid flows and together with the port hole in the plate pack. Gaskets are designed to 3A, hygienic standards, all with a special double seal around the plate port and a drain channel to atmosphere between the double seals. This sealing system keeps the product and heating / cooling mediumfrom mixing should the port area of the gasket be damaged. Some advantages of the plate heat exchanger system are:

- All surfaces easily dismantled for cleaning
- Compact floor space for a given duty in comparison with tubular design
- High heat transfer coefficient
- Easily expandable to suit new duties.

OTHER HEAT EXCHANGE PRODUCTS

- Duo-safety plates
- Welded plate technology
- Brazed plate heat exchangers
- Plate-and-shell heat exchangers
- Scraped surface heat exchangers
- Tubular heat exchangers
- Coiled tube aseptic systems
- Concentrate heater
- Plate evaporators
- Rising / falling and falling film evaporators
- Paravap type of plate evaporator
- Paraflash type of plate evaporator
- Water desalination unit
- Other evaporators

APV also covers a wide range of heat exchange products for more specialised processes. These include:

- Ohmic heating
- Radio frequency heating
- Microwave heating
- Direct steam heating by infusion or injection.

District heating units

The APV compact district heating unit is a modular installation mounted on a frame consisting of plate heat exchangers together with pumps, automatic regulating equipment, thermometers, pressure gauges and all necessary valves. The units are constructed so that a minimum of space is required and they can be quickly and simply installed. The range of the unit is 10 - 150 kW from single family dwellings to distribution stations.

CUSTOMER SERVICE FACILITIES

APV service facilities are located in over 28 countries world-wide. From complete system diagnosis to individual equipment over haul. From these facilities the following product services can be provided:

Heat exchangers and plate evaporators

- Gasket removal
- Chemical plate cleaning
- Dye penetrant testing
- One site service
- Plate inspection
- Re-gasketing
- Pressure testing

Service in general

- Material diagnosis
- Maintenance contracts
- System expansion
- Shutdown maintenance

THE QUALITY

APV's commitment to manufacturing quality products and providing high standards of service has earned us major quality certifications for the supply and manufacture of our heat exchange equipment throughout the world.

- Asme VIII (U) Stamp
- ISO 9001
- ISO 9002
- Lloyds quality assurance
- National accreditation of certification bodies

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JOHNSON CONTROLS

Exceeding Your Expectations!

HUNGARY

COMPANY INFORMATION

As you may know Johnson Controls International Kft. is a 100% American owned company in Hungary with a home base in Milwaukee, USA.
Johnson Controls is a world-wide leading manufacturer and supplier in Building Management and Automatic Systems. This is reflected in the 1996 income of our company, which is more than $10 billion.
Our Building Management and Automatic Systems could be find in control systems for energy, temperature, lighting, security, and fire safety for commercial buildings, such as office buildings, factories, district heating plants, manufacturing facilities, hospitals, schools airports, government and retails buildings.
Besides the sales installation and commissioning of our Systems, we are able to manage total operation and service.
The International Division of Johnson Controls for Eastern Europe is located in Friedrichsdorf, Germany. This Division supports all of our representations in the Eastern European countries.

Johnson Controls capability includes not only Automatic Temperature Controls, but also many other automation disciplines, some of which are:

- Building Management Systems (BMS)
- Energy Management Systems (EMS)
- Direct Digital Controls (DDC)
- Building Automation Systems (BAS)
- Lighting Control Systems (LCS)
- Security Systems (IAS)
- Card Access Systems (ACC)
- Fire and Smoke Detection and Alarm Systems (FAS)
- Emergency Voice and Audio Communications Systems (EVAC)
- Closed Circuit Television Systems (CCTV)
- Integrated Switch Boards (ISB)
- Intercom Systems (Intercom)
- Radio Paging Systems (RPS)

The Johnson Controls approach is unique in the construction industry that involves a complete job responsibility. This responsibility starts with equipment manufacturing and continues on, through system design, installation, commissioning, training and on-going Services. All products that we offer for projects are manufactured according to applicable norms and standards.
Johnson Controls International Kft. was founded in Budapest, Hungary with $2,5 million base capitals. The company is staffed with well qualified, dedicated engineers and technicians to do a very satisfactory job for you.
We have currently executed the following projects to full satisfaction of our customer such as Bank Center Budapest at Szabadság square.
Finally we would like to mention some well-known international references, as follows: Eiffel Tower in Paris, Lloyds of London, Uno City, United Nations in Vienna, Airport in Frankfurt, White House in Washington.

Johnson Controls International Kft., Controls Division
H-1107 Budapest, Fertő u. 1/d., Hungary Tel.: 36-1/262-9740 Fax: 36-1/263-1317
Bank Account No/Bankszámlaszám: ING Bank 1370016-02029010 Tax ID No./Adószám: 12054752-2-42

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JOHNSON CONTROLS

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CÉGISMERTETŐ

A Johnson Controls International Kft. egy 100%-os amerikai tulajdonlású társaság, amely Milwaukee-ban (USA) felállított székhellyel működik.
Johnson Controls az épületfelügyeleti és automatikai redszerek gyártása, beszállítása és telepítése terén világviszonylatban piacvezető. Ezt jól tükrözi a vállalatcsoport 1996 évi több, mint 10 milliárd $-os bevétele.
Az épületfelügyeleti és automatikai rendszereink megtalálhatók a különböző kereskedelmi épületek, távhőellátó rendszerek, kórházak, repterek, üzletközpontok energia, klíma, világítás, vagyon és tűzbiztonsági felügyeletek ellátására.
Természetesen a rendszerek értékesítésén és telepítésén túlmenően a komplett üzemeltetés és szervizelés is része tevékenységünknek.
A Johnson Controls Nemzetközi Divizió a németországi Friedrichsdorfban működik. Ezen Divizió irányítja és támogatja a minden Közép- és Kelet-Európai országban jelenlévő képviseleteinket.

A Johnson Controls épületfelügyeleti és automatikai rendszerek a következő területeket foglalja magában:

- Building Management Systems (BMS) (Épület Felügyeleti Rendszerek)
- Energy Management Systems (EMS) (Energia Felügyeleti Rendszerek)
- Direct Digital Controls (DDC) (Direkt Digitális Szabályozás)
- Building Automation Systems (BAS) (Épület Automatikai Rendszerek)
- Lighting Control Systems (LCS) (Világítás Szabályozási Rendszerek)
- Security Systems (IAS) (Vagyonvédelmi Rendszerek)
- Card Access Systems (ACC) (Kártyás Beléptető Rendszerek)
- Fire and Smoke Detection and Alarm Systems (FAS) (Tűz és Füst Érzékelő és Riasztó Rendszerek)
- Emergency Voice and Audio Communications Systems (EVAC) (Vészhelyzet Hang Kommunikációs Rendszerek)
- Closed Circuit Television Systems (CCTV) (Zártrenszerű Televíziós Rendszerek)
- Integrated Switch-Boards (ISB) (Integrált Telefon Központok)
- Intercom Systems (Intercom) (Intercom Rendszerek)
- Radio Paging Systems (RPS) (Rádiós Személyhívó Rendszerek)

Johnson Controls-nak ezen szakterületek megközelítése egyedülálló az építőipar területén ami teljes felelősségérzetet tartalmaz a munka iránt. Ez a felelősségérzet a berendezések gyártásával kezdődik és folytatódik a rendszerek tervezésén keresztül a szerelések, kivitelezések, betanítások és a mindennapos szervizelések végrehajtásáig. Minden berendezés és alkatrész amit ajánlunk, megfelel a mindenkori normáknak és szabványoknak.
Johnson Controls International Kft. 2,5 millió $ alaptőkéjű vállalat, amely budapesti központtal dolgozik. A vállalat vezetésének sikerült megnyerni olyan jól kvalifikált, elhivatott mérnököket, technikusokat, akik a legmagasabb színtű igényeknek és követelményeknek is képesek eleget tenni.
Megbízóink teljes megelégedésével fejeztünk be a közelmúltban olyan projecteket, mint a Bank Center Budapest a Szabadság téren.
Végezetül szeretnénk megemlíteni néhány nemzetközileg ismertebb referenciát, mint az Eiffel Torony Párizsban, a Lloyds Székház Londonban, ENSZ Központ Bécsben, Nemzetközi Repülőtér Frankfurtban, Fehér Ház Washingtonban.

Johnson Controls International Kft., Controls Division
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Bank Account No/Bankszámlaszám: ING Bank 1370016-02029010 Tax ID No./Adószám: 12054752-2-42

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REFERENCES

PROJECT NAME AND LOCATION	SIZE (points)	SYSTEM
2 METRO STATIONS, BUDAPEST		E-3000
RICHTER GEDEON PHARMACEUTICAL CO. BUDAPEST		PNEUMATIC
THERMAL HOTEL HELIA, BUDAPEST	870	IWS 16 SDC/DDC
CEMENT FACTORY, VÁC		CMT 16
INTER OFFICE BUILDING, WESSELÉNYI UTCA BUDAPEST		SYSTEM 91 (2X DC-9100)
INTER OFFICE BUILDING, NYÁR UTCA BUDAPEST		SYSTEM 91 (2X DX-9100)
RUMBACH OFFICE CENTRE (RBZ) BUDAPEST	400	SYSTEM 91 CS-9105
HOSPITAL, EGER	80	SYSTEM 91 CS-9105
HENKEL FACTORY, SZÉKESFEHÉRVÁR		DX-9100 DDC-CONTROL
MEAT PROCESSING PLANT, PÁPA	500	METASYS, OWS
PETFOOD, DEBRECEN		DX-9100 + CS 9105 DDC-CONTROL
"R"-CLINICS, BUDAPEST		DX-9100
ALBA HOTEL, BUDAPEST		E-3000
JÓKAI THEATRE, BÉKÉSCSABA		DX-9100
BIOLOGICAL MEDICINE FACTORY, DEBRECEN		PNEUMATIC
HUMAN VACCINE FACTORY, GÖDÖLLŐ		PNEUMATIC
HUMAN BLOOD PRODUCTS PLANT (8 PLANTS) GÖDÖLLŐ		DX-9100
BREWERY, NAGYKANIZSA		DDC-CONTROL
UNIVEZUM SHOPPING CENTRE, NYÍREGYHÁZA		DX-9100
NESTLÉ HUNGARIA CHOCOLATE FACTORY, DIÓSGYŐR		DX-9100
BANK CENTER BUDAPEST, BUDAPEST	1610	METASYS
HUNGRANA, SZABADEGYHÁZA		DC-9100
EURO-PARK KISPEST, BUDAPEST		IN PROGRESS

JOHNSON CONTROLS

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REFERENCIÁK

BERUHÁZÁS NEVE ÉS HELYSZÍNE	NAGYSÁG (PONT)	RENDSZER
2 METRO ÁLLOMÁS BUDAPEST		E-3000
RICHTER GEDEON GYÓGYSZERÉSZETI GYÁR, BUDAPEST		PNEUMATIC
THERMAL HOTEL HELIA BUDAPEST	870	IWS 16 SDC/DDC
CEMENTGYÁR, VÁC		CMT 16
INTER OFFICE IRODAHÁZ, WESSELÉNYI UTCA BUDAPEST		SYSTEM 91 (2X DC-9100)
INTER OFFICE IRODAHÁZ, NYÁR UTCA BUDAPEST		SYSTEM 91 (2X DX-9100)
RUMBACH IRODAHÁZ (RBZ) BUDAPEST	400	SYSTEM 91 CS-9105
KÓRHÁZ, EGER	80	SYSTEM 91 CS-9105
HENKEL GYÁR, SZÉKESFEHÉRVÁR		DX-9100 DDC-CONTROL
HÚSKOMBINÁT, PÁPA	500	METASYS, OWS
PETFOOD ÁLLATELEDELGYÁR, DEBRECEN		DX-9100 + CS 9105 DDC-CONTROL
"R"-CLINICS, BUDAPEST		DX-9100
ALBA HOTEL, BUDAPEST		E-3000
JÓKAI SZÍNHÁZ, BÉKÉSCSABA		DX-9100
BIOLOGICAL GYÓGYSZERGYÁR, DEBRECEN		PNEUMATIC
HUMAN OLTÓANYAGGYÁR GÖDÖLLŐ		PNEUMATIC
HUMAN VÉRTERMÉKGYÁR (8 EGYSÉG) GÖDÖLLŐ		DX-9100
SÖRGYÁR, NAGYKANIZSA		DDC-CONTROL
UNIVEZUM BEVÁSÁRLÓKÖZPONT, NYIREGYHÁZA		DX-9100
NESTLÉ HUNGARIA CSOKOLÁDÉGYÁR, DIÓSGYŐR		DX-9100
BANK CENTER BUDAPEST, BUDAPEST	1610	METASYS
HUNGRANA ,SZABADEGYHÁZA		DC-9100
EURO-PARK KISPEST, BUDAPEST		FOLYAMATBAN