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INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT IN HUNGARY:
Policy Options and Institutional Roles

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INDUSTRIAL ENERGY EFFICIENCY IN HUNGARY:
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CHAPTER 1: POLICY AND INSTITUTIONAL FACTORS AFFECTING INDUSTRIAL ENERGY EFFICIENCY IN HUNGARY

by RCG/Hagler, Bailly, Inc.

1.1 GOVERNMENT AND SEMI-GOVERNMENT ORGANIZATIONS

Ministry of Trade and Industry. Traditionally, the Ministry of Trade and Industry has been responsible for the energy sector. Within this ministry, the *Under Secretary for Energy Planning and for Energy Economy (EPEE)* monitors and supervises energy sector developments. This includes the implementation of government policy on energy rationalization (including energy conservation and fuel substitution) in industry, public services, transport, and the domestic sector.

The EPEE has four departments that implement and coordinate energy policies:

- The Energy Planning Department prepares and monitors annual, medium-, and long-term energy plans.
- The Technical Department implements and enforces safety in industry in connection with pressure vessels (such as boilers) and is also active in introducing energy-saving equipment and instruments in its fields of activity.
- The Regional Planning Department supervises the development of gas pipelines and district heating systems.
- The Main Energy Department coordinates energy management in large enterprises. This department also evaluates energy conservation and fuel substitution potential in industry.

The *State Authority for Energy Management and Safety (AEEF)* was created under the EPEE to implement the government's energy policies and programs at the operational level. It is responsible for the supervision of energy audits and the technical and economic evaluation of energy rationalization projects. The work of this agency has been facilitated by a law that regulates the efficient use of energy and requires that enterprises audit their energy consumption annually. A substantial part of its operational budget (70 percent) has been paid for by (mostly legally required) services to industries. About 500 people are employed by AEEF.

AEEF has two main departments:

- The Safety Department (with 250 employees) assists the EPPE in enforcing legal requirements by actually monitoring and measuring the safety aspects of energy using activities. It sets standards and issues permits for boilers and other pressure vessels. This department also plays a role in the implementation of energy rationalization projects through its regional offices, which monitor the required annual energy audits in industry.

- The Energy Management Department is responsible for the supervision of energy use and for monitoring energy conservation projects. This department has three divisions. The Planning and Information Division is a statistical division collecting information on energy balances from industries and agricultural enterprises. The Regional Energy Division has six regional offices that keep direct contacts with industries and supervise compliance with energy efficiency standards. The Technical Division assists industrial enterprises under contract and carries out energy audits.

In 1984, a small office -- the Energy Efficiency Office (EEO) -- was created within AEEF to promote energy conservation programs and coordinate the activities of other agencies involved in energy conservation and fuel substitution. Further, it is responsible for training, initiating R&D programs, and technical assistance to enterprises. This office has been primarily involved in monitoring foreign funding for energy rationalization such as World Bank loans and development aid from different countries and the EEC.

The EEO is no longer involved in monitoring World Bank loans. This is now done directly by AEEF's Energy Management Department. EEO now handles only bilateral assistance programs like DG 17, PHARE, and the energy part of the U.S. SEED program. It is also involved in organizing seminars (three to four a year).

The current situation has changed considerably for AEEF because the law that required enterprises to implement energy conservation and fuel substitution projects was repealed in 1988, due to the impression that "forcing" companies to do audits, report consumption, and obtain permits was contrary to an open, democratic free-market approach. This law served as the framework within which AEEF's activities took place. Thus, at the moment, the tasks of AEEF's various departments are unclear.

Other Ministries. Four ministries in the Hungarian Government have a Director of Energy: Construction and Mining, Agriculture, Health and Social Security, and Transport. These highly placed individuals are directly responsible to the Minister, and coordinate energy conservation activities with the Ministry of Trade and Industry.

National Bank of Hungary (NBH). Before Hungary restructured its banking system in 1987, this government agency was very active in the field of energy conservation by providing financing for all energy conservation projects. All foreign financing used for energy conservation and fuel substitution was handled and monitored by the NBH. In addition, the NBH was the main commercial and development bank of Hungary. It provided working capital and investment credits to other banks, enterprises (which were all state owned), and cooperatives.

With the restructuring of the banking system in 1987, all of the NBH's credit departments were transferred to commercial banks. The responsibilities of the NBH were redefined and limited to those of a national reserve bank without any commercially oriented activities.

In the present banking system, each of the 40 banks that now exist can finance credit for energy conservation projects. However, few banks are involved in these projects. Grant money is now handled exclusively by the Ministry of International Economic Relations. All bilateral aid for energy rationalization (and environmental studies and projects) is coordinated by this ministry with the Ministry of Industry and Trade. The funds are channeled through the latter ministry.

Technical Institutions. Many state organizations have been active in the implementation of energy efficiency projects. An important example in this connection is the *Institute for Energy Economy (EGI)*. Previously, it was a government institute under the EPEE and paid out of the government budget; today, it is an independent, profit-oriented company of which, at the moment, the government is the only shareholder. It operates in the energy conversion field as a consultant and contractor, and has many foreign contacts (Bechtel, Asea Brown Boveri, Tractabel, Comprimo). The company was restructured last year and staff was reduced from about 1000 to 520 persons. However, further cuts will be necessary for the company to survive. EGI is looking to become privatized, and discussions are being held with several interested parties abroad.

Several institutes that were formerly owned by the state are in the same position as EGI:

- Research Institute for Electricity (VEIKI) - electrical engineering
- Electrical Power Plant Institute (EROTERV) - design, engineering, and construction of power stations
- Research Institute for Combustion Engineering (TUKI) - combustion technology
- Institute for Research and Development of Hydrocarbons (SKFI) - oil and gas sector

- Hungarian Chemical Industries Engineering Center (VEGYTERV) - chemical subsector.

Most of these institutes have handled energy conservation projects. They are now on the list for privatization. In fact, some of them already have a structure independent of the government (such as EGI) that will facilitate privatization.

1.2 PRIVATE ORGANIZATIONS AND NGOS

During Hungary's transition phase, private organizations are not yet widespread, but new ones are being created every week. One such organization that has already existed for several years is the *Association of Energy Managers*. The function of energy manger was created in 1980 when all energy-intensive enterprises were required to report an annual energy balance and to audit their energy use. By law, these enterprises should have an energy manger. This association is part of the Scientific Society for Energy Economy, and has about 1000 members (60 percent of whom have an engineering degree).

Because the Association of Energy Managers was formed under the old regime and is rather bureaucratic and rigid in its policies, a new independent association was created on April 5, 1991: the *Hungarian Energy Association*. Its primary purpose is to assist industry in focusing more properly on the economic side of energy use and production, and to assist in energy conservation developments. The association tries to organize professionals who have new and innovative ideas. It also wants to create and support a lobby group that can discuss energy efficiency improvements with government authorities and Parliament. Because they do not know how to create this lobby, they are seeking assistance in this regard.

Many small consulting companies are already active in the private sector. Most of them have been created by engineers who have left state-owned companies and have seen the writing on the wall! An example is the *Digital Comp*, which is very active in the field of energy conservation and environmental control. A very interesting feature of this company is that it has now taken over part of the AEEF's energy conservation tasks and is now competing successfully on a profit basis. Digital offers training courses for energy management in enterprises, develops and sells software packages for energy management, publishes energy management and conservation manuals as well as several magazines on energy management and energy conservation on a commercial basis, provides services to small companies in energy management on a subscription basis with a quarterly visit, and offers a consulting service on a contract basis for advising companies on energy management.

1.3 ENERGY EFFICIENCY POLICY AND SUPPORTING LAWS AND REGULATIONS

In 1981, the government began an industrial energy conservation and fuel substitution program with a first reform in prices and the regulation of energy consumption in enterprises together with regulating standards for energy-using equipment and the thermal insulation of buildings. Enterprises were required to monitor energy use and perform annual energy audits to control energy losses. The major consumers were also required to obtain permits from AEEF for continued energy supply, based on their specific energy consumption.

These regulations and the law on which they were based were repealed in 1988, although enterprises are still required to send to the government, at the end of each year, an energy balance of their operations. Companies can now have their operations energy audited on a voluntary basis, although not many are doing this.

In an April 25, 1991 discussion paper for Parliament, the government has outlined a new energy policy. Its main components are safety, environmental control, reliability (including diversification of procurement sources) and cost minimization. Free market prices will be the main basis for this policy, but it is acknowledged that free market prices alone will not be sufficient to make use of the country's energy conservation potential.

Additional regulations will be necessary to reduce pollution and to minimize import dependence and the vulnerability of energy carriers' supply. The government sees the following as the main tools to promote energy conservation [1].

- Tax preferences on projects aimed at energy conservation. The advantage of this type of incentive is that it is budget neutral (although the government forgoes tax not yet earned, in the long run, it will take in more taxes from the increased profits of companies investing in energy conservation.)

- Tax preferences on profits (with a maximum of 50 percent) for manufacturers of energy-efficient equipment (including the production of materials and equipment for renewable energy sources). In this way, not only tax income but also import expenses will be reduced from the point of view of the budget.

- Preferential tariffs for the import of energy-efficient equipment and increased tariffs for energy-inefficient equipment (this will also include cars). The preferences and the penalizing tariffs are supposed to compensate each other.

- A reduction in VAT (50 percent) for energy-efficient and environmentally friendly household appliances. The insulation of existing houses will also be

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promoted. The government has suggested providing preferential loans maturing in ten years with a 25 percent lower interest rates to enterprises in this regard.

Special attention will also be paid to the energy-saving potential in electricity use. Although electricity use per capita in households is still low, it is expected that this will sharply increase in the near future.

Regulatory elements that limit free market mechanisms will be abolished. In 1989/90, regulations were already revised, which resulted in institutional changes. Now, special bills such as the acts on electricity, on natural gas, and on mining will be modified to eliminate monopolies in trade and production.

This program also implies that the government will have to introduce standards and/or labelling of energy-saving equipment and household appliances, and that the building code will have to be changed to introduce more stringent insulation requirements.

In order to promote promising energy efficiency measures and increase awareness, the government has allocated 20 million Forint in the 1991 budget. The use of this money is not yet clear, but it may be allocated toward the study of an equipment or appliance labelling program. Although this is not a large amount, it signals the government's determination to implement energy-efficiency improvements in a time of financial austerity.

Pricing Policies and Economics

Although the Government of Hungary is committed to the pricing of energy based on international prices, at present some cross-subsidies exist which leave prices for electricity, coal, steam, and hot water for some customers below market price. The issues that affect the efforts to introduce energy pricing systems governed by market forces are identified and discussed in RCG/Hagler, Bailly's reports on Component #4 of the USAID Emergency Energy program (energy price reform).

The economy, and especially industry, is still suffering from investments in the wrong subsectors and from outdated technologies that were put in place by the former regime. The many energy conservation projects that were implemented during that regime were generally evaluated in accordance with the then-prevailing price systems, which were very difficult to compare with the Western type of evaluation. Many projects, although viable at world market prices, would not have been implemented in a Western industry, simply because the industry would not have been viable.

The present situation is a transition period during which the country must sort out which industries will be viable in a free market system and during which energy prices will have to be adapted to free market standards. Many enterprises are finding it difficult to enter capital markets and Hungarian banks are hesitant to finance projects due to the unclear situation of the banks' exposure. For the time being, this will severely curtail energy conservation efforts. Most firms are, however, interested in energy efficiency improvements and are willing to implement no-cost/low-cost energy savings that can be made without external, or with minimal external, financing.

1.4 IMPACT OF INDUSTRIAL RESTRUCTURING ON ENERGY CONSUMPTION

Industrial

One of the government's main policies for this sector will be the restructuring of the whole of Hungarian industry. As is well known, Hungary's industries were rebuilt after the war, and especially between 1955 and 1985, in the same way as Soviet industry. At that time, there was a severe over-investment in heavy industries with high energy intensity, and most of the technologies used were not energy-efficient. As an example, Japans GDP is three times as high as that of Hungary with the same oil consumption per capita (3 toe/year).

The restructuring of industry means the reorganization and probably closing of several industrial production sites (iron and steel, aluminum, petrochemicals, fertilizer, ammonia, etc.). Industry is currently using between 45 and 50 percent of the total energy consumption of the nation. Of this amount, about 15 percent is used in metallurgical industries (iron and steel and aluminum) and 14 percent in the chemical industries. It is clear that restructuring of the metallurgical and chemical industries alone could have a substantial impact on energy consumption. However, no one interviewed during the course of this study was prepared to give an estimate of the decrease in energy consumption or could provide a list of plants under scrutiny. It is expected that plant closures and job elimination will cause much social unrest.

Where government publications discuss restructuring in connection with the planning of energy policy, it is always assumed that the closing down of production will be directly followed by the establishment of new industries that will fill the gap.

For the period from 1991 to 2000, three scenarios have been developed:

- **Scenario A (Optimistic).** This scenario assumes a strong restructuring and a dynamic economic growth (GDP growth of 6 percent per year). Its characteristics are:

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- -- energy intensity decreases by 3.5 percent per annum (2.5 percent for electricity)
- -- industry restructuring is carried out in favor of the manufacturing industry
- -- the share of the tertiary sector in the economy increases
- -- energy consumption in the years 1993-2000 increases by 2 percent per annum to 33.4 Mtoe (and electricity by 3.4 percent per annum to 48 TWh).

- **Scenario B (Average).** This scenario assumes a rapid restructuring, but a slower restructuring than under Scenario A, and a GDP growth of 3 percent per annum. Its characteristics are:
  - -- energy intensity decreases by 2.5 percent per annum (electricity by 1 percent per annum)
  - -- energy consumption increases by 0.5 percent per annum (electricity by 2.1 percent per annum).

- **Scenario C (Pessimistic).** This scenario sees only a low growth rate for GDP of 1.5 percent, with the following characteristic features:
  - -- slow progress in restructuring and the elimination of existing monopolies
  - -- energy intensity decreases by 1 percent per annum; electricity intensity also decreases by this amount
  - -- energy consumption increases by 0.5 percent and electricity by 2.4 percent per annum.

The government expects that Scenario B is the closest to reality. It is assumed that the total energy consumption in the year 2000 will be between the level of 1990 consumption and 13 percent above this level (between 1250 PJ and 1400 PJ, or 29.7 Mtoe and 33.4 Mtoe). Because no further details were provided, it was not possible to estimate with any accuracy the energy "savings" through plant closures and production reorganization.

Roughly, it is possible to say that savings from plant closings will be between 100 and 250 PJ, or between 2.4 and 6 Mtoe. In any case, the savings in energy consumption by closing or reorganizing production will be more important for the next three years than any savings realized by introducing more efficient technologies.

Transport

In all programs that have been developed by both the former and present Hungarian governments, very little attention has been paid to the transport sector. In 1989, transportation consumed about 10 percent (129 PJ or 3.1 Mtoe) of the nation's total energy requirements. However, in terms of end consumption, 58 percent of the country's oil products are used by this sector. Although this sector is not very important in absolute numbers, it claims a substantial amount of foreign currency. It is expected that as soon as economic recovery sets in, energy use in the transport sector will increase steeply as a result of both increased freight transport and especially increased private vehicle use (now about 1.8 million). (See [3] for a review of the Hungarian transport sector.)

Energy conservation through improved vehicle maintenance will be hampered by the Trabant syndrome (the Trabant syndrome, as it is called by Hungarian authorities, is caused by the great number of imported East German cars, Trabant and Wartburg, that have two-stroke engines with notoriously bad combustion that cannot be improved). However, measures have been recommended to mitigate the future increases in gasoline consumption.

Financial

The banking system in Hungary was totally reorganized in January 1987. The National Bank of Hungary (NBH), which had financed all industries under the communist regime, was reverted to its basic role of a central bank conducting, implementing, and monitoring policy. All of the domestic commercial banking operations of the NBH were split off and transferred to independent commercial banks that were established at that date. These banks were the *Hungarian Credit Bank*, *Commercial and Credit Bank*, and the *Budapest Bank*. Shortly after these new banks were created, the *Unicbank*, the *General Banking and Trust Company*, and the *Postbank Corporation* were created. Many more banks have been created since 1989. Nearly 40 banking companies are now in existence; of these over 30 are fully licensed banks. (A complete list of the banking system is found in [4].)

The State Development Bank also played an important role in the financing of energy conservation projects, under the supervision of the NBH. In January 1987, the *State Development Institution* was founded as the legal successor of the State Development Bank.

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At present, this institution is in a difficult financial situation as the result of outstanding loans that have not been paid off. The government is looking to privatizing this institution and possible foreign participation.

The largest commercial bank in the country is the *Hungarian Credit Bank*, in which the state still has a 49 percent interest. At the end of 1989, almost 50 percent of its investment credits financed investments in the framework of World Bank projects. One of the fastest growing activities of this bank is the financing and account keeping for small-scale enterprises and cooperatives. This bank has a keen interest in financing energy conservation, environmental, and geothermal projects (three geothermal projects are now under development, partly financed by a grant from Norway). Another field of its activity is the organization of management courses for new enterprises. This is organized in a training center in Budafok, together with the *Hungarian Scientific Institute* and the *Chamber of Commerce and Trade*. The Bank has a special leasing department at present for cars, computers, buildings, and airplanes. This leasing system could be extended to well-defined energy conservation projects.

Currently, banks are taking rather high risks in lending to enterprises in the energy and industrial sectors because of the possible radical restructuring of these industries. Although the banks try to secure their loans and different banks have different policies in connection with collateral requirements, it is often not possible to obtain collateral because the property is owned by the state or because it is not clear who the owner is.

Current interest rates for short-term lending are as high as 28 percent; long-term lending is at 22 percent. Lending from domestic sources outside the official banks is even higher (up to 40 percent). On-lending of World Bank loans is made at an interest rate of 22 + 4-5 percent. The criteria for energy conservation projects are an IRR of 18 percent and an H-factor of 1.6. (The H-factor was developed in connection with the first World Bank loan in 1983 because of difficulties with the accounting system in communist countries. It is a factor related to the incremental return achieved by a project and is comparable to a payback period of three to four years).

Manpower

In general, the skill levels of Hungarian engineers are good, and in several aspects, are comparable to Western European levels. Weak skills points are knowledge of computer applications and knowledge of the English language. There is a great need for English language courses at all levels from basic to professional (especially in engineering, accounting, and economics). Practical training in factories is still insufficient; young engineers take some time to adapt their theoretical training to a practical approach.

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Although the outlook for engineers in industry is rather bleak at present and many may be laid off in the next two years, a shortage of engineers is expected because a whole generation from after the war will soon retire. It is not possible to give a quantitative evaluation of the availability of engineers without an inventory survey. And even after a survey, the situation would still be uncertain because no estimates have been made of the number of engineers who will be laid off through the on-going reorganization and restructuring process.

As in Western countries, Hungary's technical education system is organized at different levels. Blue-collar workers can get a three-year technical school education to the level of operator or skilled laborer. They enter this school at the age of 14. The next stop is the technical secondary school, which consists of four-year courses with an optional fifth year to attain the degree of technician. University study at the college level comes next (which is comparable to a bachelor's degree in engineering). This is followed by a study comparable to a master's degree. After this, it is possible to pursue PhD or Doctor of Science work.

The *Technical University of Budapest* is now graduating about 100 energy engineers at the college level and 40 to 50 at the university level each year. Refresher courses at the post-graduate level are regularly organized by this university. Last year, however, the government stopped paying for these courses and interest dropped significantly. Now some enterprises have begun paying part of the tuition fee or reimbursing students after graduation.

The Technical University of Budapest is by far the nation's largest educational center for technical sciences. It has faculties for mechanical, civil, architecture, electrical, and chemical engineering. Nuclear power engineering is taught at a subsidiary of this university in Pecs at the nuclear power plant. Chemical and refinery engineering education is centered in the *University of Veszprem*. Metallurgical and mining engineering studies take place at the *Mining Engineering University* in Miskolc. Young engineers are now regularly trained in Western Europe for one year (primarily in Germany).

The University of Budapest devotes special attention to energy conservation. It has an energy conservation laboratory with testing equipment. However, the lab's equipment is outdated, and a request was made to make equipment and instruments available to this lab through a USAID grant.

Infrastructure

Energy efficiency services will become increasingly available as state-owned institutes begin to scale down their organizations. Several private consulting companies are already active and more are being founded (a listing -- in Hungarian -- of consulting firms and materials suppliers in the field of energy conservation is found in [7] and[8]). The base for an

efficient service and materials industry is present and could be well developed if economic conditions permit.

Local manufacturers of equipment made according to the standards accepted in Western countries are scarce. Although some manufacturers have produced equipment (especially boilers) used in energy-saving projects implemented in the period from 1980-1989, the quality of this equipment is doubtful. A special study would have to be made of this industrial subsector to evaluate the full potential for cooperation and joint ventures with western companies. Already, there is cooperation between some Hungarian contracting companies and western design and equipment suppliers. At the same time, many suppliers are shopping around in Hungary to look for possibilities for cooperative ventures (equipment suppliers are listed in [7] and [8]).

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CHAPTER 2: OBSERVATIONS ON HUNGARIAN INDUSTRIAL ENTERPRISES

by RCG/Hagler, Bailly, Inc.

2.1 ORGANIZATION

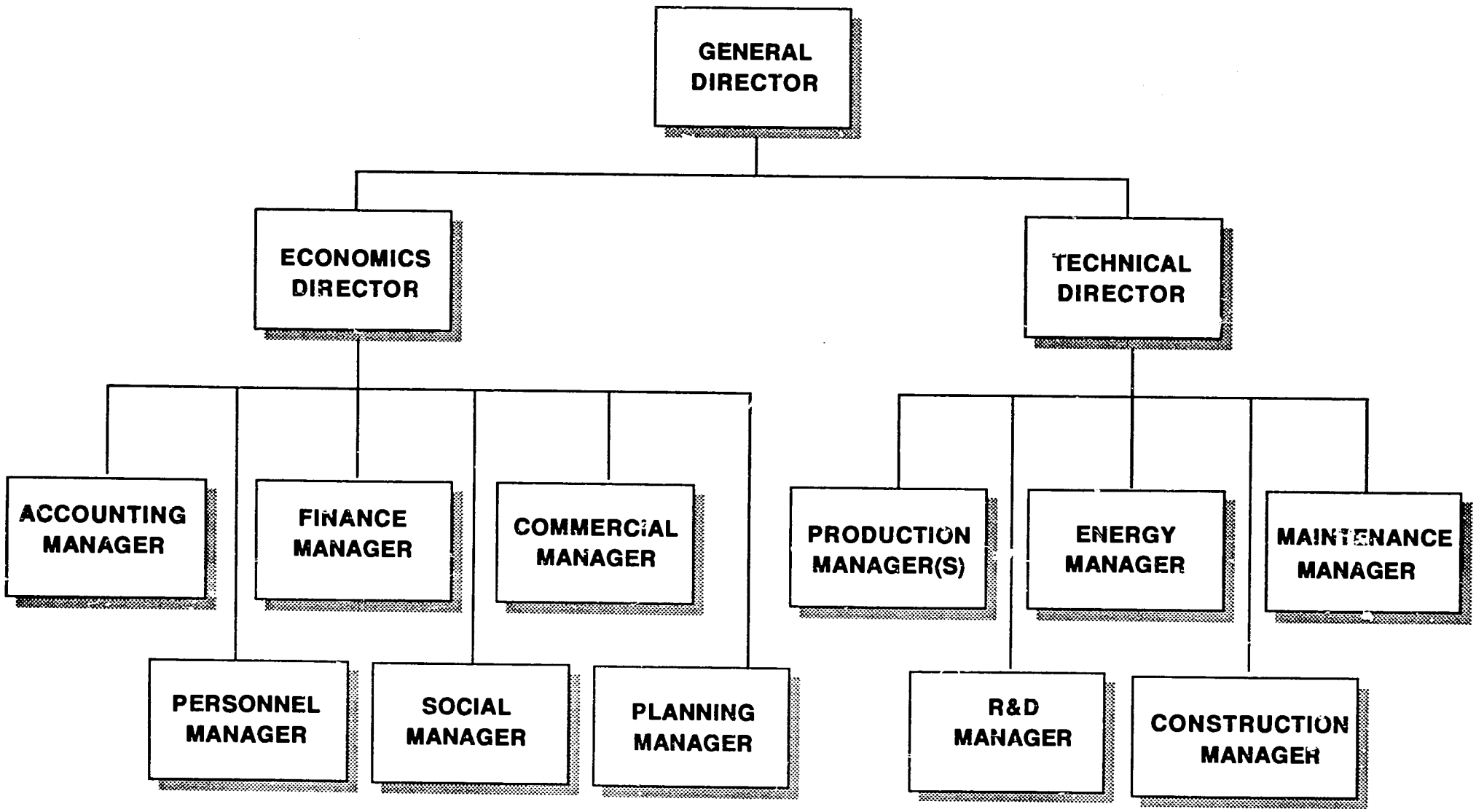
All industrial companies have certain generic functions - marketing, production, finance, management and administration, and research & development. Whereas each of these functions usually represents a division in an American company, in Hungary, organizations are structured differently. In most of the companies surveyed, there are only two primary divisions: technical and economic. The heads of these two divisions are sometimes referred to as deputy general directors, and report to the general director.

The technical division has as its departments the various production units, as well as energy, maintenance, and (if found) research and development (often designated as investment and construction). The economic division has as its departments personnel, finance, accounts, commercial (or sales and purchasing), planning, social (offices and other communal buildings), and perhaps other administrative units.

The organization in Hungarian industries is very hierarchical, and decision-making is concentrated at the top. Typically it is not possible to get information across departments; information and orders move only vertically. This creates decision bottlenecks at the General Director and Technical Director levels, and results in delays in executing tasks related to efficiency (such as equipment maintenance) which would be considered more urgent in a Western company. This problem is growing worse, as the Technical Directors are often taking on new responsibilities related to privatization or technical sales for export markets, with extensive travel.

The ownership of Hungarian industry is still dominated by the state. However, there is an active privatization campaign underway, and nearly every company has plans for privatization. In most cases, these plans revolve around the hope that a Western joint venture partner will be found.

Typical Organization Chart -- Hungarian Industry



In the past, there was a notion that energy, like production, should be consumed according to plans. These plans were developed by the planning department, based on historical energy consumption, expected production, and normatives (multipliers to convert projected production into expected energy consumption). The plan was used to develop an allocation by the energy supply companies.

In many cases, the normatives are not realistic. Today, in most cases they are too low, since they were developed based on the original equipment design ratings. Since that time, production levels have been reduced, equipment efficiency has deteriorated and energy losses (such as in distribution systems) have increased. Further, the normatives are simple multipliers, and do not consider that there are fixed energy requirements (to keep the plant hot or rotating equipment turning) and variable energy requirements (per unit of production). Thus in times of operation at reduced capacity, fixed energy requirements are more dominant, and the normatives underestimate energy consumption.

2.2 MARKETING

As could be expected, the marketing function appears to be a fundamental weakness in most companies. In the past, orders for products simply appeared, without any effort on the part of the company. This has created tremendous inertia, in two ways.

First, because of the certainty of former orders for its products, the size of the company's sales staff is minimal and is mainly made up of individuals skilled at administrative tasks. There is no network of external sales staff. In the organization, there are none of the "salesmen" as we know them, that is, personalities strongly motivated to generate sales.

Second, because of the former system of orders being made directly to the company, there is a definite tendency to continue to rely on a similar phenomenon. Simply put, the "sales" staff is sitting in the office waiting for orders. Because of the current strong interest of various Western companies to learn about entering the Eastern European market, there are a number of buyers who are making the rounds and visiting the manufacturers. This temporary phenomenon is unfortunately perpetuating the "myth" that sales can be made without travel and effort. It also is locking the manufacturers into deals that may not be the most favorable to them. The most that companies are doing is setting up a network of agents or representatives in the various market countries.

Generally, top managment recognizes their company's naivete regarding the "marketplace". In the majority of plants surveyed, general managers indicated that assistance in helping them learn "how to enter the market economy" was the one of the best ways they thought the U.S. Government could assist them.

The plans for privatization of most companies, which are based on joint ventures with foreign partners, include assigning responsibility for marketing (at least overseas marketing) to the foreign partner.

2.3 PRODUCTION

A primary objective of the 1991/92 USAID Emergency Energy Program is to achieve immediate and lasting energy savings at low cost. The best way to accomplish this goal is through improvements to plant and equipment operations and maintenance. The program in Hungary has had substantial success, mainly due to the willingness of management to make such changes and the catalytic role afforded the USAID-sponsored consultants, who in most cases are the first Westerners to advise the plant's production staff. Some brief observations on energy utilization and production in Hungarian companies follow across the key dimensions of production (staff, technology, operations, maintenance, organization, and energy management).

Staff - The production function, from inputs of raw materials (including energy) to outputs of finished products, is generally well understood by the technical managers and supervisory staff in the plants surveyed. It is clear that in Hungary, the production function has been able to attract the keenest minds available in the industrial sector. This is in clear contrast to the United States, where R&D or consulting is a bigger attraction to the best engineers, and where keen analytical minds often find their way into legal or financial professions, instead of engineering, in the first place. In general, capable technical engineering talent can be found in most Hungarian companies. Further, the general director is typically promoted from production (unless he is appointed by political fiat), whereas in American companies, the path to the top usually passes through the finance department. Energy managers are generally well-informed about energy conservation, but are at a lower level of authority than the production managers. Thus the energy managers are not in as good a position to receive fudning for annual budgets for new equipment or maintenance.

Technology - Equipment which would be deemed obsolete in western plants is still in place in most medium-sized Hungarian factories. Instrumentation and controls are the most evident need for improvement. In the case of some joint venture plants, such as in textiles and wood processing, new, modern equipment has been installed. In the case of other plants, most notably the chemicals sector, plants which have excessive pollution and very dated technology are still operating.

Operations & maintenance - Because of the generally high level of staff education, the level of production operations is fairly good, except in plants which are run at less than full capacity. New, market-driven situations are requiring equipment "turndown". Reduction of production

rate below the plant capacity requires optimizing machine operations at less than full load, and this is uncharted territory in most plants, which were run according to plans. Operation of energy equipment (such as boilers) is at a lower level because of the continued use of outdated manual control systems. The level of maintenance is generally lower than that found in Western plants. Preventive maintenance seems to be the exception rather than the rule, and inadequate attention is given to routine maintenance (such as repair of steam, water, and compressed air leaks). The reasons for this are complex, and are related to the limited funding available, the weakness of management in the organization, and a general lack of care for equipment. Hungary is now refurbishing, and recovering from years of neglected maintenance. The mindset of refurbishing, or repair (breakdown maintenance) instead of preventive maintenance may be difficult to change. Managers are not accustomed to enforcing good housekeeping.

Organization - In some cases, energy has been elevated to the position of a department, at the level of a production unit (producing steam, hot water, electricity, etc). This was been done based on a government mandate related to energy conservation (circa 1980), which includes the assignment of energy managers and energy reporting systems.

Giving energy a high level of importance has proven to be both an advantage and a disadvantage. On the positive side, this structure has created an awareness of energy and a full-time position for a manager of energy. But at the same time, the structure may have made energy too independent from the production process. This separation seems to have relieved the production departments from the responsibility to manage energy and seems to have elevated the energy department to a position of no longer having to serve the production department. In the worst cases, this dichotomy of functions has resulted in the staff of the energy department practically not being allowed to enter the production areas. The separate energy department serves to supply energy, and in the worst cases has lost touch with reality (the plant exists to make a given product), and at the same time the production department does not regard energy supply as being reliable enough. At best, energy efficiency is the hobby of the energy manager.

2.4 FINANCE AND INVESTMENT

In Hungarian industrial companies, the finance department has been primarily concerned with developing an annual budget and with managing expenditures. Financing, whether through government budget, sales, debt or equity inflows, has been handled by the trusts, which are akin to holding companies. Because of the long history of government ownership, there has been little attention paid to investment financing. The assumption has always been that the necessary capital will be there when needed.

The current financial climate in Hungary is one of severe restrictions on credit and high interest rates. There is a dire shortage of investment capital and the preferred method of privatization, which nearly all companies are seeking, is to initiate a joint venture with a Western partner, thus injecting new capital into the system. There does not seem to be a clear system of evaluating joint venture proposals.

Investment decisions are made based on proposals submitted to the Directors by the operating divisions. The Directors generally have established priorities, and they set up an annual capital budget, with the help of the Finance department.

In the transition period, and the current economic hardship, investments which relate to the survival of the plant are given top priority. These include product quality improvement (at most plants audited), diversification to products acceptable to Western markets (chemical plant), and increased production capacity. Large investments are generally being postponed or cancelled now. Decisions are often biased and not optimal.

The recent rises in energy prices has stimulated interest in energy efficiency investment, but capital is not available. It appears to be easier to get money to rebuild an old boiler than to replace it with a modern new one. The attention is being paid to capital cost, instead of life cycle cost. Further, boilers are a priority in investment decisions because without steam there can be no production. Turbogenerators are not a priority, because steam pressure can be reduced through a valve and electricity can be purchased from the grid (production can continue, although the cost of production will be higher).

There also appears to be an unfortunate tendency to repeat decisions or to consider sunk costs. For example, because a large sum of money was spent to rebuild one boiler, a similar project should be carried out on the other boilers, instead of considering alternative investments. Or, because a large sum was spent overhauling a boiler, it should be kept in operation even if it is inefficient, even if analysis indicates a good payback on a new boiler.

Hungary's chief investment problem today is the severe shortage of available capital. In the short-run, the government assumes (no doubt correctly) that the domestic economy will be essentially unable to generate any significant amount of capital. Therefore, foreign investment capital inflows are being actively sought.

2.5 MANAGEMENT AND ADMINISTRATION

Management is the area with perhaps the greatest need for improvement in Hungary today.

In American companies, there is generally a clear distinction between workers and management. Decades of socialism have left no true management class in Estonian industry. There may be trappings, such as separate cafeteria meals, or even executive dining rooms, company automobiles, and different forms of dress (the Western-style business suit), but there does not seem to be a separate mentality.

In the past, workers could get production incentives but foremen and managers could not. As a result, workers were often able to earn much more than their supervisors - a situation which left them unable to manage the workers. The poor housekeeping in the plants is evidence of this.

This lack of a management consciousness is still clearly evidenced in decision-making. Relatively small decisions become weighty problems, particularly if they involve relationships with workers. The toughest decisions, and the most critical in Estonia's present transition period, relate to shutting down all, or even just a small part of, an operation, in response to the reduced demand from the market. It is difficult for management to forget the doctrine upon which they were raised, that their factory is a "national treasure," a tool of production. Their job is to utilize this tool to its fullest.

Management's role was always to achieve production - to meet the plan. The task was not to achieve production at a given cost (this would be a fundamental first step toward maximizing profit), so efficiency is basically a new concept.

Given the lack of sophistication of their former COMECON market, changes are required to produce the right product at the right quality, the right price and in the right package. These all-important values of the Western market are the keys to the future survival of each Estonian manufacturer, and all of these fundamental guiding principles of industrial production are new. As Estonian industries come up the learning curve, they will be very vulnerable to ill-advised management decisions.

Worker productivity seems to be a major problem in most companies. The basis of the problem seems to be the fact that the factories were built as production tools, but once in place, were used by the political directorate as employment generators. Specific hiring targets were set in each year's plan. With this mission in mind, management in most, if not all, plants has hired to the point that plants are grossly overstaffed, with at least twice as many workers as would be needed in a Western plant[1]. It is human nature to take advantage of

[1] Overstaffing is the rule, resulting from several factors. A technical factor is the use of manual control systems on process and energy equipment, instead of automatic controls. An organizational factor is that social enterprises included as part of the organization, so employees work in company stores, canteens, or housing. The company

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loopholes in the system, so some workers do little more than collect their pay, and laugh at the system that makes it possible and scorning those who do bother to give a few hours of honest work. Again, this is a reflection mainly of the management problem - there is a good bank of skills available who can probably perform well if managed properly.

A derivative of the same employment generation theme is that salaries are very uniform throughout a given company and across the industrial sector. There may be only 25% difference in salary between a new shop-floor worker and his co-worker with 20 years experience. In the traditional European system, this would have been a craftsman-apprentice relationship, a concept that has been diminished if not destroyed in the socialist system. Further, the manager of an entire production department probably earns less than double the salary that the inexperienced new-hire is given. This lack of recognition of value-added saps the motivation of the experienced workers, particularly those responsible for decisions which might optimize operations.

Because salaries are low in absolute terms ($20-50 per month, probably from the bottom to the top of a typical state-owned company), Estonian products may be price-competitive on world markets, even with the over-staffing. Companies wish to reduce payrolls, but the government has ordered that stability be maintained. Many companies seem to be trimming staff (now by attrition rather than layoffs), and using the additional funds to upgrade the salaries of their most valued workers.

At the same time, new ventures with foreign joint venture partners are using injected capital to buy equipment and using the new company name to reset staff levels, giving a quantum upgrade to salaries. These joint ventures are thus able to attract staff from other concerns, who jump at the chance to double or triple their income. By doing so, these workers may be able to quit their "second" job. Holding two or more jobs is a practice that is becoming more and more prevalent, especially among the educated or professional staff. This is sapping workers' energy from their primary task.

In general, the plants that are undertaking investments in process modernization and energy efficient technology seemed to have "new style" managers. These managers are extremely well-motivated, feel that they are part of the reconstruction effort of the country, are ready to move ahead, do not want to waste time looking backward, and have turned a page of history. Some other plants are still controlled by "old style" managers, who adopt a low profile and a wait-and-see attitude. These old-style managers are unable to make decisions for one reason or the other, whether a lack of confidence, authority or guidance.

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may have its own trucking company. A personnel factor is the legacy of hiring "political appointees" and the inability to reduce staff now.

As noted above, plant operations (especially when running at less than full capacity) and maintenance (losses) does not appear to be adequate in many plants. Based on the experience during the audits, in the near term, the best opportunity for energy efficiency improvement in large plants may be process optimization. In these projects, operations and maintenance of process equipment are optimized to reduce energy and raw material requirements for a given level of production. These projects may involve loss reduction, productivity improvement, partial shutdowns of the least-efficient parts of the production process, preventive maintenance, rehabilitation, or low-cost improvements.

The ability to make basic day-to-day management decisions seems to be a clear problem. Good decisions are needed regarding hiring and firing, which equipment to operate and at what loads, retiring obsolete equipment, the allocation of costs across production units, scheduling of production runs, transportation optimization, cost control, preventive maintenance, overtime and employee benefits.

The primary reason why day-to-day decision-making is weak is the lack of a modern management information and control system. The systems in place offer very little information to management, and certainly do not provide sufficient information on performance ratios or the cost of production. The systems are operated "open-loop", and there is a tendency to perpetuate old practices inherited from the past, even under the new economic environment. This lack of information serves as one barrier to changing the attitude of "old style" managers. In cases in which we have been able to clearly present information related to the cost and benefit of operational decisions to Hungarian managers, they have agreed to make changes which improve efficiency.

2.6 RESEARCH & DEVELOPMENT

In a few industries, particularly those producing a diverse slate of products (such as pharmaceuticals or household chemicals), an organized research and development department is in place. The R&D departments that exist are busy developing new products or testing existing ones, and seem to be in touch with the Western world. In other large industries, an investment department or construction department exists instead. The investment departments are looking forward to expanding operations or modernizing equipment.

The fundamental question that does not seem to have been addressed by these R&D departments is the transition to the market economy. Market surveys, consumer surveys, analysis of competitor's products, or industrial engineering production cost analysis do not seem to be a priority.

CHAPTER 3: INDUSTRIAL ENERGY EFFICIENCY POLICY OPTIONS FOR HUNGARY

by RCG/Hagler, Bailly, Inc.

3.1 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 set 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.

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

Since 1990, RCG/Hagler, Bailly, Inc. has made energy efficiency inspections of more than 50 industrial facilities in Central and Eastern Europe and the former Soviet Union (for convenience, we will use the abbreviation former COMECON, in recognition of the fact that these countries were all members of the now-defunct Council for Mutual Economic Assistance), led teams of experts who carried out detailed energy management programs to improve energy efficiency in 21 industrial enterprises[2] in the region, conducted energy pricing studies and related training in four countries in the region, and held numerous interviews regarding energy efficiency with professionals who are active in energy efficiency in the region. This experience in the region, together with RCG/Hagler, Bailly's extensive experience in industrial energy efficiency in the United States, western Europe, and many other countries, has been used to develop the conclusions reached in this report.

[2] Similar studies were also undertaken in six district heating enterprises in the region.

3.2 INDUSTRIAL MANAGEMENT - IMPROVING PRODUCTIVITY, QUALITY AND EFFICIENCY

3.2.1 Measuring industrial energy efficiency

A definition may be a useful way to determine an objective function. In the case of the countries of Central and Eastern Europe and the former Soviet Union, this is especially important, since these are economies in transition.

Usually, for energy audits or engineering studies of an individual enterprise, a measure of specific energy consumption can be determined (such as Gcal/ton product). A similar alternate financial definition (such as dollars of sales per dollar of energy cost) could be developed. This definition would relate output (either revenues or earnings) to energy cost.

At the enterprise level, it is important that the distinction between two definitions be clearly made. The fact that the ratio of GDP to energy consumption in former COMECON countries is far higher than in the West has attracted considerable attention. Economic policy planners seek changes in the ratio, and actions on either side of the ratio can achieve improvements to energy efficiency.

The distinction is important because of the transition in the economies in the region. Many economists in the region believe that the transition to an economy which is less energy-intensive means a metamorphosis, with the result being an economy like that of a western European country, say, Sweden, Belgium, or Italy. This would call for investment exclusively in services and low-energy industries, with most energy-intensive industries being phased out.

3.2.2 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 improvement, or production expansion. 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.

Production expansion 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:

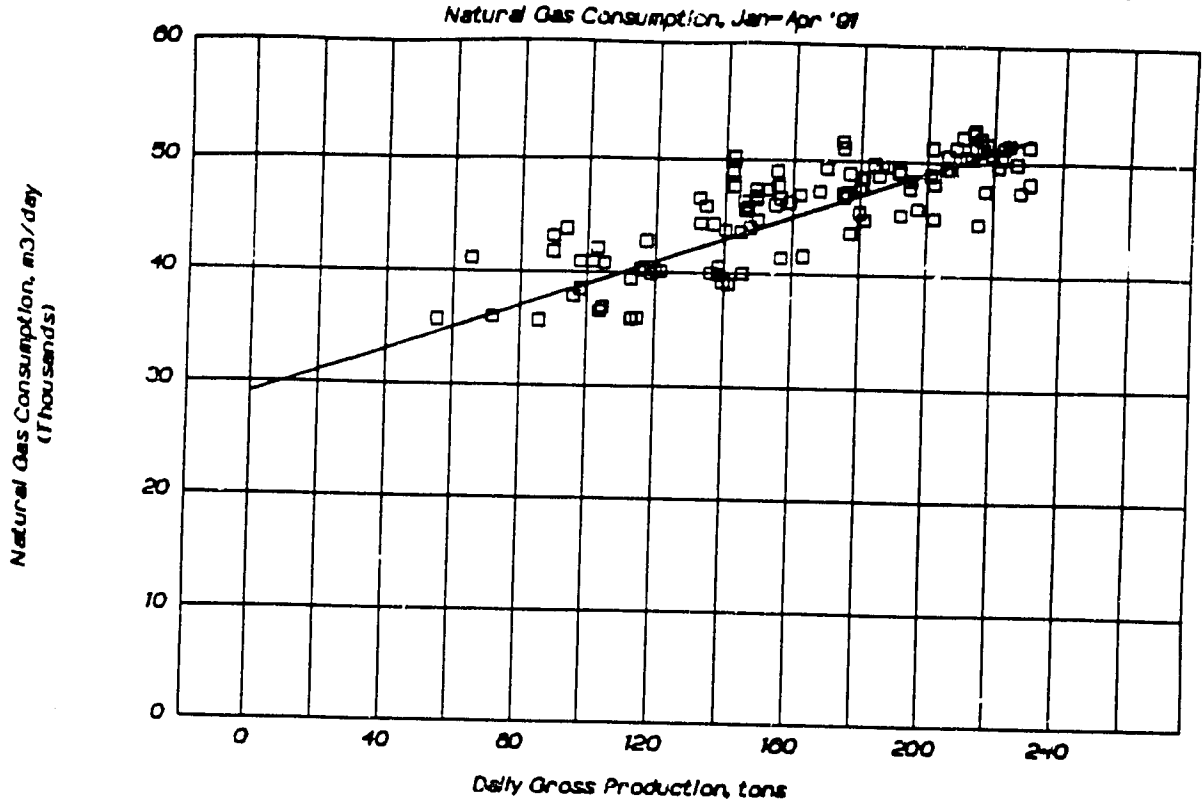
(1) daily energy consumption vs. daily production rate, showing fixed energy consumption (29,000 m^3/day) plus variable energy consumption (110 m^3/ton);

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

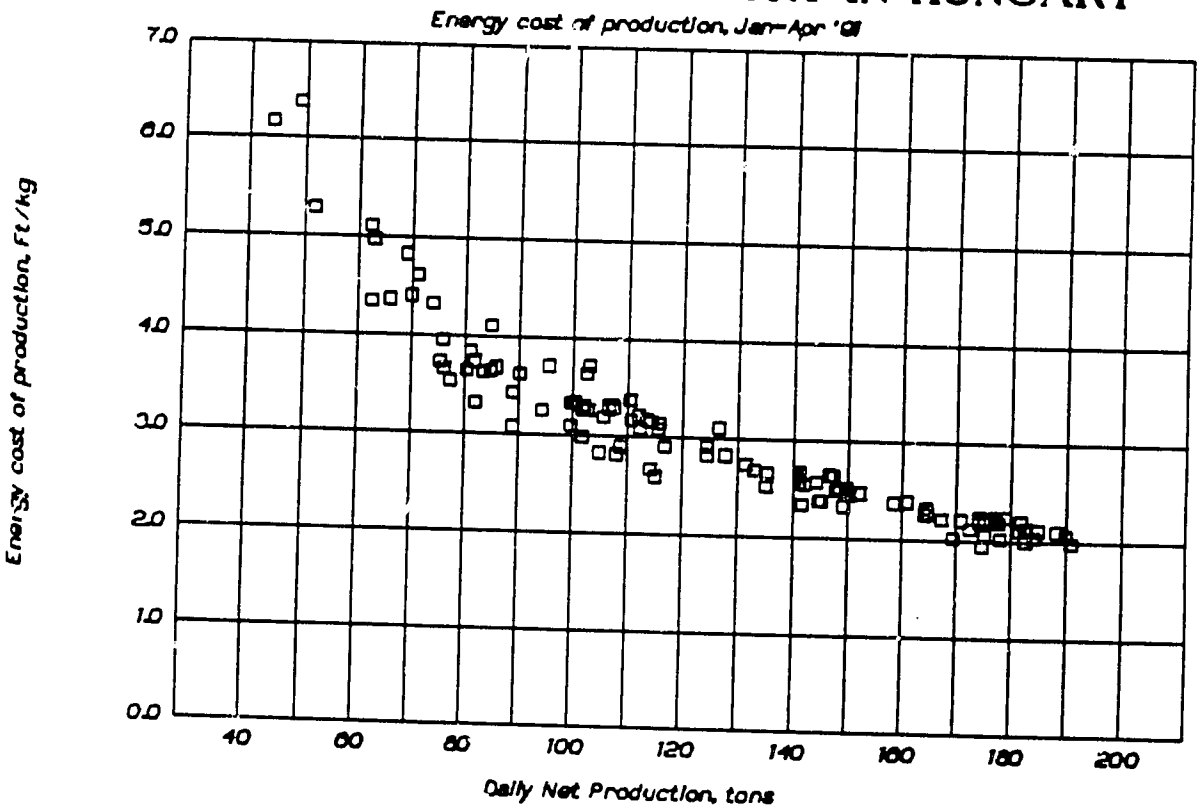
From these data, which are typical of many factories in the region, it is clear that energy efficiency is a function of production rate. Further, at any given production rate, there is significant scatter in the data, 10-20% variability in energy consumption. This indicates that management has the opportunity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

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.

ENERGY-INTENSIVE FACTORY IN HUNGARY



ENERGY-INTENSIVE FACTORY IN HUNGARY



3.2.3 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 other 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:

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

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 in 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

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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.

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

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

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

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

D. 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 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.

3.3.1 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 must 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 saving 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 markets 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[3] to increase sales, so that the plant can operate at higher capacity factor, and thereby spread fixed energy consumption over more units of production.

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

- 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[4].

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

3.3.2 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.

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

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

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

3.3.3 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 exchangers 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.

3.3.4 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 the neighboring district.

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3.4 POLICY AND PROGRAMS TO ACCELERATE IMPROVEMENTS IN INDUSTRIAL[5] ENERGY EFFICIENCY AT THE ENTERPRISE LEVEL

Since the mid-1970's, 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 of Hungary'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 of Hungary'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 Hungary are provided in the sections that follow. These are listed by RCG/Hagler, Bailly as options for consideration, not absolute recommendations.

3.4.1 Industrial energy efficiency policy options

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

3.4.1.1 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.

[5] With additional references to district heating

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.

Government policy must be directed toward establishing the trading links necessary to secure energy supplies. For Hungary and many countries in the former COMECON region, historical oil and gas supply was from a single source, Russia, and this dependency continues today. To the extent that this supply is not secure, the risk to developers is increased, and investment will tend to locate elsewhere. Thus the establishment of infrastructure, including parallel sources of supply, should be regarded as a part of industrial energy efficiency policy.

3.4.1.2 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.

Beyond that, 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. If 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).

3.4.1.3 Establish a stimulative industrial investment policy

This is because the design of industrial process equipment is continuously evolving, and new designs are more energy efficient that older designs, especially since the late 1970's. For example, a typical ammonia plant built today is 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. Hungary is 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 1970's, 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.

3.4.1.4 Establish an import regulation policy which fosters competition

A policy to open Hungary's 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.

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Further, the monopolistic situation that exists in many industries in Hungary 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, and
- 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.

3.4.1.5 Maintain control over fiscal and monetary policy

A lack of discipline in fiscal and monetary policy will lead to high inflation, which will reduce industrial energy efficiency. In periods of high inflation, nominal interest rates also become very high, and decision-making is made with fear under great uncertainty. In such times, the best decision is often no decision, so investment is delayed, even investment in low-cost, quick-payback projects like maintenance and rehabilitation.

RCG/Hagler, Bailly has observed a lack of interest among industry in the former COMECON region in any energy efficiency project (unless a payback period of one year or less seems guaranteed) or other investment which requires financing. This view reflects a combination of a lack of trust for the newly formed banks, the inflation climate which makes nominal interest rates seem very high, the lack of capital available (which drives up real interest rates), and the relative priority that energy efficiency has in today's survival/shake-out period.

3.4.1.6 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 Hungary. The rules must change. An owner's mentality is needed to make the tough decisions.

As long as the 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, the all 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 by 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 in western Europe.

3.4.1.7 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 Hungary 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.

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3.4.1.8 Reduce the standard of district heating services

The temperature of district heating supply water is based on ambient temperature conditions, according to the standard "grafik". 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 grafik 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° in flats).

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

3.4.1.9 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[6].

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, standard 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.

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

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The same tradeoff is true of most other standards, which makes a consumer 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.

3.4.2 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 ensuring 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 Hungarian 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 position of suppliers;
- Lack of services available for implementation;
- Lack of available financing for necessary investment.

3.4.2.1 Information and education programs

It is widely accepted that information and education programs offer the best return on investment for government expenditure in energy conservation programs[7]. Energy conservation awareness or public relations campaigns can be effective at an early stage, but they must then quickly proceed to educational campaigns, in which real facts are provided, giving information about ways to save energy. Educational programs need to be targeted to specific audiences, and to provide technical information in a suitable level of detail.

Government sponsorship does not necessarily mean the program is implemented by government employees. Government can provide contracts or grants to private or non-governmental organizations to carry out the 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 to pay develop.

- Public relations and awareness campaigns[8]
- 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

[7] Research by Georgia Institute of Technology on their industrial energy efficiency programs in the southeastern US during the late 1970's discovered this, and it was confirmed by an audit of all industrial energy efficiency programs sponsored by US Department of Energy by Price Waterhouse in 1981.

[8] RCG/Hagler, Bailly warns that these may not be appropriate in former COMECON countries because of previous Governments' longstanding reputation for issuing false propaganda.

- -- 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[9]

- 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
- Conferences 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

3.4.2.2 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

[9] Such as "energy efficiency in the pulp and paper industry"

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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 1970's to early 1980's. 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[10]
- Provision of limited packages of generic, low-cost energy efficiency equipment
- Installation of specific energy efficiency technologies which have wider application within the industry

3.4.2.3 Technology research and development (R&D) programs

In the US, significant government programs are funded toward energy efficiency technology research and development. Principal examples of agencies carrying out such programs are the national R&D laboratories of the Department of Energy[11]. These programs identify a specific need, such as energy losses through windows in buildings, then carry out R&D with the objective of developing technologies to improve efficiency. After developing a technology, it is released to the private sector for commercialization. The technical success of this approach in the US has been proven in a few cases, such as the pulse furnace and heat barrier windows. The cost-effectiveness of the approach is marginal, at best, compared to energy efficiency technologies developed and patented by the private sector.

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[10] Under the early government-sponsored energy conservation programs in the US, limited energy audits were 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.

[11] Most notably Oak Ridge National Laboratory, Brookhaven National Laboratory, Battelle Pacific Northwest Laboratory, Argonne National Laboratory, and Lawrence Berkeley Laboratory.

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There are significant energy R&D facilities and personnel in Hungary in the various research institutes. There are opportunities to continue to apply these resources to apply modern technology and perhaps develop new technology. However, these projects require significant funding, without any assurance of success. Hungary has limited resources at this time.

RCG/Hagler, Bailly suggests that the economy may be well served by applying the tremendously innovative human resources now available in these institutes to private sector enterprises seeking to commercialize energy efficiency.

3.4.2.4 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
- 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 or 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 approach[12].

[12] This program design was used successfully by RCG/Hagler, Bailly in the US Emergency Energy Program for Central and Eastern Europe.

3.4.2.5 Financing programs

There is a very serious shortage of capital available in Hungary. 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).

3.4.2.6 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 prices for district heat 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.

CHAPTER 4: ROLES OF HUNGARIAN INSTITUTIONS IN ACCELERATING INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENTS

by RCG/Hagler, Bailly, Inc.

4.1 INTRODUCTION

There are many institutions that can work to accelerate improvements 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 (chemicals, 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.

4.2 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 conducive 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

4.3 ROLE OF ENERGY SUPPLY COMPANIES

Energy supply companies have the responsibility to supply energy 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 consist 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 addition, 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.

4.4 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 Hungary 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 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 COMECON 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.

4.5 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 Hungary 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.

4.6 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.

4.7 ROLE OF ACADEMIC INSTITUTIONS

Academic Institutions in Hungary 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 ways 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.

4.8 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 Hungary. 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 Hungary 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 service 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 ut energy efficiency equipment into operation
- energy efficiency service companies ("ESCOs") to offer implementation services, including performance contracting or shared savings contracts

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CHAPTER 5: PRELIMINARY RECOMMENDATIONS FOR AN INDUSTRIAL ENERGY EFFICIENCY PROGRAM IN HUNGARY

by RCG/Hagler, Bailly, Inc.

5.1 GENERAL RECOMMENDATIONS FOR INDUSTRIAL ENERGY EFFICIENCY PROGRAM DESIGN

RCG/Hagler, Bailly recommends that the following considerations be included in the design of programs to accelerate industrial energy efficiency. These recommendations are directed at the industrial enterprise level, which is where actions to improve efficiency will be taken. Therefore, a national program should be designed with activities which will stimulate the enactment of these recommendations.

- **Create a policy framework that stimulates industrial energy efficiency improvements.** Government policy must be directed toward improving energy efficiency. As described in this report, this will require policy initiatives which can adopt cost-based energy prices, assure reliable energy supplies, stimulate investment, promote competition and private sector development, and rationalize district heating systems.

- **Adopt an integrated industrial management approach to achieve improvements to industrial energy efficiency.** There is a need to emphasize that industrial energy efficiency is process-related, and will be best served in Hungary by projects that address the transition to a market economy. The private sector will hold the key to efficiency in two ways - through privatization industries will have the incentive to become more efficient, and the development of private sector energy efficiency service industry will assist in implementing improvements.

  Energy efficiency programs should emphasize projects that have multiple benefits toward process refinement and cost optimization, such as product changes (modernizing uncompetitive energy-intensive products), quality control (thereby reducing energy waste through scrap generation), productivity improvement (thereby minimizing fixed energy losses), and process upgrading.

  Large projects focused on achieving only energy savings benefits, such as heat recovery, cogeneration and alternate fuels projects, may have payout times of 5 years or more. In making these investments, extreme care must be taken to first ensure the survival of a given industry.

- **Companies need to focus on daily energy management and efficiency.** Vast amounts of energy consumption data are collected which are used for administrative purposes, but not energy management. Plants need to relate energy consumption to production on a near-continuous basis (as part of the daily report, at a minimum) in order to exercise management control. In the near-term, personal computers can help management begin to address this task in a manual information and control system. In the long-term, modern computer-based industrial process control systems should be installed to achieve true closed-loop control systems.

- **Task forces should be established to plug leaks.** Management should set up teams with specific missions to cut energy losses. Dedicated teams should be established to attack problems in production (quality, productivity, reliability) and energy systems (steam, electrical, hot water, compressed air, heat gain/loss). Management must provide these teams with the tools and budgets necessary to do the job (very low cost, compared with the benefits). Specialists with appropriate incentives, such as private sector energy efficiency companies, should lead these teams.

- **Production operations must be optimized.** Existing production equipment and processes can be 10-40% more energy efficient through optimization, particularly during the shrinking market of the transition period. Management must make sure the most efficient equipment is operated and maximize the load on machinery in operation, running the minimum number needed and shutting down others.

- **Marketing demands urgent attention.** Optimization of operations, and hence energy efficiency, must be based on the demands of the market. In the near term, the best optimization opportunity for many companies will be the creation of a market. Some companies are just producing at reduced (inefficient) levels for inventory, in the hopes that the market will return.

- **Upgrade efficiency monitoring instruments.** In many plants, there is a need to modernize and expand instrumentation to meter energy and production more frequently and more accurately. In particular, submetering for gas, electricity and steam is needed at each production line. Final product quality monitoring is inadequate - more frequent testing is needed and laboratories need modern testing equipment. Raw material and intermediate product testing needs to be improved greatly, and these improvements could offer great benefits in reducing the generation of scrap.

- **Modernize production accounting systems, particularly production costing.** Based on the upgraded instrumentation, production costing can be improved. In a market economy, knowing production cost is all-important. The allocation of costs across a company's product slate needs to be improved to better reflect true costs, instead of design guides or formulae. The penalty of inaccurate costing could be that a company misjudges its competitiveness, makes the wrong decision to enter or leave a market, and ends up making a loss instead of a profit.

- **Stimulate awareness and motivation.** Management needs to involve production workers in energy conservation, as one of the keys to the survival of their jobs.

- **Modernize production shop-floor control systems.** There is a clear need for assistance in addressing the complete spectrum of industrial engineering topics, such as production scheduling, inventory control, reliability, work-in-process management, preventive maintenance, tool management, product line change-over, and automation.

- **Restructure natural gas and fuel oil prices.** Hungary has raised energy prices to levels on a par with those of most Western European countries. However, the structure of energy prices still includes substantial cross-subsidies, especially for two of the primary industrial energy sources, gas and electricity. In today's design, industry pays higher gas prices than residential customers (by a factor of three). Electric prices may not reflect the true cost of service at the various voltage levels.

- **Industrial pollution control problems need to be solved.** The needs in this area has been well-documented, and projects are being prepared by many donors to address them. At the plant manager level, there is an awareness of the need for attention in this area. In some cases, pollution abatement programs can use waste-to-energy systems.

- **Plant environmental quality and safety needs urgent attention.** Less media and donor attention has been focused on the conditions inside the plants, which is poor in many cases (particularly the metallurgy industry). It is ironic that a system built on glorifying the worker requires them to toil in such unsafe conditions. This environment has adverse affects on motivation and worker productivity, ultimately being reflected in product quality, cost, and even energy waste through excessive scrap.

5.2 RECOMMENDATIONS FOR A LONG-TERM INDUSTRIAL ENERGY EFFICIENCY PROGRAM IN Hungary

5.2.1 Objective

1. Demonstrate market-oriented approaches to industrial management, problem solving, energy efficiency, and decision-making, and serve as catalysts for action by Hungarian counterparts.

2. Demonstrate technologies and services which are well-suited to addressing the needs of Hungarian industry and thereby stimulate joint ventures in these areas.

3. Provide training and introduce Hungarian managers to their counterparts in industry in western countries.

4. Foster development of self-sustaining delivery and implementation systems for energy efficiency, such as utility-sponsored demand-side management programs, private sector engineering companies, maintenance specialists, and energy service companies, and lending organizations.

5.2.2 Focus

1. Focus on projects in energy efficiency, especially improving energy management. Concentrate on short-term, low-cost actions to optimize operations and maintenance.

2. Use the energy management principles and tools as examples to catalyze management action in other areas of the organization, such as:

   Product cost optimization
   - Waste minimization
   - Raw material utilization

   Process refinement
   - Quality control
   - Productivity improvement
   - Production scheduling and flow

   Management strategy and restructuring
   - Product slate
   - Production lines

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- Marketing
- Packaging
- Production cost accounting

5.2.3 Program elements

For the Focus shown above, provide elements of assistance that can have a measurable positive impact in the short term (within six months in each plant assisted).

1. Carry out studies and provide support to develop government policy which will stimulate industrial energy efficiency. Key areas in which to be involved include energy supply reliability, energy pricing, industrial investment policy, and industrial restructuring.

2. Establish energy efficiency program implementation systems in the energy supply companies (electric, district heat, gas, oil), based on U.S. demand-side management (DSM) programs and efficiency-related services offered by U.S. oil companies.

3. Provide consulting advice to advise and catalyze industry management in the Focus areas. Provide assistance to 30 companies per year, with a phased program leading to a self-sustaining financing structure, paid by the client plants. Develop local industrial management consulting firms to provide these services. Consultants must provide expertise in energy management, and other areas such as management consulting, process optimization, process technology refinements, for example:

   energy management - efficient technologies, information & control systems

   management consulting - marketing, production costing, joint ventures

   production optimization - operations, maintenance, shutdowns

   process technology refinements - quality, packaging, productivity

4. Provide hardware and software to demonstrate state-of-the-art U.S. technologies and services that address current needs and offer an opportunity for Hungarian private enterprise development through joint ventures, for example:

   process measurement & control equipment - quality control, quantity monitoring

   production scheduling software - shop floor control and decisions

energy management information and control systems, efficiency monitoring

instruments for leak detection/plugging teams (heat, steam, water, electricity)

computer software for scenario analysis and decision-making

production cost accounting systems

5. Finance feasibility studies for investment projects in energy efficiency that can be implemented by multilateral development banks.

6. Provide training for Hungarian industrial managers and energy efficiency engineers, particularly internships and study tours, conferences & exhibitions.

7. Procure products and services in the Hungarian market, so as to stimulate a demand and encourage joint ventures with U.S. firms.

5.2.4 Duration

A duration of three (3) years is recommended, 1993-95.

5.2.5 Budget

A budget of $13 million is recommended for the project. The method of funding recommended is a grant basis ($10 million), with at least 25% matching funds from the plants for project elements that give them immediate benefits (except feasibility studies and training), achieved on a phased basis over the life of the program. No matching funds from the Government of Hungary are anticipated.

	Project Contribution	Industry Matching
1. Support to policy development	$ 1 million	
2. Establish DSM implementation	$ 2 million	$ 1 million
3. Consulting services to plant management	$ 3 million	$ 1 million
4. Demonstrate technologies	$ 2 million	$ 1 million
5. Finance feasibility studies	$ 1 million	
6. Sponsor training, internships, study tours	$ 1 million	
TOTAL	$10 million	$ 3 million