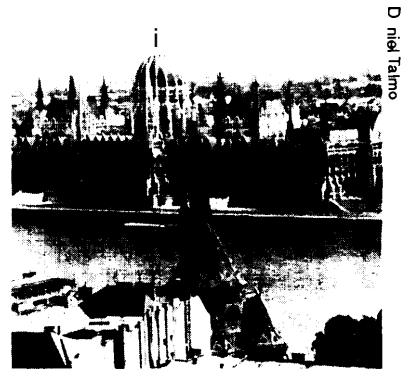


Introduction 1

Euphoria over the dramatic events of the past 3 years in the former Communist countries of Europe has yielded to a realization that converting to a free-market economy will be very difficult. The old economic system focused almost exclusively on the quantity of production rather than quality or cost, which resulted in an astonishing waste of inputs such as labor, materials, and energy, as well as a near total disregard for the environment.

Introduction of economic reform has had varying degrees of success. In Hungary, Poland, and the Czech Republic, signs of progress are clearly apparent, although their economies have not yet rebounded. Reforms in the newly independent states of the former Soviet Union and other Eastern European countries are hampered by problems such as internal political struggles, ethnic strife, an outdated industrial infrastructure, and a mindset that finds market incentives an alien concept. Termination of old economic systems without replacement by new, functional systems has resulted in economic chaos, which itself has made further reforms more difficult.

The United States has a clear national interest in seeing these nations succeed in their transition to prosperous, democratic societies. The trillions of dollars spent over the past several decades in defense against these same countries underscore the value of their present friendship. If the reforms fail, particularly in Russia, authoritarian factions could seize power and start a new cycle of hostility. Even the smaller countries have enormous potential for causing harm, especially considering all the nuclear weapons and expertise that could be unleashed on the world market. On a more positive note, these countries could become major markets for U.S. goods and services.



Parliament Building, Budapest.

6 Energy Efficiency Technologies for Central and Eastern Europe

Energy is a key factor in economic reforms. The Soviet Union was the world's largest producer of petroleum and a major exporter on world oil markets. In fact, oil exports were by far the largest source of foreign exchange and apparently propped up an otherwise bankrupt system for far longer than would have been otherwise possible. Exports have declined along with production over the last several years, but a turnaround is possible, especially with western technology. Additional hard currency revenues from increased exports of oil are likely to be essential in funding the rebuilding of the industrial sector. The region, especially Russia, is also extraordinarily rich in natural gas, coal, and uranium.

As important as increasing production will be, the greatest gains, especially over the next 5 to 10 years, are likely to be from efforts to upgrade the use of energy. The great natural resource wealth of the region led to the sense that energy was inexhaustible. Central planners kept energy prices low in order to facilitate industrial production and social welfare. The result was what appears by western standards to be extraordinary profligacy in the use of energy. For example, radiators in many buildings cannot be adjusted, so people open windows to regulate the temperature, even in bitterly cold weather. At some industrial facilities, over half the process steam is lost through leaks; the U.S. norm is less than 5 percent. Reducing this waste means that the services required can be performed with less energy, i.e., with higher efficiency.

In the United States, the efficiency of energy use has improved dramatically since the rapid price increases of 1973-74. Energy consumption per dollar of Gross Domestic Product declined by 27 percent from 1973 to 1991.¹ This improvement has been the result of many small changes in each sector. For example, industrial facilities have

installed equipment to capture heat that formerly would have been exhausted to the atmosphere; houses have been insulated; and automobiles are lighter and have greatly improved engines. Typically, some additional investment is required to improve efficiency of equipment and facilities, but the energy savings return the investment several times over.

Such improvements **did not occur in the** centrally planned economies. Implementing them now can eliminate the need for large quantities of energy. Excess fuel then could be exported from the region. The increase could be in the range of millions of barrels per day of oil equivalent, providing a major increase in revenues to oil exporting nations, especially Russia. Improved efficiency would also benefit the oil importing countries of Central and Eastern Europe, which now are suffering serious shortages because of an inability to pay for all their needs. Reducing energy consumption in all these countries also will reduce pollution in one of the most polluted regions of the world. In addition, carbon dioxide emissions would drop with the reduction of fossil fuel combustion, significantly slowing global climate change.

The United States will benefit as well from these improvements. World energy prices should decrease with the increase in exports. As the world's largest petroleum importer, the United States will benefit from increased supplies on the world market.

The market incentives now being introduced as part of economic reform will help reduce waste. Energy that could be exported, or must be imported, costs the nation the full world price. Subsidizing the price to consumers may be a necessary short-term social policy during the transition, but it can be an extremely expensive policy. As prices rise to the level of real costs,

¹ U.S. Department of Energy, Energy Information Administration Annual Energy Review 1991, DOE/EIA-0384(91) (Washington, DC: U.S. Government Printing Office, June 1992), p. 27. About two thirds of this improvement was from improved efficiency and the rest from structural shifts within the economy, as discussed in *Energy Use and the U.S. Economy*, OTA-BP-E-57 (Washington, DC: U.S. Government Printing Office, June 1990).

energy users can find ways to provide energy services with less energy. As economies revive, modern industrial facilities, designed from the ground up to minimize costs, will replace out-moded ones. Such facilities can capture all the advantages of the retrofits applied to old facilities, plus many more that are fundamental to the basic processes involved.

However, both energy reform and economic reform are proving difficult and slow to implement. Energy prices in some countries are still controlled well below world levels, reducing the incentive to control waste. Even at subsidized prices, many attractive efficiency investments are available, but industrial managers still ignore them for various reasons, including unfamiliarity with the entire concept of cost control, lack of funds to make any changes, or institutional barriers such as concern that they would not be able to keep the savings,

Furthermore, it has become clear in the United States that market incentives by themselves do not lead to an optimal use of energy, especially considering externalities such as environmental damage and security that affect the national interest. Even in an open market economy, many barriers to the implementation of economical efficiency improvements exist. These barriers include such factors as the higher initial cost of energy-efficient equipment, poor information about the availability of such equipment, and the lack of accounting for external costs such as pollution.

U.S. assistance in promoting energy efficiency directly can be an effective supplement to economic reform. It can provide financial breathing room to the new market economies by reducing costs and increasing exports. It can ease the pain of economic reform among energy users, thereby allowing reform to proceed more rapidly. In addition, these measures may provide tangible examples of how to implement modern technology and respond to market incentives, which could create the initiative to pursue other improvements. Furthermore, the increased expertise should be important in ensuring that energy



Larry Markel

Uncontrolled emissions from a combined heat and power plant in Poland.

efficiency is given due consideration in the design of new facilities. However, it is possible to overemphasize energy efficiency. Programs must be designed in the context of the overall effort to help the nations of Central and Eastern Europe in order to achieve optimal, balanced results. Furthermore, there is no guarantee that all these nations will make a successful transition to free markets and democracy even with generous assistance. Some funds may be wasted.

This report presents the interim results of an analysis of the technologies the United States could supply to help reduce energy waste, and what the consequences are likely to be for all parties concerned. It addresses questions of improving the efficiency of energy consumption, i.e., using less energy to perform a given service.

The final report, to be published in 1994, will complete the analysis of energy efficiency and also address issues of increasing the production of energy, in particular petroleum and natural gas. In addition, the energy industry itself wastes large amounts of energy during production, processing, and delivery. The final report will analyze technology transfer to reduce this waste. It will also include nuclear safety and control of pollution in the energy industry.

Technology transfer, a process of conveying information necessary to improve some capability to design or produce goods and services, is likely to be the best help the United States can offer to promote development in Central and Eastern Europe. The key is information. Sending radiator valves and thermostats would help save energy, but would not add new capability. Examples of technology transfer include design concepts for efficient buildings; manufacturing capabilities for new building materials; training for energy auditors; even the expertise to design appropriate building codes. Ultimately, these countries will have to rebuild their own economies. The West cannot do it for them, but supplying new capabilities will accelerate the process.

Technology transfer can be accomplished by government, industry, or private institutions. Industry is likely to be the most important actor, through direct investment, joint ventures, and training to accompany sales. Education also is very important. A great many foreign students in U.S. science and engineering programs return home with a sophisticated technological back-

ground as well as potentially important links with the United States.

The U.S. Government can supply technology directly through assistance programs, agency contacts, and access to databases. However, the need is likely to greatly exceed available government resources. This report considers how to get the most out of the funds that will be available. In addition, U.S. policies can be an important determinant for industry and other groups through trade promotion, foreign assistance, export controls, bilateral agreements, tax policies, and other means.

This study focuses on the Central European countries Poland, Hungary, the Czech and Slovak Republics, and Eastern Europe, including Russia, Ukraine, and the Baltics. All the countries of the region share some common attributes, including the problems of making the transition from command to market economy. However, they also show great differences. Even the former Soviet Union is now 15 sovereign nations which will follow different paths, whether or not the Commonwealth of Independent States, a loose alliance of most of them, succeeds. These differences must be considered when designing assistance programs. Thus analyzing the situation is extremely complex, made more so by difficulties in getting reliable, up-to-date data. This study is not an exhaustive survey of all the energy problems in that region, nor of all the opportunities for U.S. technology transfer. Rather, it seeks abroad understanding of the problems, the potential role for U.S. technology in addressing them, and the U.S. interests and options in doing so.