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Summary

of the

USAID Emergency Energy Efficiency Seminar

Baltic Regional Seminar

Kaunas, Lithuania

September 15-16, 1992

Conducted by: Resource Management Associates, Inc.
520 University Avenue, Suite 300
Madison, Wisconsin 53703 USA
Telephone: (608) 283-2880
Facsimile: (608) 283-2881
Telex: 469 453

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INTRODUCTION

The Baltic Regional Energy Efficiency Seminar was held on September 15 and 16, 1992 at the Lithuanian Institute of Energy in Kaunas, Lithuania. The seminar was part of the Eastern Europe Emergency Energy Program, funded by the U.S. Agency for International Development. Resource Management Associates of Madison, Inc. is the technical assistance contractor for the Industrial Energy Efficiency Component of the program in Lithuania. This Component of the Project was designed to address the problems of industrial energy efficiency with a short-term program aimed at the immediate needs of industry. The program involves three main activities: 1) identifying and implementing cost-effective low-cost/no-cost industrial energy improvements, with an emphasis on oil savings; 2) conducting industrial energy audits and transferring energy auditing and management techniques, including financial and economic analysis; and 3) providing energy auditing and/or energy efficiency equipment to implement the program objectives, improve energy management, and identify additional energy efficiency opportunities. These tasks are being carried out by a team of energy specialists and policy analysis experts. Energy monitoring and testing equipment will be turned over to the Lithuanian industrial sector and the Government of Lithuania at the end of the Program. This will be provided with analysis and recommendations for further energy efficiency measures.

Participants in the seminar came from the three Baltic countries of Latvia, Estonia and Lithuania. Over 150 participants attended the seminar. In addition to the regional participants, attendees included the U.S. Ambassador to Lithuania, Mr. Darryl Johnson, who gave the opening address; Mr. Robert Archer of USAID/Washington; the USAID representative in Lithuania, Mr. John Cloutier; the Lithuanian Vice-Minister of Energy, Mr. Kutus; and other representatives of the Lithuanian government. Nine U.S. manufacturers of energy efficiency equipment were in attendance to present and demonstrate their equipment. The seminar received considerable media attention, including a news conference on the second day.

The first day of the seminar focussed on the results of the Energy Efficiency Program in industrial plants in the Baltic countries. Presentations were made by project directors in charge of energy efficiency programs in Lithuania, Latvia and Estonia. Industrial plant participants in the program also made presentations, including Mr. Alfis Kasperivicius of Kaunas Ceramics, Mr. Janis Bazhbauers of the Riga Technical University, and Mr. Raare Kivilo of Termox. Two private sector energy consultants who have been working on the project also made presentations: Mr. Virgis Buciunas of Nega W (Lithuania) and Mr. Heinar Nurste of Enpro Engineering Bureau, Ltd. (Estonia).

The second day of the seminar consisted of presentations by the nine U.S. equipment vendors. The participants were especially interested in meeting with equipment vendors, seeing the equipment demonstrated, and learning how the equipment could be made available to them. For most of the participants, this was the most valuable part of the seminar. The manufacturers were able to make useful marketing contacts, and to distribute

their product literature. This interaction should result in increased sales of U.S.-made energy efficiency equipment in the Baltics.

The participation of the equipment vendors was jointly organized by RMA and RCG/Hagler Bailly, Inc. Arrangements were made to have country seminars in Latvia and Estonia in the same week as the regional seminar, thus enabling the vendors to have exposure in all three countries. In addition, vendors met before the regional seminar with U.S. Embassy and USAID staff in Vilnius prior to the seminar to get an introduction to Lithuania and to its business opportunities.

Subsequent to the seminar, the Lithuania Institute of Energy produced a summary proceedings, under contract with RMA. Key elements of that proceedings are found in Section B of this final summary.

SECTION A
Seminar Program

ENERGY EFFICIENCY SEMINAR
BALTIC REGION
PROGRAM

September 14
Vilnius

16:00	US manufacturers meet at US Embassy in Vilnius Lithuania with Economic/Commercial Officer, Mr. Al Rimas and Mr. Robert Archer of USAID

September 15
Kaunas

8:15	Opening Remarks, US Ambassador, Mr. Darryl N. Johnson
8:45	Introduction, Lithuania Minister of Energy
9:00	Introduction to the Baltic Emergency Energy Assistance Program of USAID - Robert Archer, Deputy Chief Energy & Infrastructure, Bureau for Europe, USAID
9:30	Lithuania: Program Activities, Findings and Institutional Implications (Michael Ellis-RMA)
10:15	Break
10:30	Latvia & Estonia: Program Activities, Findings and Institutional Implications (RCG/Hagler Bailly, David Keith-Latvia, Edwardo Maal-Estonia)
11:15	Lithuania Case Study
12:00	Question and Answer Session
12:15	Lunch
13:30	Latvia Case Study (Janis Bazhbauers - Riga Technical University)
14:15	Question and Answer Session
14:30	Estonia Case Study (Raare Kivilo - Termox)
15:15	Question and Answer Session
15:30	Break
15:45	Energy Auditing Techniques (Robert Erickson - RMA)
16:30	Open Forum, Discussion on Future Directions
17:15	Adjourn
18:00	Reception and Dinner

September 16
Kaunas

8:30	Introduction
8:45	US Manufacturer Presentation - Bacharach (combustion analyzers)
9:30	US Manufacturer Presentation - Armstrong (steam traps & valves)
10:15	Break
10:30	US Manufacturer Presentations - Energy Efficiency Systems (combustion analyzers); Sentry Equipment (boiler efficiency equipment)
11:15	US Manufacturer Presentation - Donaldson Company (baghouses)
12:00	Lunch
13:00	US Manufacturer Presentation - UE Systems (ultrasonic detectors)
13:45	US Manufacturer Presentation - Honeywell (control systems)
14:30	Break
14:45	US Manufacturer Presentation - Compac International (computers)
15:30	US Manufacturer Presentations - questions and followup
15:45	Trade Facilitation, FCS Officer, Mr. Al Rimas
16:15	Closing Remarks
16:30	Open House - US Manufacturers are available to demonstrate and show their products.

SECTION B
Proceedings from Lithuania

Summaries of raports drawn up from tape record full text being available at the Lithuanian Energy Institute, 3 Aukštadvario, 3035 Kaunas, Lithuania, tel. (0127)757304, fax (0127)751271, (ref. S.Barikus, head of information department).

General remarks of the US Ambassador
Mr. Darryl N. Johnson:

1. Energy consumption efficiency is the most important point in the economic reform in the Baltic countries.
2. The contribution of private sector in overcoming energy crises in US was the most important, so just the same is being expected in Lithuania. That is why US supports private firms, providing consultant services in the sphere of energy saving.

General remarks of Vice - Minister of Energy
Mr. S. Kutas:

1. Quite a great number of treaties have been signed between US and Lithuania in the energy sector. Lithuania thanks officially for that.
2. The common state of power generating equipment in Lithuania is not bad, but because of inadequate price policy there are serious shortcomings in the sphere of energy consumption.
3. A sound position of energy sector - is a quarantee for independence.

General remarks of the USAID Energy and Infrastructure Division, Deputy Chief, Mr. R. Archer:

1. The main directions of the USAID: energy saving and price reform in the Eastern Europe.
2. US can demonstrate how low-cost and no-cost measures can give a considerable effect in industrial energy saving.
3. Industrial energy management can give a considerable effect as well.
4. Small private consultant energy service firms must be supported. This was exactly done by US in the Baltic countries.

Mr. Ellis, Senior Consultant of the USA RMA Company:
described work of RMA firm auditing energy equipment state of 4 Lithuanian enterprises - Vilnius Furniture and Sweets Factories, Alytus Wood Products Plant and Kaunas Ceramic Plant.

1. The speaker is of the opinion that qualification of the energy specialists is high, but there are no control and metering techniques, energy consumption sphere is not prioritative. Price policy does not incentives for energy saving.
2. An abbreviation of results received is given below. See pg. 9 (copy).

USAID PROGRAM TECHNOLOGIES

TECHNOLOGY	FURNITURE	SWEETS	WOOD PROCESS	CERAMICS
Combustion Monitoring & Control		X		X
Process Piping Insulation		X	X	X
Steam Systems Improvement	X	X	X	X
Waste Heat Recovery	X		X	X
Process Control	X	X	X	X
Load Management			X	
Energy Management Systems	X	X	X	X
Maintenance	X	X	X	X

COMBUSTION MONITORING AND CONTROL

- ADVANCED MONITORING EQUIPMENT FOR AL COMBUSTION PROCESSES:
  - BOILERS
  - FURNACES
  - KILNS/OVENS

- TEST RESULTS INDICATE THAT ALL COMBUSTION PROCESS OPERATIONS CAN BE IMPROVED

- SAMPLE RESULTS:

ENTERPRISE	FUEL SAVINGS	PAYBACK(Mo's)
Sweets	1.0 MM m3/NG	2.6
Ceramics	1.06 MM m3/NG	.5

PROCESS PIPING INSULATION

- IMPROVEMENT NEEDED AT EVERY SITE

- ENTERPRISE MANAGEMENT AND TECHNICAL STAFF OFTEN UNAWARE OF THE COST OF LOST HEAT (ENERGY)

- EXAMPLE:

  HEAT LOSS CALCULATIONS SHOW THAT TYPICAL PAYBACK FOR REPLACING DETERIORATING INSULATION WILL PAY BACK THE INVESTMENT IN 6 TO 18 MONTHS AT CURRENT ENERGY PRICES.

- FOREIGN MATERIALS WOULD INCREASE INSULATION EFFECTIVENESS, BUT ARE TOO EXPENSIVE AT THIS TIME

- ALL ENTERPRISES SHOULD INSTITUTE A PROGRAM OF PROCESS PIPING INSULATION MAINTENANCE AND REPAIR

STEAM SYSTEMS IMPROVEMENT

- STEAM TRAPPING
- CONDENSATE RECOVERY
- BOILER EFFICIENCY IMPROVEMENT
- STEAM DISTRIBUTION SYSTEM BALANCING
- CONTROLS AND METERING

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OTHER FINDINGS - EXAMPLES OF LOW/COST - NO/COST

- OPERATIONS - MANY PLANT PROCESS OPERATIONS COULD BE MADE LESS ENERGY INTENSIVE JUST BY OPERATIONAL CHANGES. ONE ENTERPRISE REDUCED ITS CONSUMPTION OF NATURAL GAS BY 50% BY SHUTTING DOWN A RESERVE BOILER FOR THE WINTER

- MAINTENANCE - USING THE USAID SUPPLIED POWER ANALYZER, ONE ENTERPRISE FOUND A LARGE FAN MOTOR DRAWING EXCESSIVE AMPS. AFTER MAINTENANCE, THE MOTOR POWER CONSUMPTION WAS REDUCED BY MORE THAN 50%.

- ENERGY MONITORING - A VILNIUS ENTERPRISE DISCARDS WASTE WOOD - ENOUGH TO MEET ITS ENTIRE THERMAL REQUIREMENTS. INVESTIGATION HAS SHOWN THAT A WASTE WOOD FIRED BOILER COULD SUPPLY THE ENTIRE PLANT THERMAL REQUIREMENTS.

- METERING - AN ENERGY BALANCE OF A TYPICAL BOILER SHOWED THAT THE EXISTING INSTRUMENTATION WAS METERING MORE ENERGY PRODUCED THAN THAT SUPPLIED BY THE FUEL. THE ACTUAL PERFORMANCE OF THE BOILER WAS MUCH LESS THAN METERED.

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RECOMMENDATIONS

TECHNICAL

- LOW/COST - NO/COST ENERGY EFFICIENCY IMPROVEMENTS HAVE GREAT POTENTIAL THROUGHOUT LITHUANIAN ENTERPRISE. INDUSTRIAL ENERGY AUDITS SHOULD CONTINUE AT OTHER ENTERPRISE LOCATIONS

- COMBUSTION EFFICIENCY IMPROVEMENTS HAVE SOME OF THE LARGEST POTENTIAL ENERGY SAVINGS

- PROCESS CONTROL AND METERING HAVE THE SECOND PRIORITY

- OTHER TECHNOLOGY AREAS SHOULD BE EXPLORED ON A CASE BY CASE BASIS

- TRAINING IN ADVANCED METHODS OF ENERGY EFFICIENCY ARE NEEDED, AS WELL AS ECONOMIC EVALUATION TECHNIQUES FOR ENERGY EFFICIENCY PROJECTS

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INSTITUTIONAL

- ENACT ENERGY PRICE REFORM AND RATE RESTRUCTURING
- ENERGY UTILITY COMPANIES SHOULD INSTITUTE DEMAND SIDE MANAGEMENT PROGRAMS
- PROCEED WITH PRIVATIZATION PROGRAMS
- ESTABLISH COMMERCIAL BANKING SYSTEM
- ENACT LAWS AND REGULATIONS WHICH ENCOURAGE THE DEVELOPMENT OF PRIVATE SECTOR ENERGY SERVICE FIRMS
- INITIATE REGIONAL COOPERATION ON ENERGY ISSUES THAT AFFECT ALL BALTIC REPUBLICS
- PRIORITIZE FOREIGN DONOR AND LOAN OPPORTUNITIES IN THE ENERGY SECTOR
- ESTABLISH ENERGY USE STANDARDS
- ESTABLISH ENTERPRISE ENERGY INFORMATION AND EDUCATION PROGRAMS

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ENTERPRISE MANAGEMENT

- DESIGNATE AN ENERGY MANAGER IN EACH ENTERPRISE TO BE RESPONSIBLE FOR MONITORING ENERGY CONSUMPTION
- SET GOALS FOR ENERGY REDUCTION AND OPTIMIZATION
- DELEGATE DECISION MAKING AUTHORITY
- INSTITUTE AN INCENTIVE PROGRAM FOR ENERGY EFFICIENCY IMPROVEMENTS AMONG ENTERPRISE STAFF
- PERFORM REGULAR ENERGY AUDITS AND MAINTAIN A PRIORITY LIST OF ENERGY EFFICIENCY PROJECTS
- WORK WITH ENERGY UTILITY COMPANIES AND GOVERNMENT AGENCIES ON ENERGY EFFICIENCY INCENTIVE PROGRAMS
- COOPERATE WITH OTHER ENTERPRISES ON ENERGY EFFICIENCY IDEAS AND DEMONSTRATION PROJECTS
- BUDGET TRAINING PROGRAMS FOR ENTERPRISE STAFF ASSOCIATED WITH ENERGY PROGRAMS
- PRACTICE STRICT MAINTENANCE PROGRAMS

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SUMMARY

- THE POTENTIAL FOR IMPROVED ENERGY EFFICIENCY IN LITHUANIAN ENTERPRISE IS VERY HIGH - ENTERPRISE MANAGERS AND TECHNICAL STAFF ARE WILLING TO PURSUE THESE MEASURES

- LOW-COST AND NO-COST ENERGY EFFICIENCY IMPROVEMENT MEASURES ARE AN IMMEDIATE SHORT TERM NEED, AS ECONOMIC FORCES ARE LIKELY TO REMAIN UNSTABLE FOR THE NEAR FUTURE

- TECHNICAL ENERGY EFFICIENCY IMPROVEMENTS MUST BE ACCOMPANIED BY INSTITUTIONAL CHANGES THAT SUPPORT LONG TERM INCREASED ENERGY EFFICIENCY AS A NATIONAL GOAL

- GOVERNMENT SHOULD ENCOURAGE THE DEVELOPMENT OF PRIVATE SECTOR ENERGY FIRMS - THROUGH ELIMINATION OF BARRIERS, AND THROUGH THE ESTABLISHMENT OF LAWS AND REGULATIONS THAT PERMIT THESE FIRMS TO CONDUCT THEIR BUSINESS

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The representative of Panevėžys Glass - Works (Lithuania)

Question: Why Panevėžys Glass - Works was not included into the USAID Programme?

Answer (Mr. Ellis):

I had an opportunity to visit the Glass - Works and found a lot of possibilities in energy saving, but it excuded the financial limits of our Programme. It is a big factory and we chose the smaller ones where low-cost measures could be installed.

Comment of Mr. R. Archer:

The main tasks in the Programme of Energy Efficiency in all Baltic countries are the following:
- energy price reform
- restructuring of industrial base, to stimulate a competition and development of private sector.

General remarks of Mr. David Keith, representative of RCG /Hagler Bailly:

1. Four enterprises in Latvia have been inspected: Pulp and Paper, Building Materials, Butter and Cheese, District Heating enterprises.
2. The technologies in the above mentioned enterprises are out-of-date, boilers do not confirm to the standards of the West
3. Energy saving opportunities in those 4 enterprises were 2,4 mln $. This makes 13% of energy consumption and could be achieved by quick and low-cost measures.

General Remarks of Mr. E. Maal, representative of RCG /Hagler Bailly:

1. Four enterprises in Estonia have been inspected: Pasteboard, Phosphorites, Ship Repairs, Tartu District Heating enterprises. Two subcontractor firms from Tallin and Tartu helped us.
2. Low-cost measures, which provide a quick payback have been installed.

General remarks of Mr. H. Nurste, Director of Enpro (Estonia)

1. The Programme has stimulated activity in industrial energy saving under the market economy conditions.
2. Several private energy consultative firms appeared.

Continuation of Mr. D. Keith remarks:

4. Great energy consumption divergencies per gross production output unit are typical to East European countries. This in fact, shows a bad energy management.
5. Regressive analysis shows that at the drop of production energy consumption approaches to a constant value (30% from peak). This shows great losses in "idling" regime.
6. Four main techniques could be suggested for energy saving at the "enterprise level".

- management and organizational improvements ("A"), the most important of which is change of ownership.
- low-cost measures to improve management and maintenance, establishing special energy teams and providing them with necessary auditing instruments ("B")
- minor investments in improvement of equipment ("C")
- capital investments in modernization.

Mr. P. Lukoševičius, Kaunas Technological University

Question: In Latvia and Estonia some control and metering equipment, used in the USAID Programme, were presented to the Universities. Why this was not done in Lithuania?

Answer (D. Keith):

These is some "misinterpretation". This equipment was presented to Lithuania so that private firms could use them in energy saving programmes. Lithuania has received them as well.

Mr. V. Bučiūnas, owner of firm Nega W (Lithuania)

1. Our firm has rendered services to RMA firm inspecting the enterprises, collecting the data, presenting the data, bringing equipment to Lithuania without import duty, installing them in the enterprises, mentioned by Mr. Ellis.
2. The suggested measures at Kaunas Ceramic Plant for small investments - 30.000 $ would give 244.000 $ of annual ecomomy and would payback in 2 months.
3. The suggested measures at Alytus Wood Products Plant (kiin-drying control, combustion control, decrease of steam and compressed air leakage) by using US equipment would require 36.000 $, would give 150.000 $ economy and would payback in 6 months.
4. The main saving sources at Vilnius Sweets Factory are - combustion control in the boiler, gas metering, insulation improvement. All this could be achieved in 6 months. 29.000$ are necessary for acquiring equipment. This would provide 111.000$ saving (economy).
5. The suggested measures at Vilnius Furniture Factory (air reduce for dust collecting, air covering (screen) at the doors and presses, steam yield control, decrease of compressed air leakage) woud payback in 1 year.
6. A number of measures requiring major investments have been suggested: sawdust combustion in furniture and wood process factories, improvement of management structure, designation of a person to be responsible for energy saving, designation of a specialist in energy field as a reseller in the enterprise. The indispensable condition - strict energy rate metering.

Mr. Kasperavičius, specialist in energy of Kaunas Ceramic Plant

Mr. Kasperavičius analysed the energy situation at the plant. The installed energy capasity is of 2000 kw, there are 836 electric engines, 2 boilers. Annual energy consumption is 19,5 mln kwh, gas consumption - 52 mln m^3, it was produced 34.000 Gkal of thermal energy. The designed output - 40mln. bricks, 30 mln. tiles, 400.000 m^3 ceramsit.

Regime cards of gas boilers have been adjusted for combustion improvement. The suggestion was made for boiler insulation improvements. After boiler improvements, one boiler was quite sufficient for work.

With the help of portable devices it was ascertained that too powerful electric engines are being used in some cases.

General remarks of Prof. Bazbauers, Ryga Technical University (Latvia):

1. An inspection of energy consumption has been performed at Sloka Pulp and Paper Works, Cheeze Factory,Jelgava District Heating Enterprise, Building Materials Factory.
2. Quick and low-cost measures of energy consumption could save 13% of energy in these enterprises. These should be the following measures:
   - management improvement (prices at the enterprese, rate of separate energy resources, maintenance groups):
   - measures of low-cost (control, insulation, improvements in fuel economy).

General remarks of Prof. D. Blumberga, Ryga Technical University

My private firm "Ekodoma" worked in Sloka as a subcontractor. The main conclusions:

1. Boiler work efficiecy can be quickly improved by 3% with the help of fuel gas analysers.
2. With the help of pyrometers it is easy to define the quality of boiler brick wall and to monitor it all the time.

General remarks of M. Rubinia, representative of firm LEA (Latvia):

1. At Jelgava District Heating Enterprise before implementation of USAID Programme there was a quality management team. With the help of American equipment this team has prepared for winter season better and quicker. This experience will be disseminated all over Latvia.

Prof. Veidenberg, representative of firm "Ekodoma" (Latvia).

1. I have worked at the Building Materials Factory, which produces calx. Measures of process control in calx kilns have been installed there. There is also a computer and the programme which allows to collect complete information on all energy consumers.
2. US specialists suggested some manufacture improvements: to sort calx manufacture stuff right at the quarry, which is 19 km from the factory.
3. It was suggested to change stuff preparation technology, which could provide energy saving. All these low-cost measures could allow to save energy up to 19%.

Mr. P. Sipkovs, representative of firm "Energia" (Latvia)

Our firm has worked at the Cheese Factory. The principal measures shoud be the following:

1. Changes of hydro-pumps, improvements of freezing chamber insulation, equipment for engine adjustment, allowing to ensure thrifty engine work.

Chairman dr. R. Drižius:

Question: Don't You think that rendering of the US "know-how" technology to Baltic countries will be forgotten because market economy does not work here yet, and privatisation of bigger enterprises is being performed very slowly?

Answer (Prof. Bazbauers):

Partly, You are right. Nevertheless, atpresent time energy in production price amounts to 30-40%, so it will be necessary to save energy.

General remarks of Mr. K. Ingerman, representative of firm Thermox (Tartu, Estonia)

1. Problems of district heating have been investigated in Elva and Tartu boiler-houses, 4 living houses and in the Factory of Sports Articles by using portable control and monitoring equipment, made in US. Quality of the combustion process in the boiler, heat losses in the houses of various constructions, heat regime in pipeline have been defined.
2. By regulating combustion regime in Elva boiler - house an increace of efficiency coefficient in 1,3% was achieved. This would provide economy of 200 Estonian krones per day. After arranging combustion regime in the other boiler-house, this would provide economy of 0,9 mln. Estonian krones per year.
3. The portable US equipment is extremely effective.
   The received results should be processed by computer.

General remarks of Mr. J. Perl, senior specialist in energy field of Tartu District Heating Network

1. Energy prices in Estonia increaced 1000 times. Waste heat in the process of production makes 3%, in the supply - 20% in the consumer's house - 40%. That is why, it is expedient to begin from the consumers reconstruction.
2. Unfortunately, when privatisation problems are not solved, it is difficult to find a person who would take responsibility for everything.
   Estonian banks have no credits. There is no equipment. Cooperation of all Baltic countries would be necessary for the production of such equipment. Maybe, Western countries could help us with their investments?

Theses of Mr. R. Erickson, representative of firm RMA are enclosed.

Chairman dr. R. Drižius

Question: What is Your opinion on charge for installed heat power and charge for actually consumed heat?

Answer (Mr. P.R. Erickson):

I think that price and tariff reform is significant. The real cost of production must be reflected in the price. Besides, price system must stimulate effective energy cunsumption. Of course, subsidies should be forgotten. It is opinion of the engineer, not of the economist.

Mr. Stankunas, specialist in energy of 'ilnius Furniture Factory:

By order of Minister of Energy we pay for energy accordiny to double tariff for the installed heat power and for actually consumed power. During the latest 20 years we reconstructed a lot, so the installed power in our factory is twice less. Discussions between the Ministry and our factory were fruitless. Charges for the projected heat power is something ubnormal. This year we lost 2 mln. roubles because of that incorrect tariff.

Prof. Bazbauers (Latvia)

This project was financed by USA tax payers (the American know the value of money). Nevertheless, I kindly invite USA administrators to continue the project. Latvia imports 50% of electric energy. So, we must build new electric power stations and import fuel. The problem of energy for Latvia - is a political problem.

Abbreviation of the final speech of Mr. R. Archer, representative of USAID:

In future USA will render credits for the import of measures for energy saving to Baltic countries and irretrievable means (free grants) for specialist training and for consultations. At present we must decide upon the size of the demands of this support.

Remarks of Commercial Director of Tallin's Ship Repairs Enterprise:

Our enterprise could establish a joint-venture with US and to produce energy equipment. We have technological equipment already.

Mr. Perl (Tartu)

- Not only economy is significant. We must think about the use of local energy resources: peat, waste product in wood process. Yet, we have no means for combustion of this local fuel. There is a lot of work to be done here.

Mr. Kojelis, senior constructor of Vilnius Electric Measuring Instruments Works:

We have been producing means of electric energy meters for many years.

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We could possibly produce means of heat energy control, of energy regulation and management.

Foreign investments are necessary for that. Our capital would be our technologies and experience. At present time we produce inductive one - phase counters, three-phase industrial means for electric energy control (rate), two-tariff one-phase counters. Together with MRH firm (Germany) we are going to produce multi-tariff means of electric energy metering.

Abbreviation of the second day of the seminar which was devoted to the presentation of US manufacturers (producing energy equipment)

Mr. M. Ellis, representative of firm RMA opened the second day of the seminar and expressed his satisfaction that interest in US manufacturer presentation exceeded their expectations. Representatives of the firms told about their production, fields of application of the equipment and manufactured articles, their possibilities and prices.

The following reports have been made:

Mr. J. Schack (Bacharach Instruments International) and Mr. R. Hickox (Bacharach, Inc.) told of combustion analyzers, defining flue gas composition (O_2, CO, CO_2, SO_2, NO, NO_2).

In the European department there is a branch firm in Denmark with maintenance, spare parts and specialists. We arrange seminars for specialists and tradesmen. We are going to establish a system of equipment for flue gas analysis supply and sale. The firms also produce equipment for measuring flue gas temperature, humidity. The equipment is possible to use in a dark lodging. The equipment conforms to the European standards. The firm started the equipment production in 1929. In future we will have equipment for defining the uncombusted part of carbon fuel, mercury vapour concentration, taxic gas concentration, equipment for measuring natural gas concentration, which is dangerous for explosion.

Mr. A. Zygmuntovich, representative of firm Armstrong, European Department, recounted the firm production.

These are steam traps. They can serve for 10 years and preserve piping from hydraulic blows. The firm produces several types of steam traps (mechanic, thermostatic) and various condensate rates. The average price would be 120.000 roubles. The firm also produces reduction valves.

Mr. S. L. Earsley (Boiler Supply Corporation) told of combustion analyzers and blow-down heat recovery.

Model ENERAC-2000 measures O_2, CO_2, CO and temperature. Some other equipment was presented, among them a pocket variant.

Mr. T.J. O'Hanlon (UE SYSTEMS INC):

The firm specializes in the sphere of ultrasonic detectors. They can be applied to steam trap control, to define leaks of compressed air, leakage of vacuum

systems, leakage in heat exchangers, condensators, electric systems where is arcing. Also to define leaks in air-valves and to define vibration in mechanic systems (pumps, winches, cranes). By using these devices an effective observation of the condition of various energy equipment is possible. These instrument will payback very quickly (ex. per 1 month).

The firm has not its agency in Baltic countries yet.

Mr. J. Goosens (Donaldson Europe)

We supply 4 types of production - Diesel engine filters, industrial dust collectors, gas turbine filters, high-quality filters for lodgings, computers, copiers. These filters can be small, portable and big, stationary industrial. The efficiency of these measures is defined by special design filter elements which push out the electrostatic. These filters can be applied in metal industry, foundries, construction industry.

Dust is being collected into capsules and baghouses. Filter material produced by our firm is special - it's cellulose fibre. Sometimes, in hot places, this fibre is covered with special synthetic coating. Fractions of 10 mm can be collected with a special filter of Ultra-Web technology, when fine fibre is joined with thick one. Some filters can be cleaned by pulsating air stream, others are changed.

Mr. J. Bodziony (Introl, Poland)

Information has been presented about Kestler-Ellis firm production: flow-metering PC, energy control equipment, timers. A detailed information is given about PC for defining heat rate, carried by steam and water. Steam characteristics are programmed. At the place of measuring an orifice for mass metering, pressure and temperature transducers are installed.

They can be completed by means of local production.

This computer costs - 1000 $. Payback time of PC is small - about 1 month.

Mr. J. Murau (Honeywell)

Presented the firm producing automation means for energy economy, controlling of natural environment. Energy saving can be achieved by: control and management of district heating systems (boiler houses, electric power stations, heat-supply substations, houses, flats); by installing heat counters, improving pipe and building insulation, increasing reliability of network. The firm is going to install district heating supply system in one of districts in Moscow (Tuhino) for 5 mln. $. Payback time due of gas saving would be 2 years. When temperature in flat changes in 1°C - this means energy expenses in 6%. Temperature control (management) in flats at night or in case of a leave can stipulate energy saving.

The firm prepares energy saving programmes which suggest energy saving possibilities and means of their realization.

Last year the firm sold its product for 5 bil. $ per year. It has 58.000 workers all over the world, the firm factories are near the market.

Mrs. R. Mc Falls Klesh (Compaq Computer Europe)

Our firm is one of 3 biggest PC firms in US. This firm, after IBM, succeeded in application of PC for portable laptop, as well as processors 386. Our dealer is firm "Computerland" in Vilnius. We have installed a great number of our

production in Poland, Czechoslovakia, Hungary. PC are widely used now, because of low-cost, reliability, easy service, compatibility with other types of PC. I propose to co-operate with firms which have been working for a long time in business field. You will manage the renovation of a completion. Our firm is such.

Abbreviation of the final speech of chairman Dr. R. Drižius

I should like to end the conference in a bit minor note. General conclusions are the following:

1. Lithuanian energy saving programme was prepared last year and priorities defined: energy metering, heat insulation of the buildings, local energy sources. The intelectual part of energy saving programme the Lithuanian energy specialists overcame themselves.
2. Unfortunately, there is no economic background for realization of energy saving programme: degree of privatization is not high, improper price and tariff system, the necessary lows in energy sector are not approved, an undeveloped bank system.
3. Subsidies (loans) suggested by international banks are connected with necessity to pass to free market mechanisms. There should be an intermediate way in Lithuania, when some spheres of energy consume are subsidized, so that " shock therapeutics" effects were amortized.

Mr. A. Rimas (Economic Officer of the US Embassy)

1. US Embassy is ready to render complete information about US production and services, import possibilities to specialists in Baltic countries.

2. US Embassy can mediate for specialists and tradesmen in Baltic countries who suggest cooperation projects to US tradesmen. Partners will be found, who will analyze those suggestions.

SECTION C
Industrial Energy Efficiency in Lithuania
Summary of Findings

INDUSTRIAL ENERGY EFFICIENCY IN LITHUANIA

Summary of Findings

by

Mark E. Hanson and Michael Ellis
Resource Management Associates, Inc.
Madison, Wisconsin USA

presented at

USAID Baltic Region Industrial Energy Efficiency Seminar
Kaunas, Lithuania
September 1992

Summary of Findings

Lithuania faces an immense challenge in restructuring it's industrial base and economy as it adopts free market reforms. Energy efficiency is a wide ranging issue in this restructuring effort. In order for real progress to be made in this area, the private sector and government will need to establish a partnership, common goals and a working relationship to achieve improvements in efficiency and realize the associated economic gains. In addition, regional cooperation issues as they pertain to energy and industrial restructuring are compelling and should be considered in any energy efficiency program.

1. Institutional Setting for Energy Markets. The institutional setting is undergoing rapid change: politically and organizationally. Energy prices are escalating from month to month. Privatization is being carried out rapidly, but without an apparent overall national priority plan. The relationship between a strong central authority for energy supply and fuels distribution and the industrial sector is changing, and current lines of authority and responsibility are not clear.

The lack of established financial services and economic structure has also affected energy markets. Energy price reform is being inhibited by the lack of a commercial banking system, a national currency, and trade and investment policies.

2. Industrial Energy Management. Industrial energy management in the Baltics has followed a familiar pattern observed in East Europe and the CIS. Heavily subsidized energy prices of past years created an environment of wasteful energy practices. All sectors of the economy suffer from inadequate infrastructure to meet even minimum standards of energy efficiency. No incentives were previously available and as a result, management attention, technology and capital were applied to other areas. The current economic situation is rapidly changing the need for energy efficiency, but without management direction, knowledge of low-cost/no-cost options, capital and technical resources there is little real progress.

3. The Market in Energy Efficiency Services and Investments. The market is developing slowly. Without a clearly defined institutional structure and a reluctant industrial sector to adopt energy efficiency, the market is still just emerging. Essential financial services and economic reforms are necessary for private enterprise to become a larger presence. The USAID program has fostered the development of a private energy consultant, and a similar Danish program has done the same. Most others entering the field have established affiliations with foreign suppliers and are promoting the sale of specific products and services. The market has great potential for those willing to invest the time and effort in training and identification of potential clients. Moreover, the development of this market is essential for promoting energy efficiency. Government is not likely to have the resources or propensity to become the proponent of energy efficiency that is needed. Private energy service firms offer the best potential to promote energy efficiency services, equipment, and management.

Table 1. Lithuania Energy Prices 1990 to Spring 1992
(Taxes not included)

Sector	Fuel	unit	1990 Ruble/	1991 Ruble/	January 1992 Ruble/	February 1992 Ruble/	April 1992 Ruble/	notes
Transport								
	Gasoline	litre	0.4	4	4	10	13	1
	Diesel	litre	0.3	-	-	-	-	
Industrial								
	Gasoline	litre	0.2	0.5	4	10	13	1
	Diesel	litre	0.12	0.4	3	8	8	
	Light Fuel Oil	tonne	-	-	-	-	-	
	Heavy Fuel Oil	tonne	30	84	1320	3000	4500	2
	Electricity	Kwh	0.023	0.082	0.35	0.44	1	
	Natural Gas	k m^3	22.5	51	1000	1000	3400	
	Steam Coal	tonne	12	12	72	88	192	
	Coking Coal	tonne	-	-	-	-	-	
	Thermal	Gcal	14.85	58.8	284.5	407.5	847	3
Household								
	Electricity	Kwh	0.04	0.08	0.35	0.35	0.5	
	Thermal	Gcal	3.95	12	48	48	48	3

notes	comments
1	92 octane
2	oil (burning price)
3	average of prices from Siluma & Lithuanian energy system

Source Lithuanian Government

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Table 2. Energy Price Comparison - Lithuanian Prices with OECD and U.S. Prices

Sector	Fuel	Lithuanian Prices April 1992 Rubles/	1991 OECD Prices @120R/US$ Rubles/	1991 US Prices @120R/US$ Rubles/	1991 OECD Prices @90R/US$ Rubles/	1991 US Prices @90R/US$ Rubles per	
Transport							
	Gasoline	13	103.41	34.15	77.56	25.61	litre
	Diesel	-	70.09	35.61	52.57	26.71	litre
Industrial							
	Gasoline	13					litre
	Diesel	8					litre
	Light Fuel Oil	-	45900	29550	34432	22163	tonne
	Heavy Fuel Oil	4500	18995	9925	14246	7444	tonne
	Electricity	1	7.65	5.70	5.74	4.27	Kwh
	Natural Gas	3400	16905	11393	12679	8545	k m^3
	Steam Coal	192	10759	4939	8069	3704	tonne
	Coking Coal	-	6940	4662	5205	3496	tonne
	Thermal	847	203.81		152.86		Gcal
Household							
	Electricity	0.5	13.22	10.27	9.91	7.70	Kwh
	Thermal	48	298.92		224.19		Gcal

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Recommendations for Improving Industrial Energy Efficiency

A. National and Regional

The recommendations for national and regional improvements of energy efficiency in the industrial sector are closely linked. Promotion of each will benefit the other. Consequently, the recommendations for national could be expanded into regional issues as well.

National issues are the following:

1. Energy Price Reform and Tariff Restructuring - The most critical policy issue affecting energy efficiency is price reform and tariff restructuring. As long as energy prices are subsidized, energy efficiency will not receive proper attention. There is a mind-set among factory managers that energy prices can be passed on to consumers, no matter what the level of increase. As newly privatized companies compete on world markets they will need to reduce production costs in order to become competitive. These costs can be reduced through energy efficiency measures only if the price of energy reflects world market prices.

2. Importation of Energy Efficiency Equipment - Government can promote the importation of energy efficiency equipment first by item no. 1, enacting price reform. Foreign equipment can only be cost justified if energy prices reflect world levels. Second, by removing import tariffs and duties to allow for easier importation. Third, by enacting policy that encourages and/or requires industry to invest in best-available-technology (BAT) equipment, particularly for those industries which have foreign currency earnings.

3. Investment Tax Credits and Other Tax Relief - Provide tax credits or other tax incentives for industry to invest in energy efficiency equipment.

4. Establish Energy Efficiency Guidelines for Industry - By establishing energy efficiency guidelines and targets, within the framework of the incentive programs outlined previously, the government can promote the adoption of new technologies and even require such action where reasonable. Targeted industries would be export industries, joint ventures, and acquisitions.

5. Regulatory Agency Reform - The regulatory agencies, primarily the Ministry of Energy and its sub-agencies, need to reform their activities to become proactive promoters of energy efficiency. Concurrent with energy price reform should be a program of installing electric meters and heat meters throughout industry and the residential sector. Direct energy meters also need upgrading and standardization. Effective metering is the first step in establishing price reform and rate restructuring. The agencies activities should also be directed away from policing outdated

regulations, to that of offering incentives to industry to adopt energy efficiency technologies. Energy audits, information dissemination, etc. are possible activities.

6. Privatization - The pace of general privatization should be accelerated. Too many industries rely on central planners for direction. Accountability needs to be firmly in the place of factory managers who make investment decisions at the factory level. Government should also consider providing start-up assistance for small energy consulting firms capable of servicing the needs of private industry. Incentives should be enacted to assist these firms with start-up costs and barriers.

7. Professional Associations - Government needs to strongly advocate and assist with the establishment of professional energy associations. By leveraging the private sector interest and commitment, they can replicate progress in energy efficiency measures throughout the industrial sector.

8. Investigate BOT and BOO Opportunities - Our discussions with all levels of government agencies indicated that no attempt was being made to attract this kind of investment opportunity in the Republic. Either of these schemes represent a sound approach to attract advanced technology and equipment in the absence of capital, and should be pursued.

9. Establish A National Privatization Plan linked to Economic Priorities - The current privatization plan does not establish national priorities based on market based economic priorities. Government should immediately establish a priority plan and investigate incentives to accomplish clearly defined goals for privatization.

Regional issues are the following:

1. Energy Planning - A regional coordinating group should be established to coordinate regional energy issues, and develop regional energy plans. This exists somewhat in the Baltic System Power Resources Association, but a more encompassing and proactive organization needs to be established. This organization also needs to address the broader issues of regional economic cooperation as they affect energy resources/production development and utilization. The Baltic Republics have a unique opportunity to begin planning their energy infrastructure as a region for mutual benefit, and now is the time to initiate such action.

2. Equipment Suppliers and Services - One problem that is apparent when trying to attract manufacturers and suppliers of energy efficiency equipment and services is the small size of any one republic. By acting as a region, particularly as a region that could be the gateway to the former USSR, the Baltics will be able to attract more foreign business to set up distributors and service organizations. The market is much more attractive when viewed as a region. Similarly, any joint venture for the manufacture of energy efficiency equipment would be more attractive as a region.

3. Professional Associations - As mentioned above, professional associations in the energy field are critically needed in the changing industrial sector in all three republics. By acting as a regional association, the level of information and experience is considerably expanded.

4. Donor Country Assistance and Loan Administration - As with other national vs regional issues, assistance in the form of grants and loans should be considered on a regional basis. e.g., the oil terminal project at Klaipeda and upgrading of the Mazeikiai refinery in Lithuania could be combined with a new gas pipeline project from Finland through Estonia and Latvia. By considering the loan and technical assistance as a 'package', savings in administration and project development costs would result. The actual projects could also be combined with regional trade policies to form a truly integrated regional energy policy.

5. Regional Industrial Associations - Similar to the regional professional associations, these organizations would cover similar industrial sectors throughout the Baltics. Information and experience would be shared between industries and information dissemination of energy efficiency measures promoted.

6. Regional Trade and Investment Practices - Although a complicated issue, trade and investment on a regional basis should be explored. Potential benefits to energy efficiency would be the free movement of equipment across borders, and possible energy rate adjustments specific for Baltic republics.

B. Enterprises

There are many things that enterprises could be doing to help themselves via improved energy efficiency, in conjunction with development of government policies:

1. Form an Energy Management Association - The newly privatized sector will need a proactive voice to represent their interests in government. These interests can be communicated through a national, and potentially regional, energy managers association, as described in previous sections.

2. Establish Strict Management & Accounting Practices - A major problem with most Lithuanian enterprises is the lack of knowledge of production costs and how to manage the cost of production. This applies to energy and most other materials and methods of production. Only through strict monitoring of costs and control of same will enterprise managers be able to reduce and manage these costs. The improvement in management techniques is unlimited at this point. Modern methods of information systems, work force motivation, market based economic forces, and free market investment techniques need to be acquired and training provided. Enterprises also need to begin to manage production, maintenance, and capital improvement budgets as separate entities, currently these are grouped together.

3. Restructure Enterprise Management - Energy is a significant component of production and one that has largely been taken for granted in the past. Now that prices are approaching world market levels, energy will make up a much larger cost of production and needs to be managed as such. Enterprises should immediately establish dedicated energy managers within their organizations. These managers should be charged with developing annual energy management and conservation plans, establishing monitoring programs, and generating capital improvement programs for increasing energy efficiency.

4. Establish Foreign Associations/Partnerships - This is particularly applicable to those enterprises that generate exports or depend on imported raw materials. The current thrust in the private sector appears to be for joint ventures or nothing. Yet, it is possible to establish other forms of associations and partnerships. Creative investment schemes, acquisition of foreign equipment, barter arrangements, and innovative foreign investment opportunities are possible with aggressive and informed management. Enterprises need to take an objective look at their place in an international market and capitalize on their assets and potential production output. The same is true for imported materials of production.

5. Participate With Energy Suppliers on Rate Restructuring - Enterprises should work with energy suppliers on rate restructuring opportunities that could benefit both supplier and consumer. Our discussions indicate that the energy suppliers are not cognizant of energy efficiency opportunities at the enterprise level, or the potential rate restructuring incentives.

C. International Lenders and Donors

An important early role of these organizations is to encourage and provide practical guidance in laying the groundwork for a fully functional market economy. As described above, essential parts of the groundwork are a convertible currency and the establishment of an independent regulatory body in the energy and other natural monopoly areas.

For international lenders, a recommended action is the establishment of a government managed conservation loan fund to private firms for western currency loans through conventional banking sources within the country. International lenders should also expand their role in making loans directly to the private sector. The difficulty in channelling loans through the government is that the loans are primarily appropriate for areas where government has a traditional role in a market economy. Public infrastructure such as power, water, sewer, and roads are examples. While there are needs in these areas, the situation is fundamentally different than developing countries. Lithuania has a substantial public infrastructure in place. Thus, its most critical financing needs at this point are private sector financing. Direct relationships between lenders and the private sector are more appropriate to a market economy. Using the government as the conduit for loans tends to propagate

a government role that is being largely abandoned. It may be useful, however, as an interim step to a fully functioning market economy.

Selected loans are appropriate for electric distribution companies as nationally owned, but autonomously operated electric utilities. Loans for distribution companies should include funds for investments in industrial energy efficiency as part of demand-side management (an element of least-cost planning). U.S. utilities, which are largely privately owned, are increasingly making investments which are less costly than investments in new capacity.
It is recommended that international donors, such as USAID, focus on a variety of targeted programs. Short-term education opportunities in the form of short courses, extension type courses, and conferences are useful in rapidly infusing these markets with some of the essentials of market economy behavior and modern management. Support for long-term training is also extremely useful, but the return on this investment is longer. Semester length visiting professorships in various market management areas, including energy are a recommended means for supporting curriculum reform at the university level. Relatively low cost computers and software for energy management training (both short and long-term) are an extremely attractive area for donor support.

Because of the concentration of energy use in a relatively small number of industrial plants and the desperate need to reduce energy imports, targeted programs to measure these losses and provide limited amounts of equipment for plant guidance in energy management are valuable and timely. Not only are there immediate macroeconomic benefits, and benefits to individual firms, but there are also opportunities to introduce some elements of modern management which can be carried on in the firm and serve as demonstrations to other firms. These programs could very usefully be expanded.

Donors can also provide support in energy pricing, least-cost planning, regulation, efficiency standards, and targeted engineering design support and equipment acquisition. To the degree that international lenders are unable or unwilling to provide loans for industrial conservation or demand-side management, there are expanded opportunities for the donor community.

A particularly attractive design support and demonstration program is in the area of district heating. The losses in the system for both industrial and residential user are enormous. A demonstration project that would provide U.S. or other modern metering, control systems, and tariff reform would provide cost effective energy savings as well as demonstrate U.S. equipment. This could well open the door to subsequent joint ventures with U.S. firms to replicate such a project hundreds of times in Lithuania, the other Baltic Republics, and in the CIS.

Finally, donors can usefully support the professional management and engineering associations. These institutions could play important roles in supporting the exchange of information in a market economy.

SECTION D
Industrial Energy Efficiency in Estonia and Latvia
Summary of Findings

INDUSTRIAL ENERGY EFFICIENCY IN ESTONIA AND LATVIA

Summary of Findings

INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT
IN ESTONIA AND LATVIA:
POLICY OPTIONS AND INSTITUTIONAL ROLES

by
David A. Keith and Eduardo S. Maal
RCG/Hagler, Bailly, Inc.
Arlington, Virginia USA

presented at
USAID Baltic Region Industrial Energy Efficiency Seminar
Kaunas, Lithuania
September 1992

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1.0 BACKGROUND

Over the past ten years, industrial energy efficiency[1] in the United States and other OECD countries has improved by about 30%, on average. This improvement can be directly attributed to several actions:

- Market energy prices which reflected the cost of supply, without subsidies, administered prices or price controls;
- Structural adjustment in the industrial sector, away from energy-intensive industry and toward services and high value-added manufacturing;
- Increased awareness of energy efficiency techniques in industry to improve operations and maintenance;
- Investment in improvements to modernize industrial processes.

Experience in many countries has shown that the rationalization of energy prices is necessary to achieve energy efficiency. Without the right pricing signals, energy consumers and equipment designers make decisions which do not take the value of energy into proper account. When energy prices are sent artificially low, decisions are taken that result in energy consumption at a higher level than the economic optimum. Establishment of competitive energy markets, with pricing based on production costs, is a crucial first step to energy efficiency.

However, it has been widely recognized that while the right energy pricing policy is necessary to achieve energy efficiency, it is usually not sufficient, in itself, to realize the needed improvements, especially in a reasonable period of time. This situation arises because of various market distortions which prevent the energy pricing signals from being taken quickly into account. Many of these distortions are related to information and decision-making, and can be overcome by establishing energy efficiency policy and by developing institutions that can carry out actions to effect this policy.

2.0 INDUSTRIAL MANAGEMENT - IMPROVING PRODUCTIVITY, QUALITY AND EFFICIENCY

2.1 Energy Efficiency as an Integral Part of Industrial Management

Energy efficiency in the industrial enterprise is generally regarded as one important technique of cost reduction. Cost reduction is not the only objective of industrial management, and sometimes higher priority is given to investment in marketing, quality

[1] As measured by the ratio of industrial energy consumption to industrial share of GDP.

improvement or production enhancement. Cost reduction programs must take their rightful place in the priority structure in competition for capital investment and scarce human resources (management, engineering and maintenance attention). The appropriate place for investment in cost reduction is determined based on the conditions of the market, and the relationship of the individual enterprise to its competitors.

Improvements to energy efficiency (defined as an output/input ratio) can be achieved as part of projects designed to improve quality or productivity. A holistic approach, which takes this into account, is best used in designing energy efficiency policy.

All else being equal (particularly energy consumption and quantity of production), quality improvement projects will improve energy efficiency. A quality improvement program would show an energy efficiency improvement to the extent that scrap was reduced (more output per unit of energy input). If a financial definition is used (sales/energy cost) quality improvements will improve energy efficiency, because higher quality products will command higher prices in the marketplace (and energy consumption will be more or less constant).

Production enhancement projects, including market development, also are vital to improve energy efficiency. In any production process, there is a certain amount of fixed energy consumption required to bring the process up to operating conditions, and a variable consumption which is related to the volume of production. This fixed consumption goes for rotating equipment friction and inertia, and for bringing heating and cooling processes to the required temperature. The fixed consumption can be quite substantial, especially for the so-called energy-intensive industries. As production is reduced below the capacity of the plant, which is the case now in the majority of industrial plants in all former COMECON countries, this fixed energy consumption is spread over fewer and fewer units of production. Thus both the physical ratio of Gcal/ton and financial ratio of sales/energy cost, will deteriorate as production is reduced.

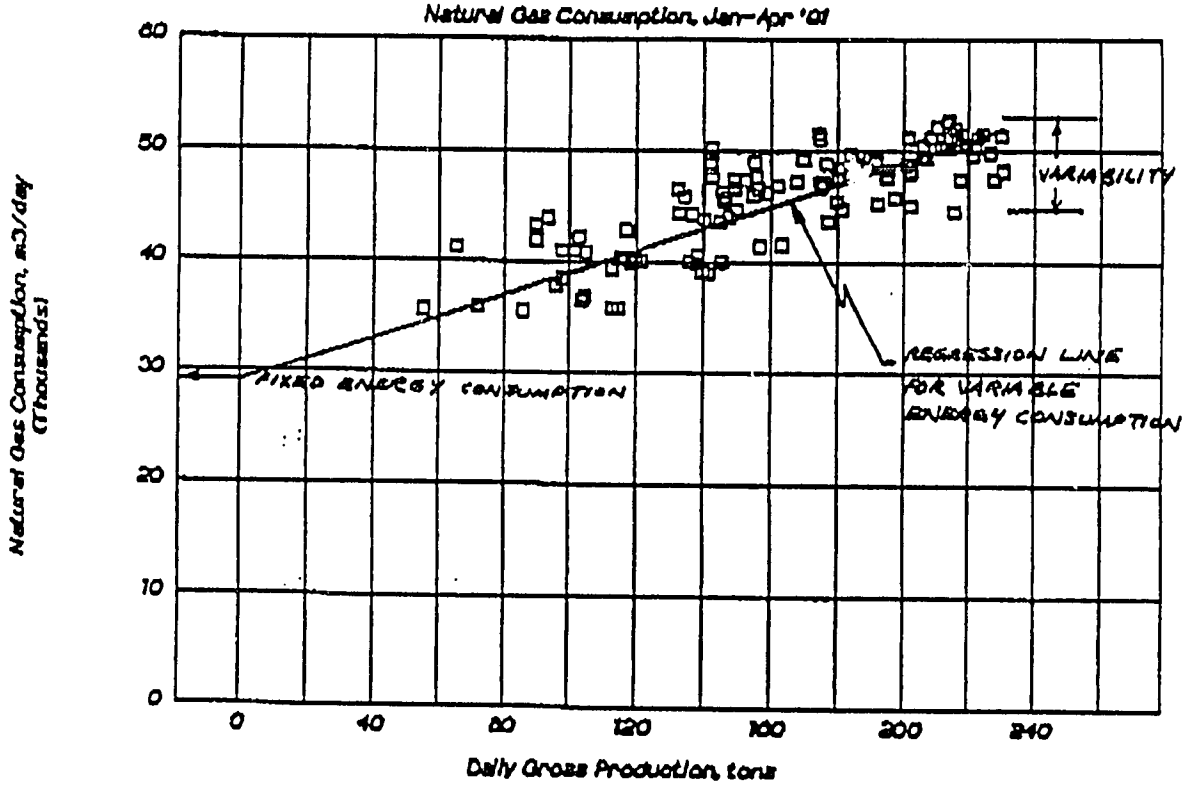
The scatter diagrams on the following page, taken from RCG/Hagler, Bailly's detailed studies of an energy-intensive factory in Hungary, illustrate:

1. Daily energy consumption vs. daily production rate, showing fixed energy consumption (29,000 m^3/day) plus variable energy consumption (110 m^3/ton).

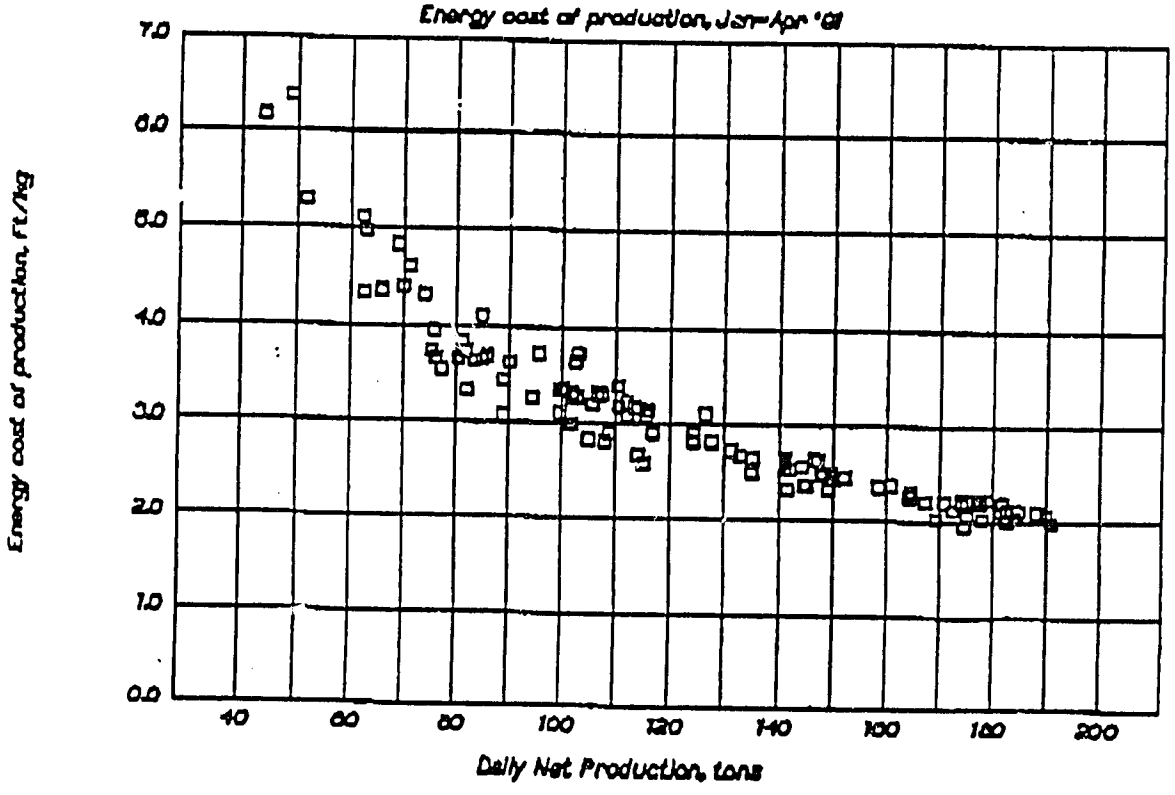
2. Energy cost per unit of production (a good measure of energy efficiency) vs. daily production rate.

From these data, which are typical of many factories in the region, it is clear that energy efficiency is a function of production rate. Further, at any given production rate, there is significant scatter in the data, 10-20% variability in energy consumption. This indicates that management has the opportunity to improve control of operations, and thereby influence efficiency.

ENERGY-INTENSIVE FACTORY IN HUNGARY



ENERGY-INTENSIVE FACTORY IN HUNGARY



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Industrial energy efficiency can best be achieved when industrial enterprises are market-driven. If there is no market for the product of the enterprise, the enterprise must either change its product or close its doors. The decision to close or consolidate operations is most critical for energy-intensive industries with high fixed energy consumption. In 1991, as part of the AID Emergency Energy Project, a glass container plant in Hungary consolidated operations from four melting furnaces to three. This measure alone saved the factory $2 million per year in natural gas cost.

2.2 Defining Industrial Energy Efficiency at the Enterprise Level

Earnings (profits) are very important to the owners of industrial enterprises. Retained earnings are used for investment in expansion, modernization and rehabilitation of capital stock. Dividends to shareholders find their way into the sale of consumer products, and investments, such as building construction and shares of other companies. Even in former COMECON countries, industrial enterprises have sought profits. These profits have been used to develop social infrastructure for the benefit of the workers, including housing, kindergartens and recreational facilities.

A financial definition of industrial energy efficiency can be made. Performance indicators, in the form of financial ratios, are the common way of evaluating industrial firms in a market economy. In a monopolistic situation, however, these indicators may not give an accurate view. A financial definition might be:

$$\text{Energy efficiency} = \frac{\text{output (\$)}}{\text{energy cost (\$)}}$$

Under this definition, there would be several general types of projects which could improve the ratio:

Energy efficiency projects, which act mainly on the denominator of the ratio:

- Energy conservation projects which reduce fixed energy consumption, such as operating most efficient equipment on priority, repair of leaks, upgrading of insulation, improved lighting or load management;
- Energy conservation projects which reduce variable energy consumption, such as installing low-energy process equipment, the use of catalysts, improved metalworking tools and radiant heat transfer equipment;
- Fuel substitution projects which reduce the cost per Gcal, or which reduce the level of fines for environmental emissions (increasing profits).

Other projects, which assist by acting on the numerator of the ratio:

- Production enhancement projects, which would spread fixed costs and fixed energy consumption over a greater number of units of production, thereby increasing profit per unit and reducing the specific energy consumption ratio (Gcal/unit);

- Quality improvements, which could reduce scrap (wasted energy) or would enable the product to be more marketable, while maintaining about the same specific energy consumption ratio (Gcal/unit);

- Marketing improvements, which would improve output (sales volume or selling price and profit margin) without affecting energy consumption;

A financial definition points out that improvements to energy efficiency is not merely a task for energy efficiency experts. The work of industrial process technologists, management experts, quality experts, and productivity experts are all needed to maximize energy efficiency.

3.0 TECHNIQUES FOR IMPROVING INDUSTRIAL ENERGY EFFICIENCY AT THE ENTERPRISE LEVEL

Any improvements in industrial energy efficiency, as measured at the sector or sub-sector level, can only be achieved by taking specific, detailed actions at the enterprise level. These actions involve changes to operations, maintenance, or equipment. An energy efficiency program at the enterprise level typically involves 10-20 actions, each of which improve efficiency by 1-2%.

Achieving and maintaining industrial energy efficiency in an enterprise is a never-ending process, and so must be fully integrated into the normal course of business operations. The standard of efficiency is always increasing, as dictated by the competition in any given market.

There are many techniques for improving industrial energy efficiency, but these are often simplified by categorization in four groups, on the basis of the investment required:

- Management and organizational improvements, which generally require little or no investment;

- Low-cost measures to improve operations and maintenance, projects which provide a payback of one year or less;

- Minor investments to upgrade existing equipment, projects which provide a payback of three years or less, based on energy savings;

- Major investments to acquire new, modern equipment, which may have multiple benefits in productivity, quality and energy efficiency.

In the sections that follow, RCG/Hagler, Bailly has used experience gathered in industrial energy efficiency programs in Estonia and Latvia, as well as other countries in the former COMECON region over the past two years to develop generic examples of actions which are suitable for the region. These actions may or may not be applicable in all industrial plants, depending on the specific circumstances and existing conditions in the enterprise.

3.1 Examples of "Type A" Actions, Management and Organizational Improvements

- Change ownership so that a new "owner's mentality" and sense of purpose for the future is created. This new mentality mst establish a management commitment to quality, productivity and efficiency. The

  owner may take an active approach to seek out foreign joint venture partners.

- Change organizational structure to establish energy department as a profit center, "selling" energy to production department, and thereby place responsibility for energy efficiency (including identification and implementation of energy savings ideas and projects) at the production level, where most energy is consumed.

- Establish energy accounting systems and management information systems to allow management to monitor efficiency in time to take control actions.

- Create working conditions that motivate all employees (especially those in the production departments) to improve efficiency, productivity and quality, including financial incentives and feedback of results.

- Provide information and training appropriate to employees at management and engineering levels in energy efficiency technology and techniques.

- Establish a "total quality management" program in the plant, based on employee participation in a process of continuous improvement based on planning, testing, action, feedback of results and refinement.

- Organize a market-driven decision-making process for difficult, but essential, management decisions which are urgently required, but are being delayed, such as:

  - which products to be in;
  - which products to produce;
  - level of quality needed by the market;

- type of packaging needed by the market;
- transportation needed to get to the market in time;
- which parts of the plant to close down.

- Establish a marketing department with sufficient staffing and funding[2] to increase sales, so that the plant can operate at higher capacity factor, and thereby spread fixed energy consumption over more units of production.

- Establish a production process R&D department to learn the state-of-the-art in the selected markets/products, and plan the future modernization of the plant. Provide a budget for experts to carry out market research and feasibility studies[3].

- Optimize operations, so that production os carried out using the most efficient equipment in the factory in the most efficient way (least-cost production).

3.2 Examples of "Type B" Actions, Low-Cost Improvements to Operations and Maintenance

- Upgrade the general standard of maintenance throughout the plant, and provide maintenance personnel with tools, training, status, and management reinforcement to carry out the job.

- Establish teams dedicated to specific efficiency-related tasks (such as for steam/heating, electric motors/drives, compressed air and combustion) and provide them with the necessary diagnostic instruments, repair tools and budgets (for assistance from professional consultants or incidental expenses). These teams will have several tasks:

  - To identify obvious energy waste such as steam leaks, idling equipment or underloaded operations, and carry out necessary repairs.

  - To identify low-cost improvements to operations and maintenance, and to establish new procedures.

  - To identify minor retrofit improvements needed, and to develop cost and benefit estimates.

  - To develop specifications for future procurement, and thereby upgrade the standard of efficiency over time.

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[2] Many western companies spend 20% of revenues, or more, on marketing.

[3] Many western companies allocate 10% of revenues to R&D and new product development.

- Upgrade the level of instrumentation in the plant, especially for energy flows and efficiency-related parameters, and establish procedures based on instrumentation readings.

- Establish a preventive maintenance system in the plant, with necessary monitoring instruments, procedures, and dedicated staff, to improve equipment reliability (reduce downtime) and thereby increase efficiency.

- Provide information and training in energy efficiency technology and techniques appropriate to employees at various production, operations and maintenance levels.

3.3 Examples of "Type C" Projects, Minor Investments in Equipment Upgrading

- Improvement of control systems, including automation and regulation, such as boiler air-fuel control.

- Installation of heat exchanges to recover waste heat in production processes.

- Improvement in quality control equipment to reduce scrap generated by production process.

- Install recycling equipment to convert scrap generated at intermediate stages of the process.

- Rehabilitation of boilers, ovens, dryers, kilns and heat exchangers to clean radiant and convective heat transfer surfaces and repair internal leaks.

- Rehabilitation of process equipment to improve reliability and reduce start/stops and downtime.

- Installation of efficient lighting systems, variable speed drives and other cost-effective retrofits where feasible.

3.4 Examples of "Type D" Projects, Capital Investments in Modernization

- Conversion of a plant to produce a different, but related, product that offers a higher value-added for a given level of energy consumption.

- Installation of new process technology for the same product to improve productivity, increase reliability, improve quality and reduce specific energy consumption.

- Conversion to alternative fuel that offers benefits in lower cost, improved product quality or reduced pollution.

- Installation of new boilers, turbines and prime movers that offer higher efficiency.

- Installation of cogeneration-combined heat and power systems, possibly including sale of power to grid or sale of heat to neighboring district.

4.0 POLICY AND PROGRAMS TO ACCELERATE IMPROVEMENTS IN INDUSTRIAL ENERGY EFFICIENCY AT THE ENTERPRISE LEVEL

Since the mid-1970s, governments in countries around the world have instituted policies and programs designed to improve industrial energy efficiency. Since its founding in 1980, RCG/Hagler, Bailly has assisted the US Federal and State Governments and Governments in many other countries to develop energy efficiency policy and has been actively involved in the design and execution of such programs. Before instituting any policy or designing any program, it is important to first establish the objective of the effort. RCG/Hagler, Bailly suggests the following objective statement:

> It is the Government's objective to establish a policy framework that provides incentives for energy efficiency, to the extent appropriate to a modern market economy. Furthermore, in recognition of the period of transition to a market economy, it is the Government's objective to use limited resources to institute programs to overcome market distortions, and thereby accelerate improvements to energy efficiency.

Many different policies and programs have been adopted by market economies, designed to overcome specific market distortions. Examples which seem relevant to Estonia and Latvia are provided in the sections that follow. These are listed by RCG/Hagler, Bailly as options for consideration, not absolute recommendations.

4.1 Industrial Energy Efficiency Policy Options

Policy options which RCG/Hagler, Bailly suggests as appropriate for Estonia and Latvia are listed in the following section.

Establish an energy supply policy designed to promote industrial investment

Industry today competes in a world marketplace, and there is tremendous competition for new investment, both within the region and in other locations. Many countries provide strong incentives for industrial development. Over the long run, investment in industrial technology is the key to improving energy efficiency. At a minimum, a stable and secure

supply of reasonably-priced energy is necessary to industrial development. Without development and investment, industry will become less and less efficient over time.

Establish energy pricing policy based on costs

Obviously, a higher level of energy prices will promote improvements in industrial energy efficiency. Thus it is important that industrial energy prices reflect market prices, or economic border prices, at a minimum. After reaching market prices, Government faces strong temptation to introduce taxes, or to raise prices on industrial consumers so that residential consumers can benefit from cross-subsidies. In fact, most countries in the former COMECON region are doing just that. Government should be warned that this policy may "kill the goose that laid the golden egg". Cross-subsidies to maintain low household energy prices are politically popular, but they may scare away potential new industrial developers. Id the existing industry is not competitive, the factory may be forced to close, leaving the workers (who support the households that were being subsidized) with no income.

Beyond considerations of the level of prices, there are various structural considerations in energy prices that can encourage industrial energy efficiency, especially in relation to the investment in and utilization of energy infrastructure required to serve the industrial sector.

These structural pricing policies include:

- Establishing energy prices on the basis of long-run marginal costs (LRMC). LRMC are typically lower for larger (bulk) consumers, or electric consumers at high voltage.

- Introducing two-part energy prices for electricity and gas based on capacity and consumption, the relationship of which is established by LRMC.

- Making capacity charges on the basis of meter readings, rather than allocative subscription charges.

- Introducing fine-tuned LRMC prices, such as time-of-use rates for both capacity and consumption, and adjustments for distribution losses, such as for power factor (cosine phi).

Establish a stimulative industrial investment policy

A policy that encourages private investors to make investment in industry can help promote industrial energy efficiency. This is because the design of industrial process equipment is continuously evolving, and new designs are more energy efficient than older designs, especially since the late 1970s. For example, a typical ammonia plant built today os designed to use 30% less energy per ton than one built in 1980. Further, even new equipment of the same design efficiency as the old equipment it replaces will provide better

energy efficiency, because efficiency deteriorates over time, as equipment wears out with use.

Investors in industry have many alternative investments from which to choose, including productivity, quality and efficiency. If energy prices are appropriate, efficiency will take its proper place in the decision-making trade-off decisions.

Investors also have many locations from which to choose, even if they have already decided to invest in the former COMECON region. Estonia and Latvia are attractive in some ways, but now Russia itself is opening up to foreign investment. This market is now very competitive, and many countries have begun adopting the same investment promotion strategies used by developing countries, such as long-term tax holidays and other concessions.

In the 1970s, many industrialized countries (including U.S., U.K. and Japan) offered investment incentives to promote energy efficiency. Investments which qualified as energy saving projects were eligible for tax credits. This policy was judged by many to have been instrumental in stimulating investment. However, since that time, general industrial investment incentives (without the energy project restriction) have been almost equally effective in stimulating efficiency improvement. The difference has been that projects of marginal financial viability (such as some renewable energy projects) have not been implemented.

Establish an import regulation policy which fosters competition

A policy to open markets to competition will promote industrial energy efficiency. Over the years, western industrial process technologies have evolved which are more efficient than the technologies of the former USSR. The shortest course to improvement in energy efficiency will be to introduce and adapt these proven technologies.

Further, the monopolistic situation that exists in many industries in Estonia, Latvia and other former COMECON countries enables costs to be passed on to the consumer, providing no incentive for efficiency.

The temptation to levy duties on imports is strong. However, high import duties will reduce the rate of improvement of industrial energy efficiency in two ways:

- by preventing access to modern, energy-efficient technology;
- by reducing competition, and hence the need for existing industry to improve its energy efficiency and competitiveness.

The need to develop and maintain local industry is great. However, the greatest need is to earn hard currency. If local industry is to compete in hard currency markets, the best place

to begin to do so is at home. If the local market is a fair one, then industry can feel confident to export.

Privatize, or at least rationalize, industry in a competitive environment

Privatization of industrial enterprises will quickly improve industrial energy efficiency. The ownership question is central to decision-making in Estonia and Latvia. The rules must change.. An owner's mentality is needed to make the tough decisions.

As long as Government is the owner, two things will happen:

- Decisions regarding the closing of inefficient plants will be delayed because of social considerations.

- Factory workers will continue to have insufficient respect for management, property or energy and will continue wasteful behavior.

If an industrial enterprise is to run efficiently, the boss must boss. Under the old rules, all the workers were equal. In the Japanese model, there is an appearance of equality, but in reality there is a strong respect for superiors and orders are followed gladly. The situation in many former COMECON factories was that management received little or no respect, and some workers regularly sabotaged a co-worker who rocked the boat be showing any initiative or being more productive than the bare minimum. Thus, state ownership of industry in a competitive market may not work as well in former COMECON countries as it does western Europe.

Require energy supply enterprises to consider demand-side opportunities as an integral part of expansion planning

Electric, gas, district heat and water utilities historically are faced with growing demand for their services, due to population growth and industrial development. This growth leads to requirements for expansion and capital investment. However, energy audits in Estonia, Latvia and most other former COMECON countries by RCG/Hagler, Bailly and other contractors under the USAID Emergency Energy Program have shown that there are economic opportunities to improve efficiency on the demand side, on the order of 10-30%. These opportunities offer an economic return on investment which is higher than investment in traditional supply-side expansion.

Experience in the U.S. has shown that electric utilities need regulatory guidance in order to stimulate them to pursue demand-side opportunities nearly as aggressively as supply-side investment. The concept of integrated resource planning, in which demand-side and supply-side projects are considered on an equal footing, has since arisen as a new discipline, which enlightened electric utilities have accepted as being in not only the country's interest but also their own.

Reduce the standard of district heating services

The temperature of district heating supply water is based on ambient temperature conditions, according to the standard "graphic". Under the new market conditions, the economy may no longer be able to afford to supply heat energy in the same quantities as in the past.

In a market economy, the level of heating services provided by the Government should represent a minimum level rather than a comfortable level. If consumers want more services, they should pay for them directly. This could be accomplished over the long run by installing electric or gas-fired augmentation heaters.

The temperatures specified in the graphic are design conditions, and are not adjusted for actual installed conditions. The result is overshooting/undershooting of the necessary temperature. Reducing the supply temperature slightly will save energy (as much as 20% over a heating season), while still maintaining adequate comfort levels (at least 15 °C in flats).

The Government should require each district heating utility to carry out an optimization program to update the graphic for the new market energy pricing conditions and the physical characteristics of its heating system, based on a trial and error procedure.

Institute equipment efficiency standards

Another possible Government policy option is to introduce minimum standards for equipment efficiency. This policy has been effective in the U.S. in stimulating energy efficiency improvements in the automobile industry. Similar programs have been used in other countries to require improvements in the efficiency of electric appliances and air conditioners[4].

Such a policy has limited applicability in the industrial sector. The characteristics of an industrial plant are based on many considerations, primarily the process itself.

One ubiquitous piece of equipment is the electric motor. In smaller sizes, western motor manufacturers offer two product lines, standards and high efficiency (for a higher price, up to 50% more). The high efficiency models save from 1% (50 kW size) up to 10% (0.5 kW size). A policy could be developed that requires the use of electric motors of a minimum efficiency, however caution must be applied. If a motor has a low duty factor (used only occasionally), the incremental cost of the high efficiency motor may not offer an attractive return on investment.

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[4] The US opted tfor a consumer information program to require that manufacturers display lables on the appliances which list expected annual energy costs, so that consumers can compare alternatives.

The same tradeoff is true of most other standards, which makes a consumers education policy a better alternative. Energy users should not be required to make decisions based on energy considerations alone - other issues may be more important.

4.2 Industrial Energy Efficiency Program Options

Program initiatives generally require Government expenditure, or access to precious donor financing. Most Western economists agree that the primary role of Government is the provision of specialized services that cannot be provided by the private sector, such as police, defense, justice and social safety nets. Many believe that Government should provide other social services, such as education, water, sanitation and health care. Fewer agree that Government should be the owner of industry or assist industry directly, other than assuring that the right policy framework is established. Program initiatives for industrial energy efficiency are controversial, and should be carefully targeted, if used at all.

Program initiatives should be designed to overcome market distortions. Market distortions are usually limited to temporary inadequacies, so the programs should be terminated when the market matures. The Government must be particularly careful that its programs do not become subsidies, or represent conflicts with the development of the private sector. For example, what chance does a private Estonian or Latvian engineering consulting firm have to sell energy audits if western consultants are doing free energy audits under a donor-financed program?

Examples of market distortions which reduce the opportunity for industrial energy efficiency include:

- Incomplete information or education, which impedes rational decision-making leading to action;
- Lack of available technology for implementation due to regulated markets or monopolistic positions of suppliers;
- Lack of services available for implementation;
- Lack of available financing for necessary investment.

Inflation and education programs

Examples of options for industrial sector information and educational programs under Government sponsorship are listed below. Many of these programs are provided without Government support in some countries, when an ability and willingness pay develop.

- Energy management training courses for plant managers and plant engineers;

- Specific energy efficiency training courses for energy using technologies or techniques, such as for:

  - energy accounting;
  - boiler operations and maintenance;
  - dryers, ovens and kilns;
  - electrical systems operations;
  - energy monitoring instrumentation;
  - energy control systems;
  - vehicle fleet management;
  - refrigeration and air conditioning;
  - waste heat utilization;
  - institutional building energy management;
  - electric motors, pumps, compressors and drives;
  - steam systems operations and maintenance;
  - compressed air systems operations and maintenance;
  - preventive maintenance programs;
  - project management;
  - industrial process-specific energy.

- Publication of handbooks or training manuals for above short courses;

- Energy auditor training programs, to develop skills among private sector consulting engineers;

- University degree curriculum in energy management;

- Publication of case studies of successful energy efficiency projects;

- Conference designed to disseminate successful experiences to peer groups and allow networking;

- Exhibitions and trade fairs designed to match suppliers of energy efficiency products and services with energy consumers.

Demonstration activities in individual plants

There are very good reasons why the Government should avoid carrying out energy efficiency activities in industrial plants. First, there are limited resources available and so those few plants that receive the assistance (especially the early ones) will obtain an unfair advantage. Secondly, by providing these services at low or subsidized cost, the Government deprives the private sector energy management consultants of a business opportunity. Finally, good energy efficiency projects are cost-effective, and so Government subsidies are very questionable.

Having said this, there are important reasons to consider a well-designed program, particularly since any improvement to industrial energy efficiency can only begin from micro changes at the plant level. It must be recognized that each plant is different, and so a given plant will benefit most from a program of expert advice tailored to their needs. Further, case studies in individual plants will provide concrete examples of potential savings and actual results of energy efficiency improvements, that can lend credence to the information and training programs. Finally, these programs can be used at an early stage as a training ground for private sector energy management consultants. One program which was used to good effect was the US Department of Energy "Schools and Hospitals Energy Conservation Program", which provided grant funding for 50% of the cost of investments in energy conservation in public school and hospital buildings during the late 1970s to early 1980s. All design, procurement and construction work under this program was carried out by consultants and contractors from the private sector.

Programs to consider include:

- Plant visits to explain energy efficiency techniques one-on-one, inspect facilities and offer limited advice;
- Brief energy audits[5];
- Provision of limited packages of generic, low-cost energy efficiency equipment;
- Installation of specific energy efficiency technologies which have wider application within industry.

Service development programs

The service sector was noticeably absent from the economy of the USSR. This lack of available services leads to an implementation gap in project execution. RCG/Hagler, Bailly observed in Latvia that a simple project, 25 ton steam/hour boiler rehabilitation, required six months, which is almost 10 times longer than a similar task takes to accomplish in market economies.

There are many services that now need to be developed to improve energy efficiency, including:

- Energy management consulting;
- Energy auditing;

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[5] Under the early government-sponsored energy conservation programs in the US, limited energy audits wree carried out. For example, in the programs designed and implemented by Georgia Institute of Technology, assistance to any one plant was limited to one engineering man-week, which included one day in the plant and four days of follow-up research and analysis. These audits referred the plant to a list of professional consulting engineers (offering services for a fee) for further assistance to implement projects or conduct feasibility studies.

- Sales and service of energy efficiency equipment;
- Maintenance services for energy-intensive equipment.

The Government can assist the development of a services sector mainly by providing training and information. beyond that, the possibility of certification should be examined. Finally, if the Government intends to carry out any in-plant energy audits to demonstration programs, these must be contracted to the private sector, so as to create a market and a base of experience for these emerging industries. If bilateral donor agencies carry out in-plant programs, these must be done with local private sector senior experts as an integral part of the team, so that they benefit from the experience and exposure to a Western consulting firm.

Financing programs

There is a very serious shortage of capital available in Estonia and Latvia. Energy efficiency is far below western standards. Many plant managers cite this capital shortage as the greatest obstacle to improving energy efficiency.

Governments have the opportunity to make funds available for energy efficiency from several sources. Governments of many developing countries borrow funds from the World Bank and other multilateral developing banks to be applied to energy efficiency. In addition, private sector sources, such as foreign investors and commercial banks, will make financing available.

Industrial sector loans can be very useful in stimulating energy efficiency improvements, and the borrowing country Government should assure that the loans can be used for such investments. These funds allow projects with multiple benefits (productivity, quality, efficiency) to be packaged and funded. The World Bank has provided many sector loans for such purposes in other countries. Usually the World Bank requires a preliminary study of rationalization of the industry, which leads to conditions precedent to the loan approval or disbursement (such as restructuring of the industry).

Convert district heating to a market commodity

As developed in the USSR, district heating is the classic example of the triumph of theory over practice. High thermodynamic efficiency was achieved at the supply side, particularly when the heat is derived from combined heat and power stations. Even when the heat is provided by boilerhouses, there are economies of scale which make this the least--cost form of generation.

From the heat source, heat transfer losses and leaks in the distribution system rob the district heating technology of part of its efficiency. Because of a low standard of maintenance, these losses have increased as the system has deteriorated over the years. But even after these losses, the system is an efficient way to deliver heat to the building.

At the building level, the realities of the system illustrate the failure. According to schematics included in textbooks published in the west describing Soviet district heating systems, meters and temperature controllers (including thermostatic radiator valves) are installed. Experts also claim that systems were built to these standards. However, upon inspection of these systems, and having discussions in four countries, RCG/Hagler, Bailly has found that meters and controls are simply not there.

Only in Budapest, Hungary are heat (Gcal) meters commonly found in substations or building inlets, and that is because an aggressive program of installing meters has been carried out by Budapest District Heating Works over the past three years.

Manual valves have been installed in some cases to regulate the flow of hot water through radiators, but we have learned that these have not been used or maintained for 20-30 years. In some modern construction, so-called one-pipe systems are installed, in which radiators on different floors are connected in series. In these systems, valves cannot be installed unless bypass loops are also installed.

Energy consumption in district heating systems in the former USSR is not metered, and is not controllable. In a way, increasing price for district heating hardly seems fair when the energy consumers cannot change their consumption.

Projects to make district heating systems meterable and controllable, and to institute heat tariffs based on consumption, represent infrastructure improvements that are good projects for Government intervention. Government attention is needed to attract the large amount of financing required, and because the consumers on their own probably will not be able to make the investment, for physical as well as financial reasons.

5.0 ROLES OF ESTONIAN AND LATVIAN INSTITUTIONS IN ACCELERATING INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENTS

5.1 Introduction

There are many institutions that can work to accelerate improvements in industrial energy efficiency. Generally these can be grouped into six types of organizations, each with important roles to play:

1. Government - which has the responsibility to establish the energy policy framework conducive to improved industrial energy efficiency;

2. Energy Supply Companies - which have the responsibility to supply energy carriers (oil, gas electricity, etc.) reliably, and at least economic cost;

3. Industrial Enterprises - which must supply industrial products (chemical, metals, food products, etc.) that are competitive in terms of quality and price;

4. Financial Institutions - which must attract savings and may make loans to viable industrial enterprises for working capital or attractive investments;

5. Non-Profit, Non-Government Organizations (NGOs) - which may assume responsibility for energy efficiency awareness-building, networking and policy advocacy;

6. Academic Institutions - which may assume responsibility for energy efficiency training, information and research;

7. Private Sector Energy Efficiency Industry Firms - which must provide products (energy efficient equipment) and commercial services (such as energy audits and implementation of energy efficiency measures) that are competitive in terms of quality and price.

The general distinctions listed above sometimes blur, and this can lead to conflicts. Such conflicts are very undesirable, as they can lead to a reduced rate of implementation of energy efficiency improvements. Sometimes energy efficiency projects fail simply because the wrong organization took responsibility for project execution. Too often, many institutions seem to be vying for the same role. This is unfortunate, since it will require the efforts of many agencies and individuals to succeed.

One typical source of conflicts arises when Government extends its mandate outside of the policy realm, and into energy efficiency training, research, energy audits or implementation. In such instances, the rate of implementation of energy efficiency is slowed considerably.

5.2 Role of Government

In a market economy, Government has a stimulative role in industrial energy efficiency, but should not be involved in implementation. Government has the responsibility to establish policy conductive to improved industrial energy efficiency. The first step is to establish the right energy pricing policy. The next steps are investment policy, industrial development and restructuring policy.

Agencies of Government which influence industrial energy efficiency include:

Ministry of Industry and Energy

Industry - must establish privatization and restructuring policy

Energy - must establish market-based energy pricing policy

Local government - must determine regional development and district heating system policy

Ministry of Environment - must set policy to regulate airborne environmental emissions which are related to energy consumption, such as SO_2 and NO_x

Ministry of Finance - must establish fiscal, monetary, taxation and foreign investment policy to control inflation and promote investment in industry

5.3 Role of Energy Supply Companies

Energy supply companies have the responsibility to supply carriers reliably and at least economic cost. Reliability is important because outages or shortages result in economic losses, and a waste of energy in starts/stops of industrial equipment. Least economic cost development requires consideration of not only traditional supply-side investments but also possible investments in demand-side efficiency improvements at the same time.

It has been demonstrated in many countries that some demand-side management (DSM) investments reduce requirements for power (kW) and energy (kWh) at lower cost than equivalent power and energy supply-side investments. To the extent that this is shown to be true in the industrial sector, the energy supply company should develop DSM programs to increase the market penetration of these technologies. DSM programs in the industrial sector can consists of financial incentives (or partial payments) for training, information, energy audits and investments.

Monopolistic energy supply companies assume their 100% market share will last forever, but changes are definitely coming. Good customer relations develop consumer confidence and lasting relationships that help build market share. The best customer is a well-informed customer. Innovative energy supply companies in the US now know that in the long-term they will also benefit from customer efficiency improvements. But in the short-term, they will suffer a loss of revenues, and so financial mechanisms have been designed to compensate the energy supply company for investments in DSM.

DSM programs are particularly well-suited to the electric and gas energy systems. In additions, petroleum supply companies can also provide information and training to help their customers use energy more efficiently.

Finally, energy supply companies have an obligation to maintain high standards of energy efficiency in their own operations (power generation heat rate, distribution losses, refinery conversion efficiency pipeline losses, etc). Financial profits of electric companies in the US are usually directly determined by efficiency and management of the enterprise.

5.4 Role of Industrial Enterprises

The primary function of industrial enterprises is to supply industrial products (chemicals, metals, food products, etc.) that are competitive in terms of quality and price. In Estonia and Latvia today, this has become a matter of survival for each and every industrial concern.

Energy efficiency improvement is one way to increase the probability of survival, and in some industries it may be the key to survival. But in most industries, efficiency is just one part of the problem, and solutions must be integrated with productivity and quality improvement programs.

The first step to save energy efficiency improvement (and productivity and quality as well) is management commitment. If the boss doesn't care, nobody cares. In RCG/Hagler, Bailly's 1991 surveys of COMECOM industries, we found that only about half of factory directors could be described as committed to change.

Given top management commitment, the next step is to establish a team dedicated to the task of energy efficiency. The efficiency team will include factory managers, engineers, accountants and outside contractors. The outside contractors may be energy management consultants, maintenance technicians, design engineers and installation contractors.

The efficiency team must develop a tailor-made energy management program. An energy audit is usually a good first step in such a program. The energy audit identifies energy usage in the factory, identifies ideas for efficiency improvement, and develops estimates of cost and benefit for each idea. The energy audit develops an energy management action plan, and sets goals for efficiency gains.

However, the energy audit is just the starting point. Actual energy savings will only result from the efforts of the energy efficiency team to make changes over time. The efficiency team will act on the plan. over time, the objective of the team will be to identify other ideas for improvements and carry out works to see that they are implemented..

As time goes by, the program must be monitored and feedback of results must be passed to the team. Recognition of the efforts of the team, particularly with financial incentives, is important to long-term success. Industrial energy efficiency is just part of operations and maintenance, and is a never-ending task.

5.5 Role of Financial Institutions

Banks and other financial institutions must attract investment capital and make loans to viable industrial enterprises for working capital or attractive investments. Energy efficiency is one such investment alternative.

It is the responsibility of financial institutions to develop an awareness of the need for financing of energy efficiency investments, so that they may receive proper consideration in the loan approval process.

Financial institutions must offer terms on loans that can sustain operations, but are not onerous. Industrial managers in Estonia and Latvia are not accustomed to debt. In today's unprecedented inflationary spiral, it may be difficult for industrial managers to understand

the banks' need to maintain positive real interest rates, and thus high nominal rates. Bankers must work to educate their borrowers, so that the whole system does not shut down, out of fear.

5.6 Role of Non-Profit, Non-Governmental Organizations

Non-profit, non-government organizations (NGOs) are usually created for a single purpose, and have a responsibility to their constituents to carry out activities related to that purpose. Examples of NGOs include industry associations, professional associations and advocacy groups.

Most NGOs are formed by people who feel a moral obligation to do good. There is an important role for altruistic, hard-working individuals in stimulating energy efficiency.

The best ways to apply the NGOs in energy efficiency are in the areas that are generally regarded by the private sector as having little or no potential for profit, for example:

Public relations - to build awareness of the need for energy efficiency through appearances, public service advertising;

Information dissemination - to prepare publications regarding energy efficiency technologies and techniques;

Policy advocacy - to speak out, within a democratic framework, urging Government to adopt policy and legislation which can accelerate energy efficiency improvements

Commercial trade associations (clearinghouse) - to serve as a meeting ground and referral service for buyers and sellers of energy efficiency technology and services, to provide information about available suppliers;

Industry associations - to inform member companies from a specific industry about process-related opportunities for energy efficiency, productivity and quality improvement, and to put together managers of industry in conferences to share experiences and case studies;

Professional associations - to inform member professionals (such as engineers, lawyers, managers) about opportunities in energy efficiency in their profession, and to put together peers in conferences to share experiences and case studies.

NGOs will not be as efficient as the private sector in the potentially profitable activities, such as energy audits, energy management consulting and implementation. The competitive power of the marketplace will work best in these areas, so that implementation will spread as quickly as possible.

5.7 Role of Academic Institutions

Academic institutions in Estonia and Latvia include universities and other training institutions, research institutes, engineering design institutes and the various laboratories of the academy of science. As with NGOs, most members of the technical staff of these institutions are well-motivated. The best way to apply the academic institutions in energy efficiency are also in areas that are generally regarded by the private sector as having little or no potential for profit, for example:

> Information dissemination - to prepare publications regarding energy efficiency technologies and techniques.
>
> Training and education - to introduce energy efficiency concepts as an integral part of the science and engineering curriculum at all levels of schooling, to hold specific short courses, certificate programs, and advanced degree programs in energy efficiency topics.
>
> Research and development - to carry out programs designed to investigate the effect of policy, programs and technology on energy efficiency, to perform general scientific and engineering studies toward designing improvements in energy efficiency.

As with NGOs, academic institutions will not be as efficient as the private sector in the potentially profitable activities, such as energy audits, energy management consulting and implementation. The competitive power of the marketplace will work best in these areas, so that implementation will spread as quickly as possible.

5.8 Role of Private Sector Energy Efficiency Industry

Private individuals go into business for two reasons: because they have an idea or are interested in providing a specific product or service; and/or to make money.

The energy efficiency business is like any other business. To survive, firms in the energy efficiency business must provide products and commercial services that are needed by the market and are competitive in terms of quality and price.

The private sector is now starting to grow rapidly in Estonia and Latvia. Entrepreneurial spirit exists, and many professionals who have dedicated their careers to energy efficiency in the past are interested in going into business in this area. They have a real challenge to first develop a market, and then to develop products and services to serve that market. There are substantial risks in going into this business in Estonia and Latvia today.

There are many business opportunities that exist, that can contribute to improved energy efficiency. These include:

- consulting firms to offer energy audits, management consulting and feasibility studies.

- manufacturing of equipment which can improve efficiency, including diagnostic instruments, repair tools, control equipment and high efficiency energy-using equipment.

- sales centers to distribute high efficiency equipment, or to represent manufacturers from other countries.

- maintenance serve firms to upgrade the standards of maintenance and carry out repairs, such as boiler tune-ups, boiler rehabilitation, steam line insulation.

- financial service firms to lease equipment or provide loan funding for project implementation.

- construction and installation contractors to carry out projects to put energy efficiency equipment into operation.

- energy efficiency service companies (ESCOs) to offer implementation services, including performance contracting or shared savings contracts.

SECTION E
Industrial Plant Energy Audit Presentation

ENERGY AUDIT TECHNIQUES

THE INDUSTRIAL PLANT ENERGY AUDIT

Presented by
Robert Erickson

Resource Management Associates
of Madison, Wisconsin USA

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AUDIT TYPES/LEVELS

- PROCESS ENERGY ANALYSIS
- FACILITY ENERGY ANALYSIS

Walk-through
- Inspect and list
- Highlight cost
- 1 day duration
- No-cost recommendations

Short/Preliminary
- Measure and quantify
- Performance and economic estimates
- Expense type equipment recommendations

Full plant
- Engineer
- Engineering and economic analysis
- 1 - 3 months duration
- Capital equipment designs

AUDIT APPROACH

Step 1	Plan entire project
Step 2	Collect basic energy consumption and production data
Step 3	Carry out plant test runs
Step 4	Calculate energy balances and efficiencies
Step 5	Identify improved energy management procedures
Step 6	Identify improved maintenance and operating procedures
Step 7	Identify minor cost improvements
Step 8	Identify major cost improvements
Step 9	Prepare a report

SURVEY FACILITY

- SPEND ONE WEEK
- GATHER DATA
- EVALUATE
  - ENERGY SOURCES
  - UTILITY SYSTEMS
  - PROCESS SYSTEMS
- ACCOUNT FOR AND UNDERSTAND ENERGY FLOW

UNIT ENERGY COSTS
(EXAMPLE OF U.S. COSTS)

FUEL	
NATURAL GAS	
$/THERM	0.480
$/M-BTU	4.66
$/M-BTUH FOR ONE YEAR	40,800
STEAM	
HEAT IN STEAM	
$/M BTU	5.83
$/M-BTUH-YR	51,000
EXPORT STEAM	
$/K-LBS	6.80
$/K-PPH-YR	59,600
ELECTRICITY	
$/KWH	0.0650
$/KW-YR	569
$/HP-YR	472
$/M-BTU	19.05
$/M-BTU-YR	166,800

THERM	= 100,000 BTU
BTU	= British Thermal Unit
BTUH	= BTU per hour
K	= 1000
LBS	= pounds
PPH	= pounds per hour
HP	= horsepower
M	= million

GATHER DATA

- MONTHLY CONSUMPTION - LATEST 12 MONTHS
- PURCHASED/IN-HOUSE
- UTILITY BILLS
- SINGLE-LINE DIAGRAMS
- PERFORMANCE DATA FOR MAJOR ENERGY USERS
- PRODUCTION/CONSUMPTION FOR EACH MAJOR USER/PRODUCER
- FUEL ANALYSES
- OPERATING HOURS PER YEAR
- DEVELOP LOAD PROFILES

FACILITY UTILITY SYSTEMS

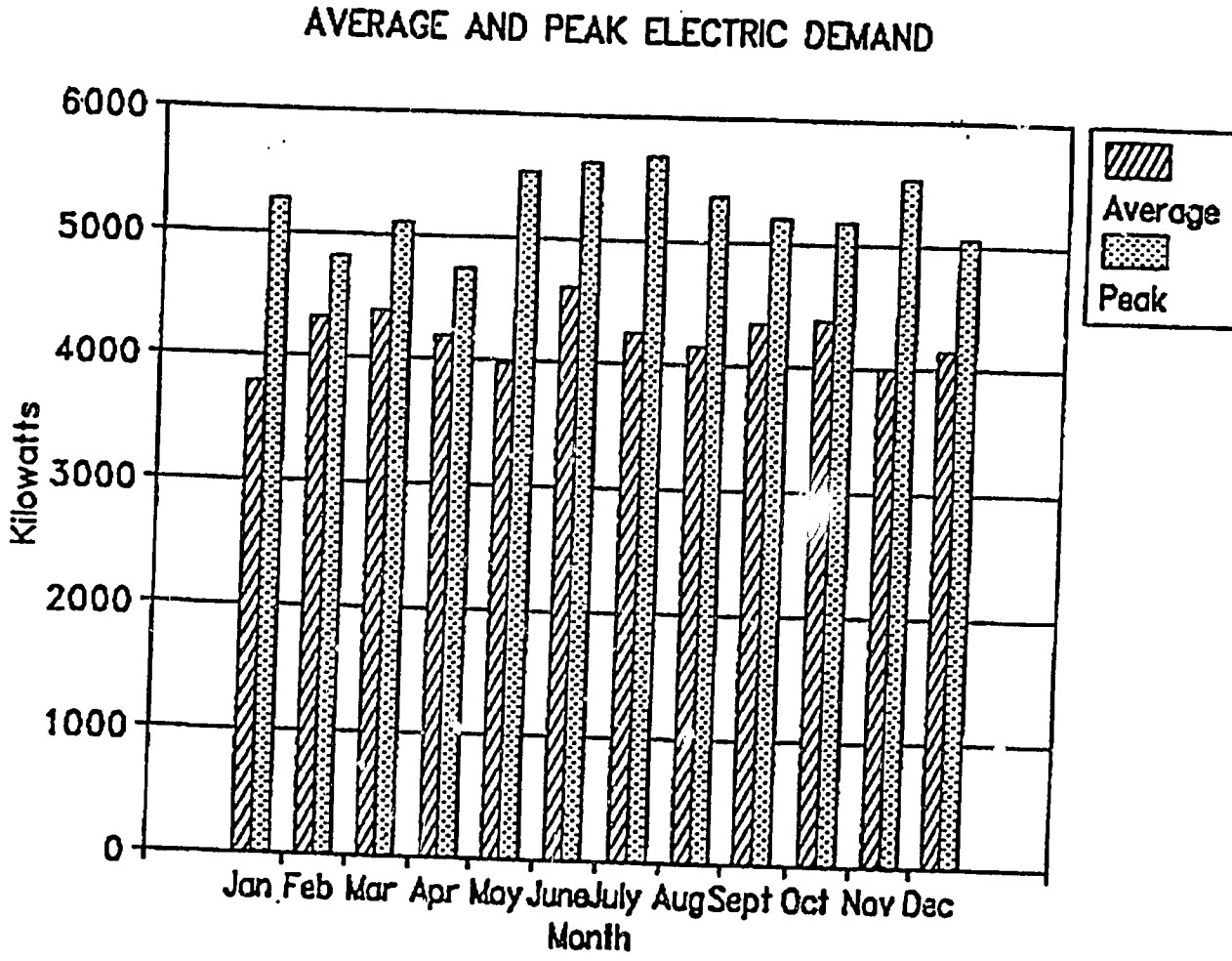
- COMBUSTION EQUIPMENT
- STEAM
- FUEL
- COMPRESSED AIR
- REFRIGERATION
- COOLING TOWER
- ELECTRICITY

COMBUSTION EQUIPMENT

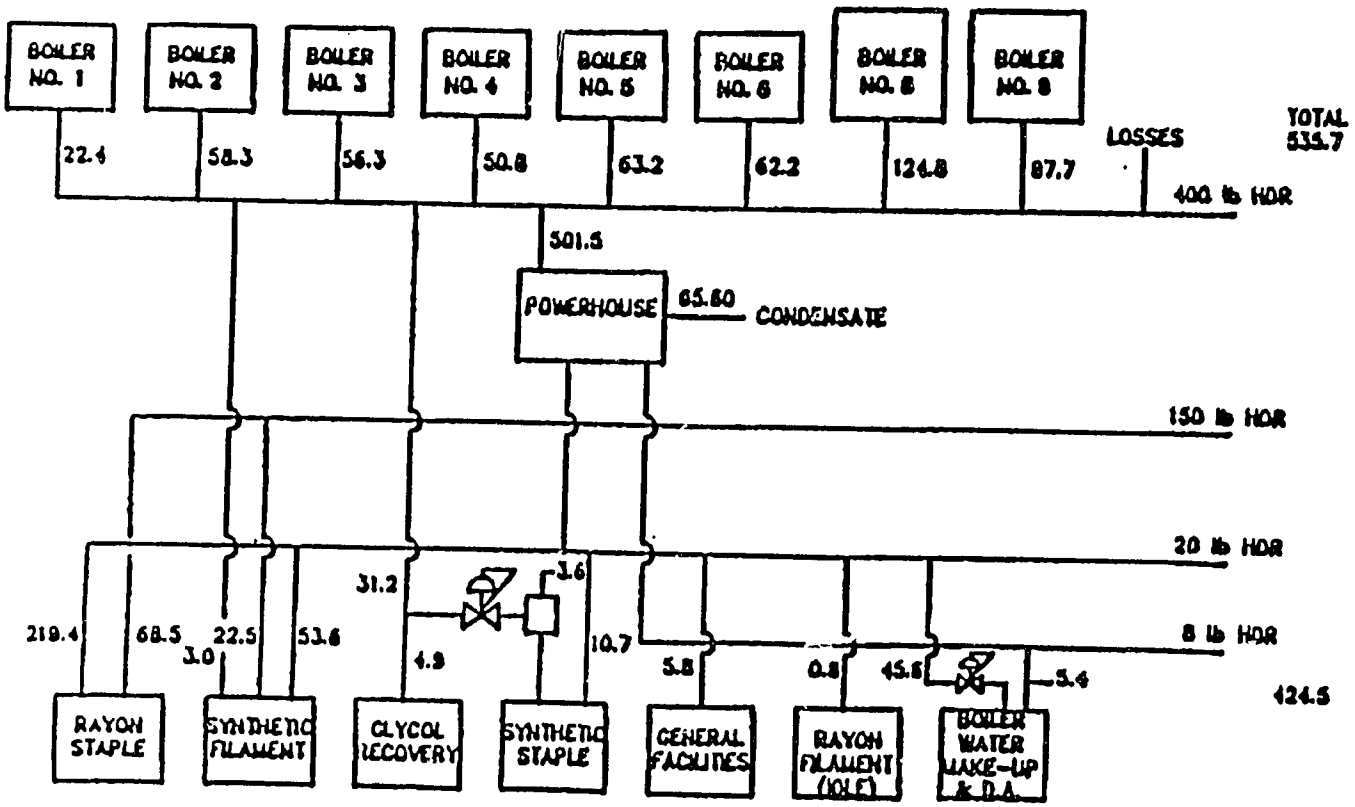
- BOILERS/FIRED HEATERS
- PERFORMANCE/EFFICIENCY
- FLUE GAS ANALYSIS
  1. OXYGEN
  2. COMBUSTIBLES
  3. TEMPERATURE
- COMBUSTIBLES
  1. CARBON MONOXIDE
  2. TOTAL HYDROCARBONS
  3. TOTAL COMBUSTIBLES

STEAM SYSTEM

- SINGLE-LINE DIAGRAM
- PRODUCTION/CONSUMPTION AT DIFFERENT CONDITIONS
- STEAM BALANCE
- STEAM CONDENSATE RECOVERY
- PRESSURE-REDUCING STATIONS


AVERAGE AND PEAK ELECTRIC DEMAND
6000
5000
4000
3000
2000
1000
0
Kilowatts
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
Month
Average
Peak

STEAM BALANCE



RESULTS OF SHORT ENERGY AUDITS FOR FACILITY

- Group projects as expense or capital in nature
- Include preliminary engineering estimates and calculation basis
- Breakdown total energy cost by utility
- Outline steps for energy management program and employee involvement
- Initiate no-cost items with department supervisors immediately
- Prepare preliminary specifications for procurement of recommended expense equipment
- Identify possible capital equipment recommendations as audit follow-up projects for long-term implementation
- Complete audit report

SECTION F
List of Participating Manufacturers

PARTICIPATING MANUFACTURERS

Armstrong International
Parc Industriel Des Hauts-Sarts
B-4040 Herstal
Liege, Belgium
Telephone: (32) (41) 480152
Fax: (32) (41) 481361
Mr. Alex Zygmuntowicz

Bacharach, Inc.
625 Alpha Drive
Pittsburgh, PA 15238 USA
Telephone: (412) 963-2007
Fax: (412) 963-2091
Mr. Richard Hickox

Bacharach Instruments International
Kongensgade 58
DK6070 Christiansfeld
Denmark
Telephone: 45 74 563 171
Fax: 45 74 563 178
Mr. Jogen Schack

Donaldson Company
Donaldson Europe N.V.
Interleuvenloan 1,
B-3001 Leuven
Belgium
Telephone: 32 16 40 04 96
Fax: 32 16 40 00 77
Mr. Johan Goossens

Boiler Supply Corporation
694 Summit Avenue
Oconomowoc, Wisconsin USA
Telephone: (414) 567-0692
Fax: (414) 569-1562
Representing: **Energy Efficiency Systems Inc.**
and Sentry Equipment Corporation
Mr. Sid Earsley

Honeywell Inc.
Tryokhprudny Pereulok 11/13
103001 Moscow Russia
Telephone: (007) 502 220 3040
Fax: (007) 502 220 3042
Mr. Bernhard Schmidt
Mr. Yuri Tarasenko

Honeyell Inc.
Maintal Germany
Fax: 49 6181401916
Mr. Joerg Muerau

Honeywell Inc.
Commercial Building Group
37 Kessel Court
Madison, WI 53711 USA
Telephone: (608) 276-3133
Fax: (608) 276-3137
Mr. Michael Frisch, contact only
NOTE: Not attending Seminar

Kessler-Ellis Products Co.
120 First Avenue
Atlantic Highlands, NJ USA 07716
Telephone: (908) 291-0500
Fax: (908) 291-1615
Mr. Jozef Bodziony

UE Systems, Inc.
12 West Main Street
Elmsford, NY 10523 USA
Telephone: (914) 592-1220
Fax: (914) 347-2181
Mr. Terrence O'Hanlon

Compac International
Postfach 810203
D-8000 Munich 81 Germany
Telephone: 49 89 9 33 28 24
Fax: 49 89 9 30 17 57
Ms. Lauren Kelley

SECTION G
List of Participants

No	Surname, name	Organization	Address
1.	Pocius	Vilnius District Heating Enterprise	Vilnius, Smolensko 12
2.	Cicėnas Bronius	Vilnius District Heating Enterprise	Vilnius, Smolensko 12
3.	Kutas Algimantas	Vilnius Cogeneration Plant	Vilnius, Jočionių 13
4.	Miškinis Vytautas	Vilnius Cogeneration Plant	Vilnius, Jočionių 13
5.	Verbyla Petras	Vilnius Cogeneration Plant	Vilnius, Jočionių 13
6.	Samerdokas Alfredas	Vilnius Sweets Factory	Vilnius, Stirnų 25
7.	Jurkšaitis	Vilnius State Enterprise "Vingis"	Vilnius, Savanorių av. 176
8.	Montvila Albinas	Vilnius Greenhouse State Agricultural Enterprise "Vilinta"	Vilnius district, Pagiriai, Alyvų 5
9.	Valaitis Algirdas	Vilnius Greenhouse State Agricultural Enterprise "Vilinta"	Vilnius district, Pagiriai, Alyvų 5
10.	Kažukauskas Vytautas	Vilnius Greenhouse State Agricultural Enterprise "Vilinta"	Vilnius district, Pagiriai, Alyvų 5
11.	Kojelis Vytautas	Vilnius State Plant of Electric Meters	Vilnius, Aukštaičių 7
12.	Maknickas Antanas	Vilnius State Enterprise "Silikatas"	Vilnius, Savanorių av. 124
13.	Klimavičius Leonas	Vilnius State Enterprise "Silikatas"	Vilnius, Savanorių av. 124
14.	Pervenecckas A.J.	Vilnius State Machine Tool Plant	Vilnius, Aguonų 10
15.	Šilepšinskas Algirdas	Vilnius State Furniture Factory	Vilnius, Savanorių av. 178
16.	Dumčius Vytautas	The Lithuanian - USA Joint Venture "Grigiškės"	Trakai district, Grigiškės
17.	Kutas Saulius	Energy Ministry	Vilnius, Gedimino 36
18.	Jarmokas Romualdas	Energy Ministry	Vilnius, Gedimino 36
19.	Franckevičius Marijus	Energy Ministry	Vilnius, Gedimino 36
20.	Šukys Rimantas	Energy Ministry	Vilnius, Gedimino 36
21.	Žiaunys Algimantas	Lithuanian State Energy System	Vilnius, Žvejų 14
22.	Vaižgėla Edvardas	Lithuanian State Energy System	Vilnius, Žvejų 14
23.	Rimkevičius Alvydas	Kaunas State Factory "Apvija"	Kaunas, Stulginskio 41
24.	Daujotas Andrius	Kaunas Closed Joint-Stock Company "Kopa"	Kaunas, V. Putvinskio 49
25.	Ališauskas Henrikas	Kaunas State Ceramic Factory	Kaunas, Chemijos av. 29
26.	Šarkus Bronius	Kaunas State Stock and Stocking Factory "Koton"	Kaunas, Ukrainiečių 4
27.	Jasionis Stasys	Kaunas State Enterprise "Pergalė"	Kaunas, Kaunakiemio 5
28.	Jančaitis Arvydas	Kaunas Joint-Stock Company "Gija"	Kaunas, Erdvilo 3
29.	Montvilas Kostas	Kaunas Cogeneration Plant	Kaunas, Taikos av. 147
30.	Martinaitis Antanas	Joint-Stock Company "Ceramics of Palemonas"	Kaunas, Pamario
31.	Kasperavičius Stasys	Joint-Stock Company "Ceramics of Palemonas"	Kaunas, Pamario 1
32.	Viršilas S.V.	Joint-Stock Company "Kauno audiniai"	Kaunas, Griunvaldo 3/5
33.	Šėebedas Vitas, Kosto	Kaunas State Enterprise "Inkaras"	Kaunas, Raudondvario h/w 127
34.	Keturakienė Ina-Marija	Kaunas State Enterprise "Inkaras"	Kaunas, Raudondvario h/w 127
35.	Simanavičius Albinas	Kaunas State Enterprise "Leta"	Kaunas, Draugystės 17
36.	Šėiupovas Valdemaras	Kaunas State Joint-Stock Wool Enterprise "Drobė"	Kaunas, Jonavos 60
37.	Samulėnas Albinas, J.	Kaunas Joint-Stock Company "Silva"	Kaunas, Raudondvario h/w 93

38.	Vaidelys Rimas	Kaunas State Firm "Furniture of Kaunas"	Kaunas, Drobės 66
39.	Baltrušaitis Vincas	Kaunas State Firm "Furniture of Kaunas"	Kaunas, Drobės 66
40.	Kirvaitis Romas	Kaunas State Paper-Mill	Kaunas, R. Kalantos 34
41.	Paulauskas Sigutis	Kaunas State Glass-Works "Aleksotas"	Kaunas, Suvalkiečių h/w23
42.	Aliolis Bernardas	Kaunas State Glass-Works "Aleksotas"	Kaunas, Suvalkiečių h/w 23
43.	Jankevičius Leonas	Kaunas State Factory of Artificial Fibre	Kaunas, Pramonės 4
44.	Ramonaitis Egidijus	Kaunas State Enterprise "Metalas"	Kaunas, A. Juozapavičiaus 82
45.	Grabauskas Jonas	Kaunas State Enterprise "Metalas"	Kaunas, A. Juozapavičiaus 82
46.	Andriukaitis Vytautas	Kaunas State Enterprise "Metalas"	Kaunas, A. Juozapavičiaus 82
47.	Švilpauskas Steponas	Kaunas State Enterprise "Energetikos remontas"	Kaunas, Chemijos av. 17
48.	Žakevičius S.J.	Lithuanian-Russian Joint Venture "Atrama-ĈerMK"	Kaunas, Raudondvario h/w162
49.	Kvasauskas Vladas	Šiauliai District Heating Enterprise	Šiauliai, Pramonės 10
50.	Šablinskas Gintautas	Šiauliai District Heating Enterprise	Šiauliai, Pramonės 10
51.	Lukošius Vytautas	Šiauliai Joint-Stock Company "Venta"	Šiauliai, Basanavičiaus 69
52.	Paulauskas S.	Šiauliai Leather and Footwear State Enterprise "Elnias"	Šiauliai, Vilniaus 72
53.	Valiukas Algimantas	Klaipėda State Meat Factory	Klaipėda, Šilutės h/w 79
54.	Alekna Kazimieras	Klaipėda State Wood Material Enterprise	Klaipėda, Liepų 68
55.	Drungilas Justinas	Klaipėda State Galvanic Cell and Battery Factory "Sirijus"	Klaipėda, Artojo 7
56.	Vaitkus Kostas	Gargždai State Construction Material Enterprise	Gargždai, Gamyklos 5
57.	Kemundris Pranciškus	Panevėžys Boiler-house Factory	Panevėžys, Smėlynės 85
58.	Griliauskas Jonas	Panevėžys State Glass Works	Panevėžys, Pramonės 10
59.	Jurgelėnas Gintautas	Panevėžys State Enterprise "Metalistas"	Panevėžys, Šermukšnių 19
60.	Gaidamavičius G.	Panevėžys State Plant "Lietkabelis"	Panevėžys, Janonio 4
61.	Rameika Petras	Panevėžys State Enterprise "Aurida"	Panevėžys, Pramonės 8
62.	Anužis Valentinas	Alytus State Experimental House Building Enterprise	Alytus, Naujoji 124
63.	Burinskas Ričardas	Alytus State Experimental House Building Enterprise	Alytus, Naujoji 124
64.	Alksnys Kazimieras	Alytus State Experimental House Building Enterprise	Alytus, Naujoji 124
65.	Bakša Jonas	Alytus State Factory "Astra"	Alytus, Ulonų 33
66.	Šavelis Vytautas	Utena State Laboratorial Electric Kiln Factory	Utena, Basanavičiaus 114
67.	Dilys Valentinas	Utena Joint-Stock Company "Mėsa"	Utena, Pramonės 4
68.	Mackevičius Ričardas	Utena State Joint-Stock Company "Utenos gėrimai"	Utena, Pramonės 12 52787
69.	Neciunskas Valdas	Ignalina State Construction Material Enterprise	Ignalina district, Didžiasalis
70.	Liutkus R.	Lithuanian Power Station	Trakai district, Elektrėnai
71.	Saudargis Edmundas	Pavenčiai State Sugar-refinery	Kuršėnai, Ventos 79
72.	Narbutas Simonas	Pavenčiai State Sugar-refinery	Kuršėnai, Ventos 79
73.	Budrys Aloyzas	Kėdainiai State Chemistry Plant	Kėdainiai, Juodkiškio 50

74.	Gavutis Juozas	Marijampolė State Spinning Factory	Marijampolė, Stoties 16
75.	Kazlauskas Jonas	Jonava State Enterprise "Azotas"	Jonava, Taurostos 26
76.	Jurgaitis Virmantas	Jonava State Enterprise "Azotas"	Jonava, Taurostos 26
77.	Žlabys Algis	Daugėliai State Construction Material Enterprise	Kuršėnai, Daugėlių 81
78.	Lideikis Rimvydas	Daugėliai State Construction Material Enterprise	Kuršėnai, Daugėlių 81
79.	Matusevičius Jonas	Daugėliai State Construction Material Enterprise	Kuršėnai, Daugėlių 81
80.	Lungevičius Antanas	Mažeikiai Cogeneration Plant	Mažeikiai district, Juodeikiai
81.	Šipkovs Peters	Physical and Energy Institute	Riga, LV-1006, Aizkrauzles 21
82.	Šipkovs Agris	Physical and Energy Institute	
83.	Rubina Maija	Latvian Energy Ministry	Riga, LV-1980, Smilšu 1
84.	Maksimv Nikolaj	Latvian Energy Ministry	Riga, LV-1980, Smilšu 1
85.	Blumbergs Nikolajs	Latvian Energy Ministry	Riga, LV-1980, Smilšu 1
86.	Kočanova Raja	Latvian Energy Ministry	Riga, LV-1980, Smilšu 1
87.	Bažbauers Janis	Riga Technical University	Riga, Kranavalo bulv. 1
88.	Blumberga Dagnija	Riga Technical University	Riga, Kranavalo bulv. 1
89.	Veidenbergs Ivars	"Ekadoma"	Riga, Juglas str. LV-1064
90.	Ivanov Jevgenij Sloka	Pulp and Paper Plant	Jurmala, Fabriko 2
91.	Pauls Ots Sloka	Pulp and Paper Plant	Jurmala, Fabriko 2
92.	Bragin Michail	Jelgava District Heating Enterprise	Latvija, Jelgava
93.	Solovjov Viktor	Preili Cheese Plant	Preili, Daugpilio 25
94.	Lebedev Igor	Preili Cheese Plant	Preili, Daugpilio 25
95.	Martvenov Viktor	Preili Cheese Plant	Preili, Daugpilio 25
96.	Eglite Inesa	Interpreter	Riga, LV-1013
97.	Einar Tippo	Estonian state energy department	Tallin, Konsiori 29, Estonia
98.	Ingerman Karl	Tallin Technical University (TERMOX)	Tallin, Kopli 116 EE0017
99.	Suik Heimich	Tallin Technical University (TERMOX)	Tallin, Kopli 116 EE 0017
100.	Agu Ots	Tallin Technical University (TERMOX)	Tallin, Kopli 116 EE 0017
101.	Alexandr Ivanainen	Tartu Energy Department	Estonia, EE 2400 Tartu, Ringl 8 (Ropka)
102.	Heikki Kulbas	Estonian State Energy Department	Tallin, 29 Gonsiori str. EE 0104
103.	Rein Ratassepp	"TERMOX"	Tartu, Tahe 112
104.	Martcheniov Vladimir	Tallin Technical University	Tallin, Kopli 116 EE 0017
105.	Juri Parl	Tartu Energy Department	Estonia EE 2400 Tartu, Kuuni 5 (city Counck)
106.	Tavgen Juri	Tallin Baltic Ship Repairers	Tallinn, Kopli 103
107.	Novoselov Egor	Tallin Baltic Ship Repairers	Tallin, Kopli 103
108.	Nurste Heinar	EnPro Engineers Burean	Tallin, Mustamae tee 33, EE 0006
109.	Soosar Sulev	EnPro Engineers Burean	Tallin, Mustamae tee 33, EE 0006
110.	Jantšilin Boris	Tallin Eestfosforit	Tallinn, Ringi 33 st. 9
111.	Nikolaj Nešumajev	Pussi Fibreboard Factory	Kochtla-Jarve, Maidla 7
112.	Latnov Aleksandr	Pussi Fibreboard	Kochtla-Jarve, Maidla 7
113.	Bodriony Jozef	Kessler-Ellis Products Co	120 First Ave. Atlantic. Highlands
114.	Gossens Johan	Donaldson Europe	Interlevvenlaan 1, 3001 Levven, Belgium
115.	Sidney L. Earsley	Boiler Sopply Corp.	694 Sommit Ave, Oconomac, UT USA 53066
116.	Yurt Tarasenko	"Honeywell" Inc .	Tryokhpudny Pereulok 11/13, 103001 Moscow

117.	Muran Jorg	"Honeywell" Inc.	Germany, 6457 Maintel
118.	Wendi S. Norris	RCG/ Hagler Bailly Inc.	1530 Wilson Blvd
119.	Teerence Hanlon	UE Systems DVC	12C West Main Street Elmsford, New-York 10523 USA
120.	David Keith	RCG/Hagler Bailly	1530 Wilson Blvd. Arlington VA USA
121.	Edvardo R. Maal	RCG/Hagler Bailly	1530 Wilson Blvd. Arlington VA USA
122.	Pedro S. Maal		
123.	Michaell Ellis	RMA	USA, Wisconsin, Madison
124.	Sherwood	USAID	Warsaw-US Embassy
125.	Robert Erickson	RMA	Madison, Wisconsin
126.	John Cloutrey	US Embassy	
127.	Edmundas Kačkus	US Embassy - Foreign Development Agency	Vilnius, Akmenų 6
128.	Alfredas Reikertas	US Embassy - Foreign Development Agency	Vilnius, Akmenų 6