CDIE
Impact Evaluation
United States Agency for International Development

SAVING ENERGY IN HUNGARY

USAID has shown that by adopting energy-saving methods and equipment, Hungarian industry can produce more and pollute less. Now the challenge lies in spreading the technology.

Since 1990, the Agency has been helping Hungary transit from a centrally planned economy to one based on market forces. A major problem is energy inefficiency, a legacy of the communist era. Addressing this, USAID projects have

- Trained a cadre of energy auditors capable of analyzing how a factory uses energy and recommending ways to eliminate waste and increase efficiency
- Introduced new ways of thinking about energy-saving technology
- Promoted low-cost, high-payoff energy conservation investments that yielded an average payback period of just 2.4 months and an economic rate of return of 165 percent
- As a by-product of improved energy efficiency, helped reduce air pollution—at almost no cost

The projects were less successful, however, in getting out the message of energy conservation beyond participating companies. Some reasons:

- Hungary shows no overriding concern for the environmental effects of energy production and use
- Although the technology clearly works, Hungarian institutions and markets are very weak
- When energy is relatively cheap, little incentive exists to use it efficiently; only when the market provides an opportunity to make money will demand for energy conservation become widespread

Author and team leader: Joseph Lieberson. Team members: Matthew Addison and Frank Hahn.

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SUMMARY

Until the 1940s Hungary was primarily an agricultural country. After World War II, a Stalinist approach to planning and an emphasis on heavy industry dramatically reshaped the economy. Central planners gave little heed to comparative advantage, rarely encouraged efficiency, and failed to recognize real resource costs. Industry grew rapidly, but eventually there were shortages, stagnating production, and serious imbalances. Inefficient energy use and high pollution levels harmed productivity and public health.

After the end of communism in 1989, Hungary launched major economic reforms and started to open the economy to trade and investment with the West. The move to a market-based economy was traumatic, particularly for industries with old and inefficient equipment. USAID assistance dealt with a number of problems in the transition from central planning to a free-market economy. In particular, if the economy was ever to be internationally competitive, it needed to reduce wasteful energy practices. Compared with Western Europe, Hungary needed two and a half times more fuel to produce a dollar of output. If the Hungarian economy could use energy more efficiently, it could move forward on economic restructuring and become part of the international economic community.*

USAID projects demonstrated that energy conservation works. Factories that made energy investments were able to pay for their investments on average in just 2.4 months, with the money saved by burning less fuel. This represents an extremely high financial rate of return—485 percent. Even from the perspective of the national economy, the investments generated a high economic rate of return, 165 percent.

Many engineers see energy conservation as a "hardware" problem of installing more efficient burners, motors, and pumps. In point of fact, even more important is the "software" side of energy management. One of the most important parts of the USAID projects was the introduction of new ways of thinking about energy management, finance, production monitoring, and maintenance—which can often be more difficult than just buying a new motor.

Companies for which energy is a major share of costs have a strong incentive to make energy-efficient investments. The USAID project targeted those firms, and the strategy paid off. It would have been much harder to promote adoption in industries where energy is a minor part of production costs.

While projects succeeded at the eight demonstration factories, and energy auditors trained by the project are finding new business, the energy conservation message is not spreading rapidly. The technology clearly works, but Hungarian institutions, markets, and incentives are weak, and much more needs to be done on dissemination.

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*Detailed technical analysis and background information on environmental, energy, and economic issues of USAID energy assistance in Hungary are available in USAID Evaluation Working Paper No. 220, PN–ABY–211, How USAID Energy-Saving Programs Are Faring in Hungary.

CDIE STUDY

In October 1995 a three-person team from USAID's Center for Development Information and Evaluation (CDIE) assessed the Agency's energy conservation program in Hungary. The assessment covered the 1990 Emergency Energy project, which provided technical assistance, training, and equipment to improve energy efficiency; the 1991 Regional Energy Efficiency project; and a 1991 energy sector grant, which addressed energy policy issues.

This was one of six impact assessments on energy conservation carried out by CDIE. Other countries in the series were the Czech Republic, Guatemala, Jamaica, Pakistan, and the Philippines. Each country evaluation examined the economic and environmental impact of USAID projects by exploring the same four evaluation questions:

1. *Policy reform.* What has been the impact of government energy policy, energy pricing decisions, environmental policy, and privatization?

2. *Technology transfer.* Was the right technology selected, was it adopted, and is it still being used?

Moving Toward a Market Economy

Hungary is a country in transition—nothing new to a land that has seen centuries of war and invasion. Indeed, Hungary's rocky past is said to give the Hungarian people their distinctive traits at once of pride (in their survivability) and pessimism (about what the future holds). In 1989–90 Hungary shook off communism to become a multiparty parliamentary democracy. Today the country is making the difficult transition to a free-market economy that will face global competition.

The 1990 elections that swept the communists from power installed into the new parliament the Hungarian Democratic Forum and its conservative coalition parties. The coalition, which gained 60 percent of the seats, had promised wide-ranging economic reform. But reform did not go quite as planned. By the end of 1991, unemployment had soared into the double digits. The annual inflation rate stood at 34 percent, and production had declined. Moreover, privatization was going slowly; by the end of 1992, only 8 percent of industry had shifted from public to private ownership.

General disillusionment with economic reform, coupled with the worldwide recession of the early 1990s, resulted in a political shift to the left. For most Hungarians, there was a strong sense of having lived better under socialism. In the 1994 elections, the Socialist party, successor to the Communist party that had controlled the country for 40 years, was returned to power.

But Hungary's enthusiasm for socialism has always been tepid at best (Nikita Krushchev dubbed the Hungarian brand "goulash socialism"). Thus the business community was generally relieved, though not necessarily surprised, when the new Socialist prime minister, Gyula Horn, reaffirmed his government's commitment to both democracy and a market economy. At the same time, Horn promised to soften the blow of radical change by pledging to meet people's basic needs.

A joke frequently heard during the early 1990s went: "What's worse than communism?" Answer: "Whatever comes next!" Hungary *is* making progress, if slowly, toward economic liberalization. (And the country has attracted significant foreign investment—since 1988, more than $13 billion.) For most Hungarians, though, there is a perception that things will get worse before they begin to get better. They may be right.

3. *Education and awareness.* How successful was the project at spreading the energy conservation message?

4. *Institution building.* Were government and private sector institutions strengthened to the point where they could promote energy conservation after USAID funding ended?

BACKGROUND

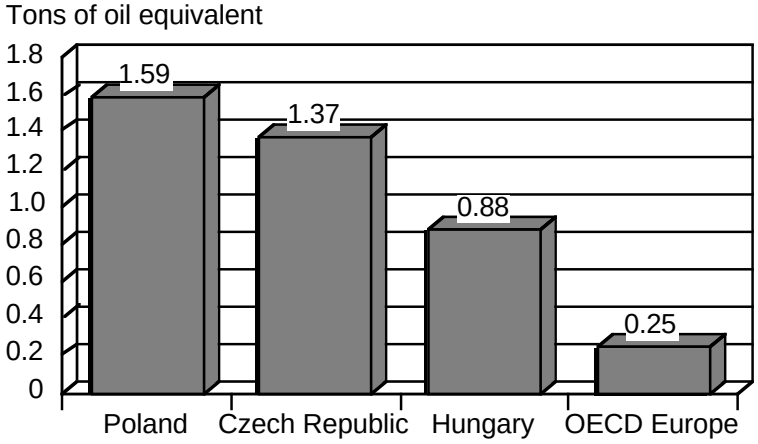
Hungary is in the midst of a difficult transformation from central planning to a market economy open to investment and trade with the West. A major problem is energy inefficiency, which makes many Hungarian industries uncompetitive in international markets. Hungary's economy is built on cheap and abundant energy, with industrial plants that waste energy and pollute heavily. (While Hungary's energy use is high, the country is more energy-efficient than the Czech Republic and Poland [see figure 1]). Under communism, energy inefficiency was not regarded as a problem. Now, with the end of communism and the economy opening to international trade, much of Hungary's industry is not competitive with the West.

In market economies, comparative advantage and market prices direct production. In Hungary's centrally planned economy, production, inputs, location, industrial structure, and technology choice were not driven by cost, but by other considerations. Old production processes were not abandoned in favor of more cost-effective processes. Since technology was not cost driven, new factories or production processes were introduced only when additional output was required. Companies did not have to market their products. They concentrated instead on maximizing output. Energy use was determined by access to energy and technology—not by international costs. Result: energy inefficiency.

Figure 1

Energy Needed to Produce $1,000 of GDP

1993



Project Rationale: Why Energy Conservation?

With the fall of communism, the new government elected in 1990 began comprehensive economic reforms with international support from the International Monetary Fund, the World Bank, and USAID. Major energy-price reforms were launched in 1990, with further plans for 1991.

But in late 1990, just as the reform process was starting, the economy faced a crisis because of drastic changes in international energy markets. The Soviet Union cut back on oil deliveries and demanded hard currency for oil and natural gas. With the 1990–91 Persian Gulf oil crisis and the cutoff of Iraqi and Kuwaiti oil, international oil prices soared from $13 to $31 a barrel. Most experts assumed oil prices would move even higher.

The new, democratically elected Hungarian government was starting to reform and modernize the economy, but high oil prices and energy shortages could derail those efforts. In such a situation, faced with mounting financial and industrial problems, pressure might build to return to the old system of state controls and allocations. USAID provided assistance to help cushion the shock and even use the energy crisis as a way to reform Hungarian industry.

The rationale for USAID assistance was economic; if the Hungarian economy could use energy more efficiently, it

could save foreign exchange, maintain economic momentum, and advance on economic restructuring. Energy conservation was a means to help the economy, not an end in itself.

RESULTS

Assistance from the Agency addressed both the immediate need to reduce energy use and longer term efforts to restructure the economy and move toward a modern, efficient energy system. The assistance centered on efforts to improve industrial energy efficiency through seminars, factory energy audits, energy-saving investments, and training of energy auditors. Energy audits were central to the program. An energy audit is a technical analysis by an engineer of how a factory uses energy. It identifies ways to eliminate waste and increase efficiency.

The Regional Energy Efficiency project trained 16 Hungarian energy auditors. Over 6 months they received 15 days of in-country training, with some receiving more advanced training in the United States. Although training covered the engineering / technical side, much of it dealt with management, marketing, and finance. Of 16 auditors taking the course, 9 of the best became certified energy managers. They then went out to factories to perform energy audits. At the time of this evaluation, all nine certified energy managers were operating their own energy service companies and were actively promoting investments in energy conservation.

To build industrial interest in energy efficiency, 10 plants were chosen to receive Agency-sponsored energy audits. The companies paid for the audits (at several thousand dollars each) and then received energy conservation equipment recommended by the auditor. USAID grant-funded the equipment, and five USAID-trained energy specialists conducted the audits. By October 1995, eight of the ten plants had received most of their equipment.

The eight energy audits under the Emergency Energy project were of a bakery, a metal works, a chemical works, a glass factory, an alumina plant, a district heating plant, a paperboard factory, and a yeast and alcohol plant. Relatively low-cost but high-payoff energy conservation investments were completed at each plant. Except for the district heating plant, the average payback period (when cost savings equaled investment costs) was about one month—a very quick return on investment. The district heating plant had a much longer payback period, 28 months, but still had a high financial rate of return.

PROGRAM ELEMENTS

The USAID program sought to improve energy efficiency in Hungary through the four complementary areas of policy reform, technology transfer, education and awareness, and institution building.

Policy Reform

Energy Price Reform

Although it is important to get energy policies right, the technical side is relatively simple compared with the political issues. From 1990 through 1992 Hungary made great strides in moving energy prices toward world market levels. The government also scaled back non-energy subsidies to bring prices in other areas of the economy in line with real costs. Those were heady times; with the end of communism, Hungary was eager for reform.

In the last few years, though, policy reform has slowed, and energy price increases are starting to lag behind inflation. For many Hungarians the rapid pace of economic change throughout the economy was too much too soon. One indication of "reform weariness" is that the free-market reform government was voted out of office in 1994, and the Socialists (of the former Communist party) are now back in power. Still, by 1995, most energy prices in commerce and industry are close to the cost of production. The only major remaining subsides are on energy for the households.

Hungary demonstrates that polices that raise energy prices increase the desire of factory

managers to invest in energy efficiency. But it also demonstrates that positive economic impacts can be offset by weakening political will.

Energy Price Reforms Do Work

Over the last three years, as the government raised real energy prices, the Csepeli Femmu metalworks has shut down its refinery and electrolysis sections—its most energy-intensive and energy-inefficient production processes. It has kept open its energy-efficient wire-manufacturing line. Management is aware of government plans to raise energy prices by 1997 to the point where they cover full costs. The company plans further energy-saving changes.

Privatization

The status of firms with respect to privatization affects how they react to opportunities to improve energy efficiency. In Hungary, success with energy conservation often depends on where a factory is in the privatization process. Plants still owned by the state or by local management lack capital, tend to have a limited view of the future, and are reluctant to make investments. Inflation, the high cost of capital, and subsidized energy make the situation worse.

The best hope lies with privatized firms that have a foreign partner or owner. Foreign firms bring in technology, management, finance, and marketing skills. They are concerned with cost controls, and they take a strong interest in energy conservation. They have access to needed funds and are willing to make energy conservation investments that have a longer payback.

The government moved relatively quickly to privatize non-energy industries, but it has been slower to privatize the electric and gas utilities and state-owned petroleum company. Nonetheless, progress has been made. By December 1995 six electricity distribution companies and two power plants had been privatized.The Hungarian Energy Office, which has received USAID support, has worked to establish the necessary industrial structure for utility privatization and to draw up a regulatory framework. It also is responsible for pricing policy under the gas law and for advising the Ministry of Industry and Trade on energy prices until other mechanisms are in place. What is still needed is a regulatory mechanism, such as the U.S. system, in which state public utility commissions set rate and service standards.

Environmental Policy Reform

I**f energy efficiency is to make economic sense, prices must reflect the true cost to society of producing and consuming energy.** Not only should prices reflect financial costs, but they should also reflect nonfinancial, nonmarket costs such as environmental damage. In late 1994, the Ministry of Environment published the "National Environmental and Nature Conservation Policy Concept Paper" covering the period up to the year 2020. The gas and electricity laws of 1994 promise that prices will cover financial costs by the end of 1996 but do not include environmental damage as a cost.

Rather than stressing energy laws, enforcement of environmental regulations may be the best way to improve energy efficiency. In the Czech Republic, for example the need to meet pollution standards has provided impetus for energy efficiency, even when energy prices did not provide adequate incentives. But that is not the case in Hungary. Although the environment is of interest, it is not a major public concern or national priority. Moreover, energy and its associated environmental problems are not priority fields under environmental programs. The Ministry of Environment has been active in publishing comprehensive guidelines, principles, and policy recommendations. Standards are tough, but enforcement is not, and little has resulted from these efforts.

Technology

The USAID projects effectively trained Hungarian energy auditors in all phases of energy technology, and the auditors then helped factories use the new technology. The project trained a cadre of private sector engineers who took on the task of convincing industry and lending institutions that investments in energy efficiency can be profitable.

Foreign Partners Can Make a Big Difference

The Reichter Pharmaceutical Company takes energy conservation seriously. It is privatized and has a U.S. partner (Johnson & Johnson Co.). Whereas most Hungarian firms prefer an investment payback of less than a year and preferably of a few months, Reichter is willing and able to make investments with a two- to four-year payback. It has used a USAID-trained energy auditor to put in place a factorywide energy-efficiency program including steam metering, high-efficiency lighting, improved feedwater pump maintenance, an improved cooling system, and new steam condensation pumps.

A big problem in introducing new technology is old ways of thinking. The mentality of socialist central planning—concentrating on production targets and output and not necessarily costs—is the norm in all too many firms. A straight engineering solution to a production problem may have been enough in the past, but in a world of higher energy prices and market competition, companies need to consider costs and cost reduction in their plans along with marketing, finance, and energy conservation. The USAID projects have helped to change attitudes carried over from the days of central planning.

USAID-trained energy auditors offered factories a wide spectrum of energy-related services, including energy audits, identification of financing sources, recommending equipment and training, and reviewing organizational and management impediments to energy savings. In addition, the Agency introduced *energy performance contracting.* This practice ties an energy auditor's compensation directly to energy savings the firm achieves.

Auditors looked closely at the "hard" technologies of production process equipment and production process monitoring, as well as the "soft" technologies of energy management. They recommended both low-cost and higher cost improvements. Generally low-cost improvements were adopted by the firms and funded by USAID. Higher cost measures, such as new burners and correctly sized motors and pumps, were to be funded by the firms but were usually not carried out. Managers cited uncertainty about market prospects and lack of investment capital as reasons for not changing over.

The experience of one of the audited plants illustrates the process. The formerly state-owned fiberboard factory at Mohacs was built in 1957. Equipment was largely of pre–World War II design and not energy-efficient. Engineers have kept the plant operational, but at only 55 percent of rated output. With rising energy prices and competition from abroad, the employees (now partial owners) are interested in solving their problems. A USAID-trained specialist completed an energy audit that identified steps to reduce energy consumption and improve production. He prepared a detailed business and financial plan to show management the benefits of recommended improvements.

The recommendations were accepted, and equipment installation began in 1994. A Honeywell computerized process control and monitoring system was installed on one of four production lines along with other energy-saving equipment. Even using existing production equipment based on a 50-year-old design, the results were dramatic. Peak electrical demand

dropped 24 percent, bringing a significant saving on electricity charges. The factory now uses less steam, production is more reliable, and the product is more uniform and of higher quality.

Through these steps the plant has offset energy price increases, remained competitive internationally, and increased annual output from 55 percent to more than 70 percent of rated capacity. Because the audit also identified other energy-saving opportunities and only one production line has been improved, the energy auditor and plant managers are seeking more money for these improvements. Here is a clear case in which exposure to the latest management techniques and technology paid off.

District heating companies provide another example of how knowledge of technology and information fosters the spread of energy conservation investments. In Hungary 103 towns have large groups of apartment blocks heated by central steam plants. Often several thousand apartments are heated by one central plant. Unmetered heat is provided to each apartment, and temperature regulation is accomplished by a simple technology: opening and closing windows. As a result, heating costs are high and heat distribution in buildings is uneven.

With cheap energy, few incentives existed to make improvements. Now the situation is changing. A USAID-sponsored energy audit demonstrated that heating companies could realize significant cost savings and improve heat distribution by installing meters, thermostats, and on–off valves in individual apartments.

USAID spread the energy conservation message with presentations to the Hungarian District Heating Association. At the same time, Agency-trained energy auditors and engineering professors at the Technical University of Budapest also promoted conservation. To test the spread of the message, the evaluation team examined a recent (non-USAID) energy demonstration project at the Eger District heating system. New valves that control and monitor heat distribution to individual buildings are being installed in steam substations, and one demonstration building has been retrofitted with meters and thermostats. Another district heating company is installing 540 valves in its steam substations.

More efficient production-line technology was an important part of USAID projects. Efforts were not limited to equipment; energy auditors were also given training in management methods that use the latest computer-based control techniques and standard business and financial management analysis. They learned about sources of funding and how to approach lending institution and equipment manufacturers for favorable financing terms. Energy auditors have a vested interest in the financial success of an energy conservation project, since typically their compensation depends directly on the value of energy saved. Therefore, they choose projects with care and continue to be involved over several years.

Education and Awareness

Training, seminars, and other promotional activities are all well and good, but success depends more on having in place realistic energy prices and incentives, and factory owners interested in making a profit.

USAID education and awareness efforts concentrated on training energy auditors. The auditors have established a network among themselves (the Hungarian chapter of the Association of Energy Engineers) and with government energy agencies, district heating systems, the academic community, equipment suppliers, and the electric utility. Through these contacts they remain up to date and maintain their technical capabilities. Most are aggressive, entrepreneurial, and creative in marketing energy services.

Other actors include the government's Energy Center, which has prepared informational pamphlets for energy conservation professionals and the general public. The national electricity

company has set electricity rates that reflect time-of-day and peak-usage pricing to encourage conservation. The Technical University of Budapest offers courses in energy conservation, and nongovernmental organizations (NGOs) such as the Hungarian Energy Association and the Energy Club provide technical networks.

But the public at large is accustomed to subsidized, unmetered heat and electricity, and there seems to be little public concern about energy conservation or energy-related pollution. Awareness and education programs directed at the public have been few. Moreover, energy providers face a strong lobby from the elderly and households, both of which want cheap power. Some district heating companies have started pilot programs to inform the public, but this effort is limited.

The government recognizes the need to improve energy efficiency, but action has been limited. As noted elsewhere, government energy pricing provides large subsidies to households, a policy that deters conservation. The government has not yet stood up to political pressure to provide cheap energy to households. Raising prices closer to actual costs will be the real measure of the government's commitment to energy conservation.

Energy awareness is very low in state-owned factories and most privatized local companies. The most success is with privatized firms that have a foreign partner with deep pockets and a commitment to compete in the international marketplace. How can energy awareness be raised for other firms?

Probably the most important step toward raising interest in energy conservation lies on the policy side: energy prices need to be increased. Subsidized energy for households needs to be cut sharply and narrowly targeted. Privatization needs to go forward. And the energy investment climate needs to be improved. Until those steps are taken, education and awareness programs will have only minimal success.

Institution Building

Government and private environmental agencies and institutions are weak and just beginning to take shape. In Hungary there is no overriding concern for the environmental effects of energy production and use and no clear public mandate for NGOs in this area. To be sure, several NGOs, such as the Energy Club and the Clean Air Action Committee, are active in energy and the environment. However, they often deal with issues—nuclear energy, automobile pollution, regulatory accounting procedures—only peripherally related to USAID projects. In some instances, they take a populist position of opposing profits in energy production and actually propose rolling *back* energy prices.

The Hungarian Association of Energy Engineers carries on discussions with the government on energy policy and serves as a de facto energy conservation trade association. In the industrial sector the Hungarian Energy Association speaks for industry and equipment suppliers. Large industrial energy users have the Association of Hungarian Energy Consumers. District heating companies have formed an association to share technical information and experiences, and hospital energy managers have their own association. These associations are the principal pathway to share knowledge of new energy equipment, technology, projects, and funding sources.

The government's Hungarian Energy Office is responsible for regulating and pricing energy, overseeing conservation, providing public education, and approving construction of new power plants. But the office has been functioning for only a little more than a year, and many of its responsibilities still need to be established.

In a similar energy conservation program in the Czech Republic, USAID helped establish an NGO that then provided seminars, training, and other work in the energy field. The NGO (known by its Czech acronym, SEVEn) helped raise energy awareness and developed energy auditors and energy service companies. The

Agency's program in Hungary took a different tack. It was not designed to develop an institution like SEVEn, but aimed instead at direct training of energy auditors and direct support for energy service companies. To some degree this may have been necessitated by the lack of strong environmental or energy NGOs and a low level of public concern. Though USAID projects did much to improve energy efficiency, they did not leave behind strong institutions to continue the effort.

IMPACT

Financial and Economic Impact

The USAID project components dealing with energy audits and equipment installation have extremely high rates of return—a financial rate of return of 485 percent and an economic rate of return of 165 percent (table 1). Rates of return are calculated by first taking all program investments, next valuing the flow of benefits, and finally comparing costs with benefits. The flow of benefits occurs for a number of years, and that flow, less all costs, yields the net annual benefit. As a simplified example, if a $100 investment generates net annual benefits of $40, the rate of return is 40 percent.

One can look at rates of return in two ways: first, from the perspective of the individual firm and, second, from the perspective of the entire country. Economic analysis examines costs and benefits to the country, including externalities such as pollution. In contrast, a company looks only at its own financial rate of return. For example, the price a plant pays for coal does not include the damage coal smoke causes, such as increased health problems or ruined house paint. Although pollution affects society as a whole, it is of no cost or benefit to the plant. The company is interested only in the cash it takes in and pays out. It receives no cash benefit from less pollution.

From the viewpoint of the firms, benefits include energy savings equivalent to 4,431 metric tons of oil a year, or $1,020,300. In addition, by better production scheduling, firms are able to avoid peak electricity charges of $547,400 a year. Together these benefits amount to a first-year pretax saving of $1,567,700 for the eight factories. But firms do not keep all of these savings, since they pay increased income taxes on their new profits, which reduces annual financial benefits to $1,019,005.

The financial analysis proceeds as if firms had purchased the equipment and therefore includes both equipment costs (paid by USAID) and energy audit and installation costs (paid by the factories). Equipment costs totaled $168,300, and installation costs were estimated at $35,000, yielding a total investment cost of $203,300. These costs compare with energy savings of $1,019,005 in the first year. Energy savings cover investment costs in just 2.4 months—a very quick payback. Projected into the future, even with 10 percent yearly depreciation and assumed closure of some factories in the first few years, the financial rate of return is very high, at 485 percent.

The financial rate of return is converted to an economic rate of return by adjusting costs—

excluding income taxes and peak energy charges and adding in USAID project management costs. A major difference between benefits to the firm and society is the reductions in pollution and electricity demand charges. Reduced pollution has an estimated economic benefit of $551,950 (table 2; see also the environmental impact section below for a discussion of how pollution benefits are determined). Since electricity demand charges are simply a transfer of money from the utility to the energy-using company with no change in real resource use, they are not an economic benefit. The same is true of income taxes: they are merely a transfer from the firm to the government.

Energy Savings Generate Large Returns for Energy-Intensive Industries

As a result of a USAID-funded energy audit, Budapest District Heating saved 15 percent on its energy costs by installing monitoring equipment, new burners, and new pumps. A 15 percent saving may seem modest, but since fuel represents 80 percent of total costs, these measures generated large dollar savings.

When all adjustments are made, the result is an estimated economic rate of return of 165 percent.

Environmental Impact

Through improved energy efficiency, air pollution was reduced at almost no cost. Energy efficiency and positive environmental effects go hand in hand. When factories use less electricity or burn less coal, less pollution goes up the smokestack. The Agency's energy conservation projects helped reduce energy consumption, which in turn reduced air pollution.

Pollution is harmful, but it is difficult to place a dollar value on cleaner air. Since long-term health costs and aesthetic values are hard to determine, environmentalists often use alternative ways of valuing cleaner air.

One approach is to look at *abatement costs*—how much it costs to reduce pollution by installing pollution-control devices at the factory. If new burners and stack scrubbers remove a ton of sulfur dioxide pollution, and the burners and scrubbers cost $800, then that is a good proxy for the value of reducing air pollution. It costs $800 to eliminate one ton of pollution.

Another way to place a value on cleaner air is to count the abatement cost *avoided*. If a factory reduces sulfur dioxide pollution by one ton by burning less fuel or by burning fuel more efficiently, it avoids the costs of new burners and stack scrubbers. The value of reduced pollution is counted as the money saved by *not* having to invest in pollution-control devices—in this case, the same $800.

Abatement costs avoided in Hungary are estimated at half those in the United States. This lower amount reflects two factors: the difference in income levels and the technical stage of pollution control. U.S. incomes are higher than Hungarian, and compared with Hungary, the United States is willing to pay more to reduce pollution. On the technical side, Hungary has high pollution levels, and measures to reduce pollution are much cheaper than in the United States, where easy and low-cost early measures have already been completed.

Table 2 shows the pollution reduction resulting from USAID energy audits and equipment installed at eight factories. It is useful to link these pollution benefits to energy savings and equipment costs. The annual value—$551,951—of reducing annual emissions needs to be compared with the one-time investment costs of $203,300 (financial costs to the firm) or $883,300 (economic costs to the economy). But in one sense equipment costs are not really an environmental cost. *Pollution benefits are a gift,*

since energy conservation equipment was installed by factory managers as a way to save on their fuel bill; the financial rate of return on the energy-saving investment is 485 percent. *From the manager's perspective, the equipment pays for itself in fuel savings, and the country receives the bonus of reduced air pollution for free.* This is one of the most powerful justifications for energy efficiency: cost-effective energy efficiency investments yield surplus environmental benefits to the country.

Sustainability and Replicability

Energy conservation investments were sustained at the demonstration plants, but the spread to other plants was limited. A foreign aid project transfers resources and provides benefits, which is all well and good. However, of equal interest is what happens after a project ends. Have project benefits been sustained? Have they spread beyond the original demonstration sites? And what were the factors affecting sustainability and replication?

Sustainability deals with whether program benefits continue after the USAID project ends. Will new technology and practices introduced by the project continue? Evidence of sustainability is the continued use of energy-saving equipment and institutions years after a project ends.

The Emergency Energy project was implemented during 1991–93, so it was possible to go back in 1995 and make a preliminary judgment whether benefits had been sustained and were replicable. Under the second project, Regional Energy Efficiency, equipment is still arriving and activities are not fully completed. Still, it is possible to make some preliminary assessments.

A 1994 USAID-funded evaluation found that eight plants receiving energy conservation equipment under the Emergency Energy project were using the equipment effectively, and all investments were generating a high rate of return. From the CDIE evaluation team's on-site visits and discussions with those familiar with the plants, it appears the plants are continuing to use the energy conservation investments. In many cases they are *expanding* their energy conservation efforts.

Another way to measure sustainability is through activities of energy auditors trained under the project. Are they still in business, and has demand for their services increased? The evaluation team conducted in-depth interviews with nine USAID-trained energy auditors to determine if they were still in that line of work and if business was growing. All trainees were still in the energy business; all had received follow-on energy contracts and related engineering jobs. They were also able to identify new energy investments that resulted from the USAID program.

Replication relates to the demonstration or spread effect of information and technology among plants and industries. To test for actual spread effects, the team interviewed a broad

range of engineers, factory managers, equipment providers, and government officials. There were cases in which companies were making energy conservation investments, but the numbers were small, in relation both to the size of the industrial base and to existing high levels of energy inefficiency. One of the more promising signs was the Eger District Heating System, in which an energy conservation project was out for bids. Of energy auditors bidding on the project, half had been trained by the USAID project. Another USAID trainee was serving as technical consultant to the District Heating System.

In contrast to USAID programs in other countries, no attempt was made to create an energy conservation institution. The project relied on a cadre of energy auditors to establish successful examples that could be replicated by other plants. The test is the degree to which project-supported changes have spread to other companies.

Existing institutions are weak. The Energy Center has a program, but its role is limited; it could never service the whole country. Hospitals and district heating systems have their own technical associations, but the flow of information on energy conservation is uneven. Little information appears to flow among industrial firms: most plants are isolated and unfamiliar with what others are doing in energy conservation. Several managers spoke wistfully of the "good old days" of central planning, when technical directives and instructions came out regularly from the government or industrial trusts. Now they receive little guidance.

The project relied on a cadre of energy auditors to establish successful examples that could be replicated by other plants. However, project-supported efforts have not spread widely. Replication within an industry or even within a geographic region is limited. Hungary lacks the institutions that disseminate information in the West: trade associations, technical societies, industry newsletters and seminars, and, in particular, private sector equipment salesmen. As in the West, private sector and commercial providers are needed to spread the message.

Effectiveness

The program was effective at reaching target groups, and benefits have continued. But continuing effectiveness depends on the willingness of firms to make energy-saving investments, and that depends on four factors. First is the *business climate.* As Hungarian industry goes through economic restructuring, individual firms face major problems. They realize they should improve their energy efficiency, but other tasks—finding working capital, maintaining production, finding markets—seem more immediate to the firm than investments to improve energy efficiency. When a company concentrates only on the short term, there is little interest in trimming costs. Right now, most firms are thinking short-term.

The second factor is *availability of capital.* Government capital needs are great, and the government has crowded private borrowers out of the marketplace. The small amount of credit available to private companies is offered on very stiff terms. Most firms find it impossible to borrow from financial institutions. Thus they depend on their own resources and are usually reluctant to make investments. Even when they do have the money, energy-saving investments often rank very low.

The third factor is *energy prices.* Until recently, energy was cheap; many Hungarian businessmen still have a mind-set toward cheap energy and operate factories with machinery and production processes so designed. Even though the government expects to have energy prices fully cover costs by the end of 1996, most factory managers are reluctant to junk energy-inefficient equipment.

The final factor is a factory's *energy intensity.* Companies for which energy is a major share of costs have a strong incentive to make energy-efficient investments. The USAID project targeted those firms, and the strategy paid off. It

would have been much harder to win adoption in industries for which energy is a minor part of production costs.

LESSONS LEARNED

1. **Energy conservation measures are first and foremost business investments. The type and level of investment a firm is willing to make depends on the business climate and the attitudes of business managers.**

With the end of Hungary's socialist economy, many firms find they are using obsolete manufacturing equipment to produce goods that are difficult to sell in a competitive market. Although managers would like to lower costs, most efforts are directed at short-term, low-cost measures to increase production and sales.

Because of high inflation and the government's insatiable demand for credit, private industrial companies find it difficult to find capital for energy-saving investments. Most firms must self-finance energy conservation measures. A large part of the problem is macroeconomic; as long as inflation is high and government borrowing demands are large, little credit will be available for private investors.

The key is how business managers react to this climate. Some have a can-do entrepreneurial attitude, whereas others continue the passive caretaker approach they followed under communism.

2. **When energy is cheap, little incentive exists to use it efficiently. So long as the government provides major energy subsidies, broad-based energy conservation is difficult.**

Under socialism, cheap energy encouraged energy-intensive investments that now make many Hungarian firms uncompetitive. In the last few years the government has raised energy prices, but recently, with high inflation, real energy prices have fallen. In most cases, industry pays energy prices reasonably close to real costs, but household energy users are heavily subsidized. (The government has pledged that by 1997 it will bring all energy prices to the point where they equal real costs.)

3. **Without adequate incentives it is difficult to find capital to fund energy-saving investments.**

It Takes Money to Save Money

At the Mohacs Fiberboard Factory, equipment is 40 years old and technology is at least 50 years old. Management sees the need to modernize and figures it would take $3 million to buy the necessary equipment. With new equipment, product quality would improve, labor costs would drop, energy costs would fall sharply, and output could increase by 50 percent or more. The equipment could pay for itself in three to five years. However, the company is unable to find domestic financing. It will continues to operate outdated equipment, and its future is bleak.

Experience in the United States shows funding for energy conservation will be provided only when the market provides an opportunity to make money. In the United States, starting in the mid-1970s, energy prices rose sharply, and the states and federal government established incentives to make energy investments attractive. These included insurance, tax incentives, loan guarantees, free audits, and free equipment. In addition, mandatory energy-efficiency standards for buildings and appliances were phased in. These incentives and higher energy prices created a market for energy-efficient equipment and materials. *Hungarian government policies are too weak to stimulate such a market.*

4. **Privatization can bring in new capital, new management, and an interest in energy conservation, but is most successful when it brings in a foreign company with deep pockets and a commitment to compete in the international marketplace.**

State-owned firms are carrying on much as before. With a secure market and government subsidies or guaranteed prices, they stress production rather than efficiency or costs. Many so-called privatized firms are still majority owned by the national government or by a municipality; they are not really privatized. Energy conservation is of minor interest.

Hungary has started to privatize its economy, and many newly privatized firms have a strong interest in energy conservation. But much depends on the type of privatization that takes place.

Companies awaiting privatization or those that have been privatized by turning the factory over to previous managers and workers are often as uninterested in saving energy as state-owned firms. These companies need to worry about markets and costs, but they lack capital resources to invest in equipment modernization and energy efficiency. They can pursue no-cost and low-cost energy investments but cannot afford major investments.

The most responsive companies are likely to be privatized firms with a foreign partner to bring in technology, management, finance, and marketing skills. They also are concerned with cost controls and take a strong interest in energy conservation. They have the money and are willing to make energy conservation investments with a longer payback.

5. **So long as the public and business fail to see energy and pollution as urgent issues, NGOs and special-interest groups will have a limited role, and the government and legislature will be slow to act.**

Since energy and pollution are not viewed as serious problems, energy and environmental NGOs and special-interest groups play a small role in a limited public debate. On the question of energy conservation, the government, industry, and NGOs all agree on the solution: prices must rise and energy subsidies to households must be sharply limited and targeted to those most in need. *The problem is when and how to make politically difficult changes.*

Public education programs must be developed and coordinated by the government and NGOs. Awareness of the links between energy production, energy prices, and pollution take a long time to instill. Such programs are entirely lacking now.

6. **Energy conservation is more than "hardware" (equipment and machinery). Even more important is "software" (management, finance, and marketing), and the United States has much to offer on the software side.**

Under socialism, production and output were supreme. Business planning, marketing, finance, and energy conservation were not needed. Now they are.

Hungarian engineers are good technicians, but they need to learn a new way of approaching problems. *The most important part of the USAID projects was the introduction of new ways of thinking—for example, the total practice of energy management, energy operations and maintenance, financial analysis, and marketing.*

7. **Long-term energy conservation requires an independent regulatory body (a public utility commission) that supports economic prices, minimizes cross-subsidization, has a framework for public participation, and develops rate structures that support conservation.**

Hungary is well ahead of other Eastern European countries in energy management, having set up in 1994 the Hungarian Energy Office to regulate wholesale and retail prices and to define responsibilities and relationships among energy companies. But rules and procedures

are not fully in place, and the Ministry of Industry and Trade and municipal governments still determine most energy prices—often on a political rather than an economic basis. Uneconomic prices and subsidies continue to send the wrong signals to energy users and providers. *Energy regulations for electricity and gas producers and distributors must be well defined. In Hungary they are not yet in place.*

8. **Good energy conservation technology is not enough; effective and continuing dissemination is needed.**

During the USAID program a number of energy conferences and training sessions covered practical industrial problems. But since the end of major USAID involvement, few seminars have been conducted. There are organizations for government operations (such as the Hospital Managers Association and District Heating Managers Association) and for broader technical audiences, but little such support exists for industrial energy managers. In the West a panoply of consultants, newsletters, equipment salesmen, trade associations, and other sources of technical interchange keeps managers abreast of technological developments. In Hungary those information sources barely exist. *When USAID designs a project, it should also consider a longer term dissemination strategy that relies mainly on the private sector.*

9. **Pollution controls do more than just cut down on pollution; they can discourage wasteful and inefficient energy consumption, but only if the government takes a strong initiative.**

As the Czech Republic demonstrated, pollution control may be one of the most effective ways both to cut harmful emissions and to improve energy efficiency (see Impact Evaluation PN–ABS–546, *Saving Energy in the Czech Republic*). But it has not been important in Hungary. The government has talked about the importance of pollution control and has strong measures on the books, but it has done little to enforce laws or change practices. Neither the government nor the public is seized with the issue.

10. **If the objective is to cut back on energy consumption, efforts directed at heavy energy users may be the best approach.**

If energy is a major cost of production and fuel costs are "expensive," major energy conservation measures will be adopted. Ore smelting, district heating, and some heavy industries are major energy users. By contrast, for most manufacturing and processing companies, energy is a minor part of production costs and thus these enterprises are not ideal candidates for energy conservation activities. *The USAID program achieved high financial and economic rates of return by concentrating on firms that were moderate to large energy users.*

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