Implementing demand-side management through integrated resource planning in Poland

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1. SYNOPSIS

This paper describes how the U.S. model of utility integrated resource planning is being transferred to Poland to support the implementation of demand-side management programs.

2. ABSTRACT

Many of the technical and policy disciplines of integrated resource planning (IRP) have been conceived, developed and tested in progressive regulatory jurisdictions throughout the United States over the last decade. The practical effect has been a rapid increase in utility investments in demand-side management (DSM) resources. Through the support of multilateral and bilateral agencies, the U.S. model of IRP and DSM is now being exported to formerly communist countries in Eastern Europe. This paper describes the activities of the Poland DSM Project sponsored by the U.S. foreign aid program which is providing training and technical assistance on IRP and DSM to Poland. The program's tasks include work with the energy ministry and utilities to enact IRP into law, document the DSM potential in Poland, and develop and implement DSM and end-use load research programs. What makes this activity interesting is that the results will be combined with supply-side and tariff studies to produce an integrated resource plan that will be the basis for a substantial World Bank power sector loan. This activity is challenging because Poland has different energy infrastructures, pricing systems, and regulatory institutions and it is also experiencing wrenching political and economic transitions. The paper focuses on how the transfer of the U.S. IRP/DSM model will fail without sensitive recognition of conditions in Poland and appropriate adaptation.

3. INTRODUCTION

The Energy Sector Restructuring, Privatization, and Regulatory Reform Program of the Government of Poland, which is currently underway, aims to:

(1) liberalize energy prices and eliminate subsidies as far as possible;

(2) promote enterprise competition through the elimination of barriers to market entry in all productive sectors which are not "natural monopolies;" and

(3) transform the governance, ownership and control, and regulation of state-owned enterprises.

These reforms are expected to revitalize the energy sector, enhance its long-term financial viability, and encourage economically optimal investment and consumption decisions. The program is being conducted with the assistance of the World Bank, the United States Agency for International Development (USAID), and other bilateral agencies (World Bank 1991).

In order to guide the future development of Poland's power sector, the Energy Sector Program includes an integrated resource planning component through which both supply-side and demand-side resources are being identified that produce a mix of energy resources which yield the least cost to society. Several teams are contributing to the development of the integrated resource plan in a two phase program. Under Phase I, A USAID Electricity Transfer Pricing and Retail Tariff Study is underway to formulate an electricity

pricing strategy. An Austrian team has commenced the formulation of a Supply-Side Development Plan. This paper describes the efforts of another USAID team to identify and assess demand-side resources (the Poland DSM Project). Once these Phase I supply-side and demand-side activities have been completed in mid-1993, Phase II will commence with the formulation of the integrated resource plan using the results of these studies. The integrated resource plan will then be the basis for power sector loans from multilateral development banks (MDBs) such as the US$ 1 billion loan that is set for appraisal by the World Bank between late 1993 and mid-1994.

4. DEMAND-SIDE MANAGEMENT

End-use energy-efficiency in the electric utility sector is referred to as demand-side management (DSM). Demand-side management programs involve the identification, use, and evaluation of demand-side resources such as energy conservation, the reduction of kilowatt hours (kWh) of energy consumption and load management, the reduction of kilowatts (kW) of power demanded or the displacement of demand to off-peak times. DSM encompasses a broad range of measures to encourage consumers to modify their consumption. Tariffs can be designed to stimulate a shift in consumption to off-peak periods. End-use energy efficiency can reduce both energy and peak power demand. Direct load control can likewise limit peak power demand. Low cost/no cost opportunities abound; often it is a matter of providing the right incentives or information to utility consumers.

In the last five years, utilities in the United States have been relying on DSM to meet their resource needs at a rapidly increasing rate. Based on these efforts, it has been estimated that full adoption of all cost-effective DSM measures could reduce the U.S. aggregate electricity consumption by 22-42 percent (Fickett et al. 1990). It has been further estimated that roughly half the cost-effective potential is functionally achievable, meaning that utility DSM programs are conservatively expected to provide for 10-20 percent of electricity resources in the U.S. (NYSERDA 1990).

Such technical potential translates into large capital investments. For example, the most aggressive DSM programs (e.g., those being implemented by New England Electric System and Puget Sound Power & Light) are spending 4-5 percent of those utilities' gross annual revenues. While this level of activity is increasingly common in New England and on the West Coast, the national average of utilities with DSM programs is more like 1-2 percent. Even at the average level, the U.S. market for DSM investments is estimated to be $30 billion annually by the year 2000 (Vallen 1991).

5. INTEGRATED RESOURCE PLANNING

The great interest in DSM in the U.S. has been the result of utility and regulatory recognition of the resource represented by a utility customer's electricity usage. Utilities and regulators have come to understand that electric resources exist on the customer's side of the meter and it may be as cost-effective to reduce electric demand in a customer's facility as to build expensive new power plants. This understanding has spawned the fundamental regulatory reform phenomenon in the U.S. called integrated resource planning (IRP).

Integrated resource planning is a comprehensive process through which utilities identify and acquire the most cost-effective electric resources necessary to meet their customers incremental requirements for energy and power. IRP provides significant changes to the way that utilities traditionally have conducted business and also provides a strategic context in which to better understand the importance and role of demand-side management.

IRP is often called "least-cost" planning which refers to the acquisition of electric resources by utilities at the lowest possible cost to themselves, their customers and society at large. "Electric resources" are available throughout the entire power system from the point of generation to the point of consumption. They include the traditional supply-side measures that provide megawatts from construction of new generators, repowering and rehabilitating existing generation facilities, and purchasing power from

wholesale markets or independent power producers. Electric resources also include measures that provide "negawatts" from efficiency improvements in generators (better heat rates), the transmission and distribution system (fewer line losses) and at the end-use (demand-side management).

In determining which are the most cost-effective resources to a utility, it is important to calculate costs and benefits properly. Utilities have traditionally calculated costs and benefits strictly from their own perspective. Thus, the benefits of a DSM program (utility avoided operating and capital costs) would have to exceed the costs of the program (administrative costs, financial incentives, and lost revenues from reduced consumption) for the program to be cost-effective. From this utility perspective, the most cost-effective DSM is that achieved by load management, preferably the shifting of load from peak to off-peak times.

An important innovation of IRP is the inclusion of costs and benefits of the utility's customers. Thus, customer bill savings from DSM add a tremendous benefit that makes a number of energy efficiency measures cost-effective. Adding the customer's perspective to the cost/benefit analysis is increasingly important in economies such as Poland's that are struggling to be competitive in world markets. Another innovation of IRP is the inclusion of benefits to society from the acquisition of electric resources that are environmentally benign, such as DSM and most renewable resources. The reduced social costs from reliance on technologies that do not create pollution from the combustion of fossil fuels are increasingly important in a country like Poland that has suffered tremendous environmental damages from uncontrolled power generation.

It would be safe to say that IRP is sweeping the U.S. as a phenomenon that is being incorporated into regulatory practice. The Edison Electric Institute (EEI) found that IRP is under way in 26 states through regulatory orders, backed up by legislation in 15 states (EEI 1992). Lawrence Berkeley Laboratory (LBL) has determined that the IRP concepts originally developed for electric utilities have been extended to natural gas regulation in 15 states (LBL 1991).

6. THE POLAND DSM PROJECT

Through the support of multilateral and bilateral agencies, the U.S. model of IRP and DSM is now being exported to less developed and formerly communist countries. This activity is challenging because each country has different energy infrastructures, pricing systems, and regulatory institutions. Perhaps no where is the challenge more daunting than in the formerly communist countries of Eastern and Central Europe and the former Soviet Union which are experiencing wrenching political and economic transitions. The Poland DSM Project is the most prominent activity in this regard, made more important as a precedent and model for MDB financing of DSM investments in the post-communist world.

Under the Energy Sector Program, the Polish power system is evolving to consist of five generation companies, a single transmission company (the Polskie Sieci Elektroenercetyczne (PSE) or Polish Power Grid Company), and twelve local electric distribution companies (Coopers & Lybrand 1991). Power transfer pricing and retail tariffs are based on cost-plus principles designed to yield acceptable profit margins for each entity. Although there are no direct government subsidies to any of the Polish power entities, the widespread undervaluation of assets allows tariffs to be set at levels ranging from US$ 0.03 to 0.06 per kWh (plus relevant demand charges) depending on the tariff class, below the expected long-run marginal costs (Popczyk 1992).

Total installed public generation capacity is approximately 29,000 MW, compared to peak demand of around 22,000 MW. Approximately 57% of generation is based on hard coal and 43% on lignite. Peak demand occurs in the winter on a seasonal basis, and in the evenings on a diurnal basis. As a result of the continued recession in Poland, electricity sales in the country have fallen by 16% over the last three years, but now appear to have stabilized around 96,000 GWh annually. Load forecasts vary widely reflecting the uncertainty of overall economic trends (RCG/Hagler, Bailly 1993 (1)).

It may seem irrational for Polish utilities to try to sell less of their product, especially with a 30% reserve margin and declining to flat sales. However, the fundamental institutional changes resulting from the

Energy Sector Program present a unique opportunity to develop a lasting framework for optimal power system planning and operation. For example, the current reserve margin is not that much more than the 20% level currently deemed prudent for Poland. As the economy improves, load will eventually increase, especially if the rate of electrification increases as Poland's economy modernizes. Also, if old, polluting generating units are shut down before normal retirement, further capacity may be needed. Because it is uncertain when these events will happen, an institutional framework that encourages IRP should be developed now so that effective DSM responses will be available when they are needed.

There are several other reasons why Poland should be interested in IRP and DSM. First, If IRP is implemented in Poland to account for societal costs, then environmental costs of the severe pollution damage will weigh heavily against the coal-based power plants which account for virtually all of electricity generation. DSM will offer immediate environmental benefits.

Secondly, by adopting DSM, electric consumers will forego energy costs that would have otherwise been incurred, allowing them to price their products more competitively. Overall energy intensity in Poland is two to three times higher per unit of gross national product compared to Western European countries. Clearly, there is considerable scope and justification for DSM programs which emphasize energy efficiency that will increase the competitiveness of the Polish economy.

Thirdly, whereas utilities which rely solely on conventional supply-side resources such as power plants often view themselves as commodity producers, utilities which tap the potential of DSM perceive themselves as service providers, i.e., they are in the business of meeting consumer needs rather than simply producing kilowatt hours. Adopting a customer service approach is an important step as utilities leave the central planning mentality behind.

Finally, a DSM industry will create a new labor market for high skilled energy service workers. The creation of jobs will be an important benefit to Poland's economy which is facing substantial unemployment from the post-communist transition, made worse as coal mines and old power plants are shut down. An energy services industry will also contribute to an economy that needs to move from a heavily industrialized past to a more service oriented future.

To deliver these potential benefits, the Poland DSM Project has the following objectives:

(1) To establish an institutional and regulatory framework in Poland that will support the development of integrated resource planning;

(2) To identify DSM resources in Poland which should be considered within the context of an integrated resource plan;

(3) To evaluate the costs and benefits of these resources to support their appraisal in MDB power sector loans; and

(4) To assist Polish authorities to develop a lasting institutional capability within the government, the utilities, and the private sector to design, implement, and evaluate DSM programs.

The Poland DSM Project is being carried out through the following activities which simultaneously address the need for institutional development and DSM data collection and assessment at the national level, and the need to develop capabilities at the local electric distribution companies for the accelerated implementation of DSM and end-use load research programs.

6.1 Institutional development

The legislative and regulatory framework under which the power sector operates in Poland must ensure that IRP is the most profitable plan for the utility as well as the least-cost plan for its customers and society at large. Draft national energy legislation introduced in May 1992 and now pending before the Sejm (Parliament) may provide an opportunity to create a system that encourages the use of DSM when justified.

Through the Poland DSM Project, the Polish Ministry of Industry and Trade and its Energy Restructuring Group (an advisory body established by the World Bank) are reviewing proposals for different legislative and regulatory mechanisms that encourage the implementation of IRP, covering the following topics:

6.1.1 Development of an integrated resource plan

The draft Energy Law requires that an energy plan be developed by the Ministry of Industry and Trade every two years. It appears this plan is intended to support government policy with subsequent plans to be developed by a newly-created Energy Regulatory Agency (ERA) that will address specific actions by energy producers and consumers. ERA may be given the responsibility for overseeing the development by PSE of a detailed integrated resource plan for the electric sector which would include the following components:

(1) Identifying the objectives of the plan (e.g., reliable service, minimal environmental effects, low cost of environmental controls, meeting peak demand in a cost-effective manner, and minimal bills for electricity customers);
(2) Developing one or more load forecasts for different scenarios;
(3) Determining the levels of capacity expected for each year of the plan;
(4) Identifying needed resources (e.g., fuels, generating capacity, transmission and distribution capacity, a manageable load shape, and demand reductions) needed to bridge the gap between expected loads and capacities;
(5) Evaluating all of the electric resources in a consistent fashion;
(6) Selecting the most promising resources for fashioning an effective, flexible, and responsive plan;
(7) Integrating methods of supplying power with methods for controlling and moderating demand;
(8) Constructing scenarios that project the selected mixes of resources against possible economic, environmental, and social circumstances;
(9) Evaluating the economic and technical characteristics of each mix of resources under the various scenarios;
(10) Analyzing the uncertainties associated with each possible plan of action;
(11) Screening the alternatives to eliminate those that are not suitable;
(12) Rank-ordering the alternative courses of action;
(13) Testing each alternative for cost-effectiveness from a variety of perspectives (e.g., the utilities, ratepayers of different classes, and society at large);
(14) Reevaluating the alternatives considering economic, environmental, and societal factors;
(15) Selecting a plan for implementation, one that most nearly satisfies all the objectives of the plan;
(16) Developing a plan of action;
(17) Implementing the plan of action; and
(18) Monitoring and evaluating the operation of the utilities under the plan and revising the plan if necessary.

6.1.2 Authority for PSE to implement the integrated resource plan

In order for IRP to function properly in Poland, it is essential that the PSE be given the authority to implement the plan, under ERA's regulatory oversight. As the monopoly wholesale supplier, PSE should take the lead responsibility for acquiring both supply-side and demand-side resources according to the plan. "Acquiring" means arranging, directly or indirectly, for resources to be made available to the Polish electric system. PSE could acquire resources through contracting with generating companies, contracting with distribution companies for DSM resources, or requesting competitive bids for supply-side and demand-side resources.

This does not mean that distribution companies would necessarily be excluded from building or purchasing supply-side resources. As presently proposed, some distribution companies would, under certain circumstances, still be able to build and operate their own generating facilities or contract directly with generators. Presumably, however, those facilities and transactions would have been identified as cost-effective resources to be acquired under the integrated resource plan.

6.1.3 Recovery by the distribution companies of the costs of DSM investments and expenditures through electric rates

There are two mechanisms for recovering the costs of DSM in the United States: expensing and ratebasing (Nadel et al. 1992). When the cost of DSM is expensed, the utility recovers 100% of the cost of the program during a short period of time, typically one year. When the cost of DSM is ratebased, the cost is capitalized (listed as a utility investment) for a period that approximates the useful life of the DSM measure and then the full cost, plus interest and an allowed rate of return, is amortized and partially recovered each year until the full cost is recovered. In both cases, the costs are recovered from electric customers through rates. Whichever method is used in Poland, the distribution companies should have the authority to invest in DSM and recover the costs of those investments in electric rates.

Discussions with representatives of the Polish electric industry revealed that the negative impact that DSM expenditures could have on revenues and profits is a very substantial deterrent to DSM implementation. In the U.S., utilities are increasingly able to recover as program costs the lost revenues from reduced consumption caused by the implementation of DSM. Therefore, the distribution companies should also be allowed to recover revenue losses from qualifying DSM expenditures (those expenditures associated with DSM programs that meet minimum qualifications or performance criteria).

The costs of DSM need not be shared equally among all customers of the distribution companies. For example, it may be decided that the costs of industrial DSM programs should only be charged to industrial customers. Those distributions companies with a higher share of their load from industry would then have more of the costs of DSM charged through the industrial rates.

6.1.4 Ability of the distribution companies to earn financial incentives to implement DSM

For many years, state regulatory commissions in the U.S. exhorted electric utilities to increase their DSM expenditures without providing the utilities any financial incentives to do so. In fact, for most utilities, DSM was undesirable because it resulted in lower revenues and profits. This situation has changed. Many states now provide positive financial incentives to utilities to invest in DSM. These incentives take many forms. For example, some states set specific performance targets (such as for cost-effectiveness and program participation rates), and then offer financial rewards through subsequent rate increases. Other states allow utilities to ratebase their expenditures and then earn a higher than normal rate of return on that investment. Other states provide utilities a share of the total resource savings achieved by their DSM programs. Experimentation continues with many alternative approaches to rewarding utilities for acquiring cost-effective DSM resources. Regulators generally believe that such rewards are appropriate to compensate utilities for the increased risks of doing something new and relatively untested, such as implementing DSM programs. For the same reason, utilities in Poland should earn financial incentives for implementing DSM consistent with the integrated resource plan.

Without cost recovery and financial incentives, DSM (particularly DSM that focuses on reductions in energy use) is unconventional and antithetical to the normal utility course of business. For many utilities throughout the world, DSM is the opposite of what they think they should be doing. Poland will probably be no different than the rest of the world in this respect. Even if IRP is adopted in the Energy Law, there will likely be utility resistance to DSM activities, at least until utilities learn how to implement DSM programs and appreciate their benefits. Nonetheless, failure by any distribution company to implement the DSM recommended by the integrated resource plan will raise system-wide costs, even for those distribution companies that implement DSM programs.

It is difficult to judge how receptive each of the distribution companies will be to implementing the integrated resource plan's recommended DSM activities. It may be necessary to institute a mechanism that will dissuade distribution companies from refusing to participate. A possible mechanism would be a surcharge that could be added to the wholesale electric rates charged to the non-participating utility. The surcharge should be set equal to an estimate of the additional costs imposed on the national system as a result of the utility's failure to participate. Regulatory incentive approaches in the U.S. provide a comparable mechanism in the form of a penalty for utilities that implement DSM programs that fail to meet

pre-established performance criteria. Such an approach is probably premature in Poland, however, the surcharge for non-participation may be appropriate. Nonetheless, assessing a surcharge is reminiscent of the old central planning mentality and thus, may unnecessarily raise opposition to DSM by the distribution companies.

6.1.5 Provision for public involvement

Public involvement is an essential element of IRP. Ratepayers, electric utilities, generating companies, DSM equipment manufacturers and vendors, environmental interests, and the organizations that represent them should be involved throughout the process of developing and implementing a plan. Although public involvement will surely slow the process initially, the process and plan will be better for it, and the political support for the plan will be broader and stronger in the long run. Public hearings, solicitation of written comments, and procedures for adjudicating public disputes with the plan should be provided. Thus, a commitment to broad public participation should be made explicit in the Energy Law.

6.2 DSM assessment

Through the Poland DSM Project, PSE is conducting a national assessment of DSM potential to help identify promising aggregate DSM resources. This work is addressing:

(1) How electricity is used in Poland by predominate end-use in each customer class;

(2) The technical DSM potential based on "DSM supply curves" that show how much savings can be achieved by DSM technologies at what cost;

(3) The achievable DSM potential based on cost/benefit analyses of candidate DSM programs that are being defined; and

(4) The likely market penetration of DSM in Poland based on an assessment of DSM impacts and Polish economic and energy consumption trends.

This evaluation is being carried out in both economic as well as current financial terms to demonstrate the importance of tariff and tax reform to DSM implementation. The results of the DSM assessment are providing a means for PSE to identify investments in DSM resources to be included in the power sector loan from the World Bank.

DSM planning in practice is a dynamic process, continually evolving as utilities develop new levels of analytical sophistication and as corporate structural changes are made to meet integrated resource planning requirements. For this purpose, the Poland DSM Project is using a family of models developed by the Electric Power Research Institute (EPRI) in the United States to perform the following functions:

6.2.1 Development of end-use load shapes

This task is producing an understanding of where and how system and customer load shape changes are required to meet PSE's strategic objectives. It is a new type of load forecasting "from the bottom up" in which engineering estimates and end-use load research inform the characterization of customer end-use patterns and requirements. The Polish Foundation for Energy Efficiency (FEWE) and the Polish Institute for Power Engineering have been involved in data collection which has turned out to be a very difficult process. All pre-1989 data are generally suspect, as they were collected to serve political, rather than technical purposes. Additionally, very little end-use data have been archived in Poland.

6.2.2 DSM technology/measure screening

PSE is using EPRI's DSManager software model to undertake technical and economic assessments of particular DSM technologies. Sixty four candidate measures were "screened" or ranked for consideration in DSM program development, including two innovative rate measures (time-of-use and interruptible rates).

From this screening, thirty four measures (including the rate measures) were conservatively considered to be cost-effective resulting in a technical potential of 20,000 GWh or roughly 20% of consumption (RCG/Hagler, Bailly 1993 (2)). The results are summarized in a number of outputs including the amount of energy and demand savings, the cost of conserved energy and power (considering different discount rates), and the total technical potential available at less than the utility's levelized avoided energy and capacity costs.

6.2.3 DSM program assessment

PSE is also using DSManager to define utility DSM programs that could be undertaken to implement the cost-effective measures identified in the technology screening process described above. In addition to the technical DSM costs, the utility's program costs (administration, financial incentives, lost revenues) are also included. Then various cost/benefit analyses of the programs are being performed using the total resource cost and societal cost tests. Finally, the energy and demand impacts of cost-effective DSM programs are being calculated.

6.2.4 Integrated planning analysis

PSE is using EPRI's IRPManager software model (formerly called LMSTM) to integrate the results of the DSM assessment with those from the supply-side analysis and tariff study. This process includes: (1) preparation of long-range load forecasts; (2) resource planning to determine the type and timing of supply-side and DSM resources that cost-effectively meet the demand forecast requirements; (3) production costing to establish a cost-optimized mix of fuel and other operating costs to meet forecasted load at particular times; (4) financial analyses to determine the impact of resource selections on the utility's income statement, balance sheet, and source and use of funds; and (5) rate analyses to project the impact of the resource plan on utility revenue requirements and customer electricity rates. The IRPManager results will be ported to the WASP model which the World Bank is using to appraise the power sector loan for Poland.

6.3 DSM and end-use load research pilot program design

The impacts of DSM programs are difficult to assess prior to implementation because of the many factors which influence program effectiveness. Pilot programs provide opportunities to demonstrate whether proposed programs work as expected. Further information can also be gained to reduce uncertainties regarding program impacts and improve program delivery. This task entails work to identify sectors and end-uses where pilot programs would be most appropriate in Poland. The work is being performed with Zaklad Energetyczny Gliwice (Z.E. Gliwice), the largest electric distribution company in Poland, serving 15% of the country's load. It is located in the industrial heartland of Upper Silesia in southern Poland. A pilot industrial DSM program is being designed to include incentives that ensure program participation by utility customers, a marketing approach to solicit program participation, and a program evaluation plan. It is initially focusing on motors and the processes they drive. Alternative program delivery mechanisms were explored through focus groups with the utility, its customers, and vendors of DSM products and services that will participate in program implementation.

This work also focuses on developing capabilities at Z.E. Gliwice to understand how its customers use electricity, a critical component in DSM program design and evaluation. A pilot end-use load research program is being designed to include an analytical framework and load monitoring plan. In addition to whole-premise and end-use load monitoring, the load research program encompasses customer surveys and statistical analyses of billing data. To support the design of the load research program, substantial spot monitoring of utility customers' facilities was conducted using Rustrak Ranger power monitors. The spot monitoring effort was conducted in a wide range of customer facilities including single family and apartment residences, a school, a hospital, and a number of industrial facilities including a coal mine, a steel mill, and a combined heat and power plant.

7. CONCLUSION

Integrated resource planning and the demand-side management activities it engenders is principally an American concoction. As such, it relies heavily on government regulation of the utility sector for its implementation. It is also a phenomenon which is relatively new on the scene, and therefore untested in terms of its long-term impacts on the utility industry. For all these reasons, some have criticized the adoption of IRP and DSM as a key activity in restructuring the utility sectors of post-communist countries such as Poland.

Clearly, a major challenge to the transfer of the U.S. IRP/DSM model is to be sensitive to the conditions in Poland and adapt the approach appropriately. In this regard, a number of interesting issues confront the implementation of IRP and DSM in Poland (Ledbetter et al. 1992).

Foremost among these is the fact that in restructuring its electric system, Poland has adopted the "U.K. model." Five years ago, the U.K. started a radical restructuring of its electric system. From a nationalized, vertically-integrated utility, the U.K. now has a largely privatized, disaggregated utility system with separate generation, transmission, and distribution companies. This restructuring was undertaken with the primary goal of introducing competition and economic efficiency with rate stability to be the theoretical benefit to consumers.

It is still unclear the extent to which this grand experiment has succeeded in accomplishing its goal. It has become apparent, however, that the U.K. system provides significant disincentives to the development of demand-side management (DSM) as an electric resource. With tariffs based on cost-plus principles, all participants in the system are motivated to maximize their profits through increasing electric sales. There are no mechanisms to compensate or reward utilities for undertaking DSM with the result that very little DSM is currently being implemented in the U.K.

To the extent that DSM is a least-cost electric resource, this situation poses a real problem for countries like Poland that have adopted the U.K. model. If the problem is not fixed, Poland may be condemned to a utility planning and resource acquisition process that is seriously flawed from society's point of view. The fix could be accomplished through incorporation in the Energy Law of the institutional mechanisms discussed above such as an integrated resource planning process, the provision of rate incentives for DSM, or the use of a bidding process to acquire electric resources competitively.

A related issue facing the implementation of DSM in Poland is the lack of a regulatory framework. In Poland, 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 able to implement the types of changes required by IRP, unless the Energy Law and subsequent rules promulgated by the Energy Regulatory Agency allow and encourage it.

A politically charged issue is the perception that DSM will contribute to the unemployment problem which is especially great in the utility and mining industries. For example, coal mining has been hit hard by the economic transformation in Poland, both as a result of the removal of production subsidies as well as the fall in demand. The mining workforce has been cut by one-third since 1990 and 22 of 70 mines are slated for closure in the next two years. In the utility industry, a curious holdover from the communist years is that a substantial portion of employee pay is based on sales volume. In both cases, Poles are asking why DSM should be considered a resource option when it may only accelerate unemployment and raise the associated social costs.

Another issue is the uncertainty of industrial facility survival. In the highly unstable economic environment of Poland, 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 DSM programs in which special precautions have to be taken to avoid a high rate of loss or non-performance of utility DSM investments.

Another issue is that many DSM measures that are uncommon or nonexistent in U.S. utilities because of

their high labor costs may be economic in Poland, due to the relatively low labor costs. The prevailing labor wages in Poland may allow much more customization for each DSM investment, perhaps involving more direct utility installations. The programs will also probably focus more on no cost/low cost and operations and maintenance measures, compared to high technology solutions.

Finally, while the downward spiral of Poland's economy over the last three years is generally considered to be over (Economist 1993), a number of problems still remain such as currency instability and uncertainty in business transactions. These problems have generally discouraged aggressive market development and related business activity by international companies that have the capital which Poland so desperately needs to rehabilitate and modernize its economy after forty years of communism. Of course, this problem is not unique to Poland, but is also shared by the other post-communist countries of Eastern and Central Europe and the former Soviet Union. In that context, the Poland DSM Project should provide a useful model to these other countries on how an electric system can be restructured to obtain the benefits of demand-side management through integrated resource planning.

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REFERENCES

Coopers & Lybrand Deloitte. 1991. *Restructuring of the Electricity and Lignite Sector in Poland.* World Bank, Washington, D.C.

Economist. 1993. "Poland's Economic Reforms: If It Works, You Fixed It." *The Economist*, January 23, 1993, p. 21.

EEI. 1992. *Integrated Resource Planning in the States: 1992 Sourcebook.* Edison Electric Institute, Washington, D.C.

Fickett, A.P., C.W. Gellings, and A.B. Lovins. 1990. "Efficient Use of Electricity." *Scientific American*, September 1990, p. 65.

LBL. 1991. *Survey of State Regulatory Activities on Least Cost Planning for Gas Utilities.* Lawrence Berkeley Laboratory, Berkeley, California

Ledbetter, M.R., D.R. Wolcott, M.J. Cherniack, and C. Pechman. 1992. "Exporting Integrated Resource Planning to Less-Developed and Post-Communist Countries." *Proceedings from the 1992 ACEEE Summer Study on Energy Efficiency in Buildings*, Volume 8, p. 8.111-8.118. American Council for an Energy-Efficient Economy, Washington, D.C.

Nadel, S.M., M.W. Reid, and D.R. Wolcott, ed. 1992. *Regulatory Incentives for Demand-Side Management.* American Council for an Energy-Efficient Economy, Washington, D.C.

NYSERDA. 1990. *The Achievable Conservation Potential in New York State from Utility Demand-Side Management Programs.* American Council for an Energy-Efficient Economy for the New York State Energy Research and Development Authority, Albany, New York.

Popczyk, J. 1992. "Trends in Polish Power Industry Development." *Power Gen '92 Conference.* Orlando, Florida.

RCG/Hagler, Bailly, Inc. 1993 (1). *Electric Power Tariff Study: Polish Power Grid Company* (draft report). RCG/Hagler, Bailly, Inc. for the U.S. Agency for International Development, Washington, D.C.

RCG/Hagler, Bailly, Inc. 1993 (2). *Demand-Side Management Assessment for Poland* (draft report). RCG/Hagler, Bailly, Inc. for the U.S. Agency for International Development, Washington, D.C.

Vallen, M.A. 1991. "Overview of the Demand-Side Management Industry," *Proceedings of DSM: Business and Finance Issues Symposium.* Infocast, Tarzana, California.

World Bank 1991. "Polish Government Letter of Sector Development Policy." The World Bank, Washington, D.C.