Exporting Integrated Resource Planning to Less-Developed and Post-Communist Countries

Marc R. Ledbetter, American Council for an Energy-Efficient Economy
David R. Wolcott, RCG/Hagler, Bailly, Inc.
Mark J. Cherniack, International Institute for Energy Conservation
Carl Pechman, New York State Department of Public Service

After more than ten years of refinement in North America, Integrated Resource Planning (IRP) is ready for export. Extensive environmental damage, capital shortages, and low levels of energy efficiency make less-developed and post-communist countries (LDCs and PCCs) good candidates for application of IRP. The authors' recent work in several of these countries has identified a number of important issues to be considered when applying IRP in LDCs and PCCs, including problems with importing efficient equipment, structuring programs to cope with widespread business failures, understanding how low-labor costs change demand-side management (DSM) considerations, achieving high environmental leverage from DSM, encouraging private sector involvement in the export of IRP and DSM, and using IRP to consider new industry and regulatory structures. Suggestions are made for overcoming problems and taking advantage of opportunities.

Introduction

A rapidly growing number of countries around the world are expressing interest in implementing North American-style Integrated Resource Planning (IRP) in their electric power sectors. (For readers unfamiliar with IRP, see Box 1 at the end of the paper for a brief definition.) Of course, IRP as practiced in North America will have to be modified to suit each country's needs, but IRP is a highly flexible and adaptable approach to power planning and is suitable for a very wide range of power industry structures and regulatory environments.

For several reasons, it appears that application of IRP to less-developed countries (LDCs) and post-communist countries (PCCs) will proceed rapidly in the 1990s. Among the more prominent of these reasons:

1) Electric power demand is growing very rapidly in many LDCs It averaged 7.8 percent per year between 1973 and 1987. There is potential for it to grow rapidly in PCCs (Levine et al. 1991).

2) The environmental damage associated with power production and consumption in these countries is substantially higher than in developed countries, especially in Eastern Europe and the Commonwealth of Independent States, most of whose power comes from coal plants with few environmental controls (Coopers and Lybrand Deloitte 1991).

3) Capital for the electric industry is critically short in most LDCs and PCCs, and must be borrowed from foreign sources.

4) Electric energy use in these countries is typically very inefficient, which makes the potential demand-side management (DSM) resource unusually large (IIEC 1991; Bashmakov 1992).

This paper addresses application of IRP to less developed and post-communist countries, and specifically, discusses how application of IRP will be different from the North American experience. It focuses on the DSM component of IRP, mainly because this resource has been largely ignored in these countries, and because, as said above, the potential DSM resource is believed to be so large. Despite this paper's focus on DSM, the authors believe that IRP will also deliver substantial supply-side benefits to these countries, particularly improved use of independent power generation and combined heat and power plants providing heat to district heating systems.

Although IRP has not been implemented in these countries yet, several of them are working toward its implementation. Some of the initial efforts are yielding information that should be useful to others involved in applying IRP outside of North America. Most of the information for this paper was gained from the authors' experiences in working on IRP and DSM in Thailand, Poland, Czechoslovakia, and the Commonwealth of Independent

States. Ten prominent problems or issues of applying IRP in developing and post-communist countries are listed in Table 1 and discussed shortly in the following section.

Table 1. Ten Major Issues in Applying IRP and DSM in Developing and Post-Communist Countries

1. Uncertainty of Industrial Facility Survival
2. IRP as a Vehicle for New Industry & Regulatory Structures
3. Low Labor Costs and its Effect on DSM Cost-Effectiveness
4. Evaluating Costs and Rate Design
5. DSM's High Environmental Leverage
6. IRP and DSM Training
7. U.S. Private Sector Export of IRP and DSM
8. Imported Equipment is Expensive
9. Financial Integrity of Utilities
10. The Need to Prove Savings

Issues in Applying IRP in Less-Developed and Post-Communist Countries

Uncertainty Over Which Industrial Facilities Will Survive the Economic Transition

Except in DSM bidding, all of the utility-sponsored DSM programs in North America are offered to customers without discriminating on the basis of customer financial health. A financially weak company or homeowner is offered the same kind of financial incentives in DSM programs as a financially strong company.[1] This approach is made possible because of the relatively stable economic environment in North America, and it is made desirable because it avoids the expense of financial reviews of DSM program participants.

In the highly unstable economic environment of Eastern Europe, a large number of industrial and commercial facilities are being closed, many of them permanently. This situation creates a difficult challenge to the successful implementation of utility-sponsored DSM programs. Special precautions will probably have to be taken to avoid a high rate of loss or non-performance of utility DSM investments.

Simple financial reviews of companies applying to participate in DSM programs probably won't be adequate. Most of these companies have had very limited exposure to the free market. Furthermore, their financial records are usually based on accounting methods inconsistent with the West's. The amount of time required to conduct an accurate financial review of each company applying for participation will probably be prohibitively expensive.

Utilities will probably have to turn to other measures to protect their DSM investments. For example, rather than depending heavily on rebates for efficient equipment installation as do North American utilities, they could choose to depend heavily on equipment leasing arrangements in which they have the right to remove equipment from failed businesses and closed facilities.[2] Although the cost of labor in North America often makes it prohibitively expensive to remove and reuse many types of energy-efficient equipment, very low labor costs in Eastern Europe will tend to make equipment removal and reuse relatively attractive.

The problem of non-performing DSM measures will largely be restricted to the industrial sector, where business failure often leads to abandonment or long-term closure of facilities. The problem will most likely be uncommon in commercial and residential buildings, which are in short supply throughout Eastern Europe, and thus much less likely to be abandoned or closed for long periods. Unfortunately, however, electrical use is heavily concentrated in the industrial sector. For example, in Czechoslovakia, 67% of final electricity consumption was in the industrial sector in 1988 (Marousek 1992).

Using IRP as a Vehicle for New Industry Regulatory Structures

In Eastern Europe, the entire nature of the electric utility industry and its relationship to government is in a state of flux. Existing decision making structures may not be poised to implement the types of change suggested by IRP. Although IRP is highly adaptable to many regulatory and industry structures, as demonstrated in North America, it is easy to envision some structures that would limit the attractiveness of IRP.

IRP could be used as a vehicle to consider new industry and regulatory structures (Ledbetter 1992). It could identify important financial flows, transmission interties, and other important matters that would make IRP work especially well. An example of how IRP could be used to implement a new industry structure can be found in Russia, where there is both a shortage of capacity and

capital. All electric production is performed by state-owned utilities, which will presumably be privatized at some point in the future. There are, however, no independent power producers that can provide both capacity and capital. An IRP can provide a mechanism for introducing this type of entity into the market structure.

Low Labor Costs May Significantly Change the Typical Menu of Cost-Effective DSM Measures

Many DSM measures that are uncommon or nonexistent in North American utilities because of their high labor costs may be economic in LDCs and PCCs, due to their relatively low labor costs. For example, installing wall insulation on the exterior of masonry buildings or replacing functional windows in existing buildings with high-efficiency windows may be found to be cost-effective DSM measures in LDCs and PCCs.

Low labor costs might also enable the electric industry in developing and formerly communist countries to economically offer more customized services to their customers. Due to high labor costs within the utility, North American utilities typically package their DSM programs to limit the amount of customized service offered to each program participant. The prevailing labor costs in LDCs and PCCs may allow much more customization for each DSM investment. Clearly, a close look at many labor-intensive energy saving programs and measures that have been largely ignored in North America is needed in LDCs and PCCs.

Evaluating Costs and Rate Design

The transition from a centrally planned to a market economy will dramatically alter the types of costs that PCC utilities are facing. All of the major factors in the utilities' cost of service will change. Furthermore, the utilities may find themselves subject to taxes and cut off from subsidies.

IRP can be used as a vehicle for establishing new cost concepts. Analyses should start with an evaluation of the current cost concepts, with particular attention to the relationship of cost to price. Cost-based rates should also be evaluated, despite the political difficulties of implementing them in many areas. While evaluating costs and prices, analysts shouldn't be surprised to find industrial prices above residential prices, as they still are throughout Eastern Europe and the Commonwealth of Independent States. The fundamentals of rate design are different in a planned economy.

New cost concepts will be important in maintaining the financial viability of the utility and evaluating new supply- and demand-side options in a consistent framework. Furthermore, the development of the relationship of costing concepts and rates provides a vehicle for training on the theory of optimal rate design and efficient rates.

DSM Will Have More Environmental Leverage in LDCs and PCCs

A growing number of states in the United States are including environmental costs in the analysis that supports their ranking of future power resources (PUCELS 1991). And not surprisingly, doing so significantly increases the attractiveness of DSM resources. The shift in the attractiveness of DSM resources due to environmental considerations is likely to be much more pronounced in LDCs and PCCs, where emissions resulting from conventional power generation are much less controlled. In the U.S., a DSM-caused avoided kilowatt hour of consumption may lead to a small reduction in sulfur emissions from a plant whose controls already remove 90 percent of the sulfur. On the other hand, a DSM-caused avoided kilowatt hour of consumption in Poland will result in a sulfur reduction that could be an order of magnitude larger, given that Poland's electric industry still doesn't scrub their emissions.

IRP and DSM Training Are Top Priorities

In most LDCs and PCCs, there is little professional experience with energy efficiency programs. Despite Thai government efforts since 1982 to promote energy conservation through studies, information, training, and a small number of foreign-sponsored demonstration projects, there is very little private sector activity offering professional opportunities for energy conservation specialists. Similarly, former energy conservation programs in Eastern Europe were small, ineffective, and of the type to be of little use as a training platform for future IRP and DSM efforts.[3]

The initiation of a comprehensive utility-based DSM program in Thailand, which calls for 225 megawatts of savings in five years, has focussed attention on the need for trained DSM professionals within the utility sector (IIEC 1991). The DSM plan calls for the establishment of a DSM office with more than 100 staff. Unfortunately, however, the nationwide economic boom has led to a shortage of engineering personnel qualified for the new positions. The private sector is offering salaries and compensation at two to three times the level that can be given to utility employees. It appears that it will take a substantial amount of time to staff the new office.

Assuming these problems can be overcome, and qualified engineering staff hired, there will remain a deep need for comprehensive training and assistance. The training needs identified during the preparation of the DSM plan include program design and management, evaluation methods, load research, market research, data analysis, technology assessment and related topics. The situation requires a substantial training effort using the services of experienced DSM professionals from North America, where most of the IRP and DSM experience resides.

The World Bank is now supporting a new feasibility assessment of a potential investment by the Global Environment Facility in the Thai DSM program, which also includes an initial training assistance program to the Thai utilities. Without the intensive start-up effort, the Thai utilities would be very slow in moving forward to meet the DSM objectives.

Because of the complete absence of DSM and IRP experience in LDC and PCC electric sectors, training assistance will have to be highly intensive and long term. The depth of need requires a more dedicated assistance effort than is typical of many international energy conservation assistance activities thus far.

One attractive approach to training that appears to have been successful in Thailand is utility-to-utility personnel training.[4] The U.S. Agency for International Development is also enthusiastic about this approach. In 1991, it launched a program for Eastern Europe in which U.S. utilities are paired with Eastern European utilities to train and advise their staffs. Unfortunately, there are severe limitations on the availability of experienced personnel from utilities in North America. In fact, there appears to be a shortage of DSM personnel among U.S. utilities (Sangamon State University and Illinois Department of Energy and Natural Resources 1991). Private DSM and IRP consulting firms, or the newly created DSM Training Institute based in Narberth, Pennsylvania, can help fill the gap, but with few exceptions, experienced firms have not entered foreign markets.

U.S. Private Sector Involvement in the Export of IRP and DSM

In efforts to export IRP and DSM from the United States to LDCs and PCCs, the focus has been on exporting information, i.e., exporting knowledge about how IRP has been implemented in the United States and about technical end-use data on DSM measures. However, another important component of this technology transfer is business-oriented. How can U.S. businesses participate in the development of energy efficient infrastructures abroad? How can the information flows be structured to include the technical, managerial, financial, and legal expertise of U.S. business people? How can contacts be brokered that facilitate business transactions that will help to make IRP and DSM a reality in the target countries?

These are questions that are being asked increasingly by federal and state government sponsors of these programs. Efforts to export IRP and DSM will have to demonstrate significant economic development benefits that accrue to U.S. businesses. And ultimately, in order for IRP and DSM to be successfully exported, an attractive, profitable market for the most experienced U.S. firms will have to be identified and developed.

For example, government leaders in New York recognized that improving the competitiveness of New York industry and building a competitive work force requires that New York compete successfully in world markets. International business activity provides a hedge to domestic firms during economic recession. Therefore, such activity in the field of DSM strengthens New York's energy efficiency industry and allows it to more vigorously participate in domestic energy efficiency markets.

To address this opportunity, the New York State Energy Research and Development Authority initiated a pilot program to broker business contacts between Eastern Europe and New York. Through the program, business and professional relationships have been established between New York organizations that offer energy efficiency products, services and information and their counterparts in Poland and Czechoslovakia. The program is assisting New York vendors of energy efficiency services and equipment to identify appropriate marketing strategies, financing, technical assistance, and timely data relevant to markets in Eastern Europe.

From experience to date in the program, it is becoming clear that the following key issues need to be resolved for U.S. business people considering participation in the markets of Eastern Europe:

- Which are the existing energy efficiency enterprises in those countries that could actually participate in joint venture partnerships? Would it be more realistic to target Western European partners as a way to get a foot in the door to Eastern Europe?

- Where will the markets be for energy-efficient products made under such joint ventures? The depressed markets of Eastern Europe, at least in the near term, are unattractive to many businesses.

- If the market for DSM products is Eastern Europe, will the multi-lateral and bi-lateral assistance programs support substantial utility financial involvement in DSM so that resource-poor customers can afford to purchase the products?

- When will legal systems exist that provide the customary protections that businesses require e.g., regarding patents, licenses, bankruptcies?

- The currencies of Poland, Czechoslovakia, and Hungary are now "internally" convertible, which, with some restrictions, allows U.S. firms to repatriate profits in dollars. However, when will these currencies become "externally" convertible, allowing normal interbank transactions essential for sustainable business activity?

These and other questions will have to be resolved as the opportunities for IRP and DSM evolve in these countries. How these matters are resolved in the relatively advanced economies of Poland and Czechoslovakia will undoubtedly provide a model for the resolution of similar issues in other, more problematic Eastern European countries and the Commonwealth of Independent States.

Imported, High-Efficiency Equipment Is Expensive

Many of the products whose use could be promoted with DSM programs are not made in LDCs and PCCs. Electronic ballasts, variable speed motor drives, glass with selective coatings, and advanced industrial process equipment typically have to be imported. And as with most countries, imported items are subject to import duties. But unfortunately, governments in LDCs and PCCs typically impose high import duties, and heavily depend on these duties as a large source of revenue. It is therefore difficult to persuade these governments to reduce import duties for most items. In most of these countries, products that are energy efficient do not receive special treatment from the tax authorities.

For the past five years the government of Thailand has allowed an import duty reduction for efficient industrial machinery. After a somewhat lengthy and complicated procedure, end-users of the equipment could have the import duty reduced to no more than 10 percent, from as much as 60 percent (Royal Thai Embassy, Office of Science and Technology 1991).

The tax reduction was also available for raw materials that could be used to make efficient products. In a recent case, a Western-based lighting equipment manufacturer in Thailand applied to the Thai government for an import duty reduction on components used to make 36 watt fluorescent lamps. They applied for reductions on the end caps and the rare earth phosphors used in the lamps. The government agreed to the rare earth materials reduction, but not the end caps since they were manufactured goods. Similarly, the manufacturer has been frustrated in its attempts to seek a duty reduction for imported compact fluorescent lamp components.

In 1990, the Thai National Energy Administration (NEA) did an analysis of the macroeconomic benefits of reducing import duties on efficient fluorescent lamps. NEA identified the reductions in the cost of purchasing imported oil for power plant fuel, the reductions of capital costs (including foreign debt service) for avoided power plants, and environmental benefits, as well as the import duty revenue to the government. The analysis indicated a benefit-cost ratio of 3:1.[5] However, the Ministry of Finance and the Customs Department rejected the recommendation for the duty reduction. No specific reasons were given. It was clear however, that there was no consistently applied government policy in this case. On one hand, there was a government policy to promote energy efficiency, and electric utilities were struggling to find capital for a massive power plant construction program. On the other hand, the Ministry of Finance and Customs Department only looked at the effect a duty reduction would have on government revenue.

Fortunately, the government of Thailand has partially resolved the problem of import duties on efficient industrial equipment by recently reducing import duties to 5 percent for all machine tools and manufacturing equipment. High import duties remain on other energy-efficient imports, and one must still apply for a reduction in duties on the raw materials used to make efficient products. Clearly, high import duties are a barrier to improved energy efficiency, and must be reduced for successful implementation of IRP.

A related problem in PCCs is that many energy-efficient, imported products that might be promoted through DSM programs are very expensive relative to similar domestically made products. The cheaper domestic products, however, are often of inferior quality and less efficient. For example, a Polish manufacturer of high pressure sodium lamps can provide its lamps at about half the cost of lamps imported from developed Western countries. Yet, the manufacturer will quietly admit their lamp has a higher rate of failure than its competitors' imported products.[6]

IRP and DSM analysts may find that domestically available, "somewhat" efficient products are more cost effective than more efficient, but much more expensive, imported products. DSM programs will have to be designed accordingly.

Financial Integrity of Utilities

IRP as practiced in the United States is based upon a regulatory structure that is designed to maintain the financial health of the electric utility. With the move from centrally planned to market economies in PCCs, there are many factors that threaten the financial health of electric utilities. For example, over the winter of 1991-92, the price of natural gas to the electric utility in Moscow increased fivefold, while the rates remained fixed. The utility had to deal with the problem of rapidly increasing fuel prices, a problem reminiscent of the oil embargo in 1973, during which Consolidated Edison was forced to skip its dividend. Regulatory structures, like the fuel adjustment clause, have been developed in the United States that can smooth the transition to a market based economy.

It is necessary to expand the scope of IRP to incorporate mechanisms designed to maintain a utility's financial health. This process must first provide a road map for the transition to a market-based economy. This can be done by incorporating financial models into the planning process. Then the IRP can provide the framework for evaluating a host of other financial considerations, such as the rate treatment of DSM expenditures.

The Need to Prove Savings

There is a growing amount of data about the potential for electricity savings from DSM programs implemented by electric utilities in North America. Although these data do not always confirm the claims made by some DSM supporters for large savings, they provide a critical level of confidence in the impact of DSM programs.

There is little such experience, data or confidence in most developing nations. To date, energy efficiency activities have typically been in the form of industrial energy audits and a few demonstration projects, aimed at all fuels, focused on selected energy-intensive industries, and sponsored by various technical organizations from developed countries. A large majority of the audits have not led to significant savings, and the results of demonstration projects have not been effectively disseminated. Almost no evaluation or follow up has been conducted on most audits or projects.

In Thailand, the single most important issue among utility managers with regard to DSM is the need for confidence in the amount of savings that can be achieved. Electricity demand has been growing at about 10 percent per year since 1987, with forecasts of continued growth at 10 percent annually for the next five years. The state-owned Electricity Generating Authority, is required to bring on line more than 1,000 megawatts of new generating capacity each year for the next 10 years to meet the current load forecast. While the utility understands that an aggressive DSM program might reduce these capacity additions as much as 25 percent, it naturally insists that it cannot afford to be wrong and end up not meeting the power requirements of the rapidly expanding economy.

The Thai utilities have committed to move forward with pilot DSM programs for new commercial buildings, commercial lighting, and industrial motors. In addition, steps are being taken to develop appliance efficiency specifications for a utility DSM program and to establish regulatory standards for appliance efficiency.

The two major components for creating confidence in the potential for savings in Thailand and elsewhere are the design of practical pilot projects and rigorous impact evaluation procedures. Engineering estimates, manufacturers' claims, and examples of savings from other developed or developing countries are informative, but in no way sufficient to make the case locally.

Recommendations to the Thai utilities by energy efficiency advocates have included the establishment of a DSM program evaluation staff to develop structured evaluation procedures for DSM program activities. In addition, several load research activities that can provide further information on the potential for energy and demand savings have been identified. Thai utility staff will need extensive technical assistance and training in a variety of DSM program design and evaluation techniques in order to produce information and analysis that will provide confidence to utility management about the potential for DSM in Thailand.

Whether significant savings can actually be achieved with DSM programs is much less of an issue in post-communist countries. There is already widespread recognition of how inefficient their economies are relative to Western developed countries, not just with regard to electricity, but with regard to the use of almost all economic resources.

Conclusion

North America now has more than a decade of experience with IRP and DSM, and is beginning to reap the substantial environmental and economic rewards of their implementation. Without question, the information, expertise, technology, and products developed and promoted through IRP are exportable commodities of great value. LDCs and PCCs are among the best candidate countries for importing IRP.

Furthermore, the tremendous rate of change in PCCs facilitates the adoption of innovative ideas. For example, while the incorporation of externalities in power production costs has met opposition in the U.S. due to the embedded interests of existing parties, it is quite possible to incorporate externalities in Eastern Europe, where extensive environmental damage from power production is universally recognized. That substantial changes are needed in the electric industry of PCCs is undisputed.

Learning how to successfully export the North American experience will be difficult, at best. But IRP and DSM are highly adaptable procedures for improving the electric power industry, reducing its environmental impacts, and improving the economies in which they are implemented. Successful adaption of IRP and DSM in other countries will require close attention to the differences between those countries and North America.

Endnotes

1. Utility-sponsored low-income weatherization programs are, obviously, an exception to this.

2. Low labor costs in Eastern Europe may make it relatively cost-effective to remove and re-deploy equipment, a labor-intensive activity.

3. Personal communication to Ledbetter from Slawomir Pasierb, Foundation for Energy Efficiency, Katowice, Poland, and from Jaroslav Marousek, Center for Energy Efficiency, Prague, Czechoslovakia.

4. Personal communication to Cherniack from Dr. Piyasvasti Amranand, Director of the National Energy Policy Office, Royal Government of Thailand, 1991.

5. Personal communications to Cherniack from Amorn Phandhu-fung, Director, Energy Economics Department, National Energy Administration, November 1990.

6. Personal communication to Ledbetter from Natrium Company, Warsaw, Poland.

Box 1. A Brief Description of IRP

IRP refers to a utility planning process that considers both supply-side (e.g., a power plant) and demand-side (e.g., an efficient refrigerator) resource options for meeting future customer energy service needs. IRP considers demand-side resources to be legitimate substitutes for supply-side resources. IRP typically yields a plan that rank orders a portfolio of resource options according to cost-effectiveness, taking into consideration environmental, reliability, availability, and other characteristics of each option. The following items are common components of IRP:

1. establishment of mechanisms, e.g., bidding, to systematically acquire cost-effective resources on a "level playing field;"

2. development of methods to provide non-discriminatory transmission access and pricing to independent power producers, including those using renewable resources;

3. incorporation of environmental costs, both direct and external, in acquiring new resources and operating existing ones;

4. provision of regulatory incentives to align utility profitability with the goals of IRP;

5. involvement of public interest organizations in the regulatory process.

References

Bashmakov, I. 1992. *Energy Conservation: The Main Factor for Reducing Greenhouse Gas Emissions in The Former Soviet Union.* PNL-SA-20400. Battelle Pacific Northwest Laboratory, Washington, D.C.

Coopers and Lybrand Deloitte. 1991. *Report on the Restructuring of the Polish Electricity and Lignite Sub-sectors in Poland.* Prepared for the World Bank. London.

International Institute for Energy Conservation. 1991. *Demand Side Management for Thailand's Electric Power System: Five Year Master Plan.* Washington, D.C.

Ledbetter, M. 1992. *Least Cost Planning in Slovakia's Electric Sector: Getting Started.* ACEEE, Washington, D.C.

Levine, M. D., H. S. Geller, J. Koomey, S. Nadel, and L. Price. 1991. *Energy Efficiency, Developing Nations and Eastern Europe: An Analysis of Key Issues.* Lawrence Berkeley Laboratory, Berkeley, California.

Marousek, J. 1992. "Energy Efficiency in Czechoslovakia," *CADDET U.S. National Team Meeting, Final Proceedings*, p. 25. U.S. Department of Energy, Office of Technical Assistance (PUCELS) Pace University Center for Environmental Legal Studies. 1991. *Environmental Cost of Electricity*, Oceana Publications, Dobbs Ferry, New York.

Sangamon State University and Illinois Department of Energy and Natural Resources. 1991. *Survey of the DSM Industry.* Springfield, Illinois.

Royal Thai Embassy, Office of Science and Technology, 1991. *Special Tariff Rate for Energy Saving and Environmental Protection Technologies.* Washington, D.C.